VERTEBRATE EVIDENCE FOR DIET AND FOOD-PROCESSING AT THE MULTICOMPONENT FINCH SITE (47 JE-0902) IN JEFFERSON COUNTY, SOUTHEASTERN WISCONSIN

by

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ABSTRACT

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The University of Wisconsin-Milwaukee, 2015
Under the Supervision of Dr. Jean Hudson

The focus of this study is the intrasite analysis of the vertebrate faunal assemblage from the Finch Site. The Finch Site (47JE-0902) is located in Jefferson County, southeastern Wisconsin, roughly one mile east from Lake Koshkonong's southeastern shoreline and the Rock River drainage. Stratigraphy and diagnostic artifacts from numerous cultural features indicate that the site was repeatedly occupied over a temporal span of several thousand years including Paleoindian, Archaic, and Woodland periods. Faunal remains were recovered from 169 excavated units and 119 cultural features across the full horizontal extent of the site.

Investigations of faunal remains from archaeological sites can yield interpretations about prehistoric diet, resource acquisition strategies, food processing, and site function. The multicomponent nature of the Finch site assemblage offers an exceptional opportunity to analyze and explore possible chronological shifts in diet and resource utilization at a single locale. This thesis focuses on the following questions.

What vertebrate resources were utilized by occupants of the Finch site? Does vertebrate resource use change through time? What evidence is there for food processing at the site? Does food processing intensity change through time? Where is vertebrate resource use identified spatially at the Finch site? Does vertebrate use change spatially through time?

The total sample analyzed consists of 14,544 vertebrate remains collected from a combination of dry-screen, water-screen, and flotation recovery techniques. Temporal comparisons are made between proveniences using vertebrate class-level identifications. Species level identifications are used in an attempt to identify the season of occupation for the site. A Geographic Information System (GIS) analysis is applied to taxonomic identifications, fragmentation data, and categories of burned bone to investigate differences in the spatial and temporal utilization of the site and to identify patterning in food processing.

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Finally, thank you to my loving family and my incredible wife Elyse. Your patience and love have always encouraged me to reach for my potential, to stay present and mindful, to be thankful, and to shoot the moon!

Chapter 1: Introduction

This study is an analysis of the vertebrate faunal remains from the multiple prehistoric components present at the Finch site (47 JE-0902) in southeastern Wisconsin. The Finch site was discovered by CRM field survey work in conjunction with the Wisconsin Department of Transportation's (WisDOT) State Highway (STH) 26 expansion project in Jefferson County, roughly 1 mile east of Lake Koshkonong. The site sits along the western bank of a small spring fed pond and is bordered to the south by a small knoll. The Finch site produced an extensive assemblage of diagnostic artifacts associated with multiple prehistoric components: Early and Late Paleoindian; Early, Middle, and Late Archaic; and Early, Middle, and Late Woodland.

Research Goals

This study had several goals. The first goal was to reconstruct the prehistoric vertebrate contribution to diet at the site. A list of expected fauna was generated from an environmental reconstruction of local habitats. Identified taxa were compared to determine which class supplied the greatest contribution to diet. Additionally, mammals were divided into three size groups, small, medium, and large, to determine their contribution to diet. The identification of species was used to explore evidence for the season of occupation at the site in order to interpret the site function: was it a year-round habitation site, or a seasonal resource extraction site? This investigation was then used to compare faunal assemblages associated with cultural components to explore change through time. Did the dispersion of utilized taxa change through time? Did the dispersion of mammal-size groups change? Is there evidence that the season of occupation changed through time?

The next goal of this study was to identify evidence for food processing intensity. Food processing was identified through an investigation of bone modification. Evidence for food processing in the form of cut marks, fragmentation, and burning was analyzed and quantified. This investigation was then used to compare processing intensity between associated cultural components to explore change through time. Does a specific cultural component exhibit evidence for more intensive food processing? Does food processing change through time? Are any specific trends identified?

The final goal was to conduct an intra-site analysis of the faunal assemblage utilizing several GIS spatial analysis methods. This analysis was conducted to investigate the distribution of faunal specimens in space. Where are vertebrate resources used at the site? Is there a correlation between the spatial distributions of identified taxa? Food processing evidence was also explored spatially. Burned bone densities and cut-marked specimens were mapped to delimit activity areas of potential food processing, such as marrow extraction and bone grease production, and food waste disposal. Where is vertebrate evidence for food processing and/or waste disposal located at the Finch site? This analysis was then used to compare the spatial distribution of vertebrate taxa between associated cultural components. Did the spatial distribution of taxa change through time? Did the location of possible food processing activity areas change through time? Does the spatial analysis indicate that the Finch site was utilized differently through time, or did its function remain constant?

Significance

The Finch site provides a robust faunal assemblage, with a NISP of 14,544 pieces of bone, to investigate prehistoric vertebrate diet and resource use. The presence of multiple cultural components offers the potential to evaluate chronological changes in vertebrate utilization and subsistence strategy at a single location. The identification of taxa diversity and equitability (evenness) using comparisons of NISP and weight are useful proxies for discussing subsistence in terms of generalist and specialist strategies (Reitz and Wing 2009: 245). Reconstructing subsistence strategy preference at the Finch site will add data to present and future discourse on subsistence in the region. Intra-site analysis of the Finch faunal assemblage using GIS contributes to discussions of the spatial utilization of prehistoric sites. This method offers a unique way to utilize the spatial distribution of taxa and modified bone across a site, and thus investigate site function changes through time. This study will provide an analysis of prehistoric subsistence and vertebrate resource utilization from southeastern Wisconsin to be added to the current knowledge of prehistoric lifeways in the Western Great Lakes.

Layout of the Thesis

Chapter 2 begins with a discussion of the site background. This includes information about the history of the survey work completed as part of the WisDOT STH 26 expansion project; the initial survey search for the Finch family cemetery; the discovery of the extensive prehistoric component at the site; and the subsequent Phase I, II, and III archaeological investigations that produced the assemblage. The geography and pedology of the area are then discussed to contextualize the Finch site within the landscape of southeastern Wisconsin. Next, an environmental overview is provided. A catchment analysis exercise was completed to identify the surrounding ecological zones adjacent to the Finch site. An expected fauna list was generated using this information. The Paleoindian environment is reviewed and the potential for identifying extinct Pleistocene taxa is discussed. Chapter 2 concludes with a review of the survey and excavation work completed at the site, including a discussion of diagnostic artifacts and the previous work completed with the faunal assemblage.

Chapter 3 provides an overview of the prehistoric chronology of Wisconsin with particular focus in the southeastern region of the state. This chapter begins with a discussion of the Early and Late Paleoindian periods including a review of diagnostic artifacts, subsistence strategies, and several Wisconsin Paleoindian sites. Next, an overview of the Early, Middle, and Late Archaic periods is discussed. Evidence for subsistence and diagnostic artifacts from several sites in Wisconsin are reviewed. Finally, a discussion of the Early, Middle, and Late Woodland periods is presented. Diagnostic artifacts that differentiate the temporal periods are reviewed, along with evidence for subsistence. This information is presented to provide a regional review of the prehistory of the region, and to contextualize the Finch site in southeastern Wisconsin.

Chapter 4 discusses the methods used to complete the faunal assemblage inventory and analysis. This chapter starts with a discussion of the site's temporal components and the methods used to subdivide the faunal assemblage. Following this is a discussion of the analytical methods used to identify and quantify taxa, skeletal elements, and bone modification. Finally, I present a review of the statistical and spatial analysis methods that were utilized.

Chapter 5 presents the results. This chapter starts with an initial report of the site-wide faunal assemblage including the identification of species, the subdivision of taxa by class, bone modification evidence, and spatial analysis of the site-wide faunal distribution. Following this is a report and comparison by temporal component. The faunal assemblage from each time period is described and compared.

Chapter 6 concludes the thesis with a discussion of the results of Chapter 5. My initial research questions exploring vertebrate diet and evidence for food processing are revisited. The Finch site is then compared to two other sites, the Plantz site and the Cooper's Shore site, to address questions about subsistence change through time. The Cooper's Shore site (47 RO-0002) is a Middle Woodland site (Wiersum 1968) roughly 10 kilometers southwest of the Finch site, located where the Rock River exits Lake Koshkonong in Rock County. The Plantz site is a multicomponent site (Kuehn 2008) roughly 100 kilometers north of the Finch site, located at the northeast end of Rush lake in Winnebago County. Finally, I conclude with a review of some remaining questions and suggestions for future research and work with the Finch site's artifact assemblage.

Chapter 2: Site Background

The Finch site (47 JE-0902) is a multicomponent prehistoric - historic site found just southwest of Fort Atkinson in the southwest corner of Jefferson County, southeastern Wisconsin (see Figure 2.1). The site occupies a small hill and a sloping terrace near a spring-fed pond, approximately one mile east of Lake Koshkonong and the Rock River drainage. The excavations on which this thesis is based were conducted between 2009 and 2012 and consisted of 420 units, revealing 168 cultural features. These produced diagnostic lithic and ceramic artifacts dated to the Early and Late Paleoindian; the Early, Middle, and Late Archaic; and the Early, Middle, and Late Woodland periods.

Site Discovery and History

The site at that time was bounded by the existing State Highway (STH) 26 to the west and agricultural fields to the north (see Figure 2.2). Archaeological survey was originally required by the Wisconsin Department of Transportation to locate an historic era cemetery, as brought to the attention of WisDOT by Gus Fisher, a local Fort Atkinson resident, who was concerned about the cemetery's destruction (Rusch 1989). The name for the Finch Site actually comes from an historic family name "Finch," which belonged to a group of early settlers who came to the Fort Atkinson area, hailing from St. Joseph, Michigan, in order to fight in the Black Hawk War (Miller and Brown 1937; Swart 1981: 61). The Finch family had a rather unsavory reputation in the area for being a "hard-drinking, hard-fisted, and hard-riding crew," (Miller and Brown 1937: 1) often participating in horse thievery, gambling, and even dressing as American Indians and staging raids in disguise. It may be for these reasons, and many others, that the Finch family was rumored to bury their dead in secrecy.

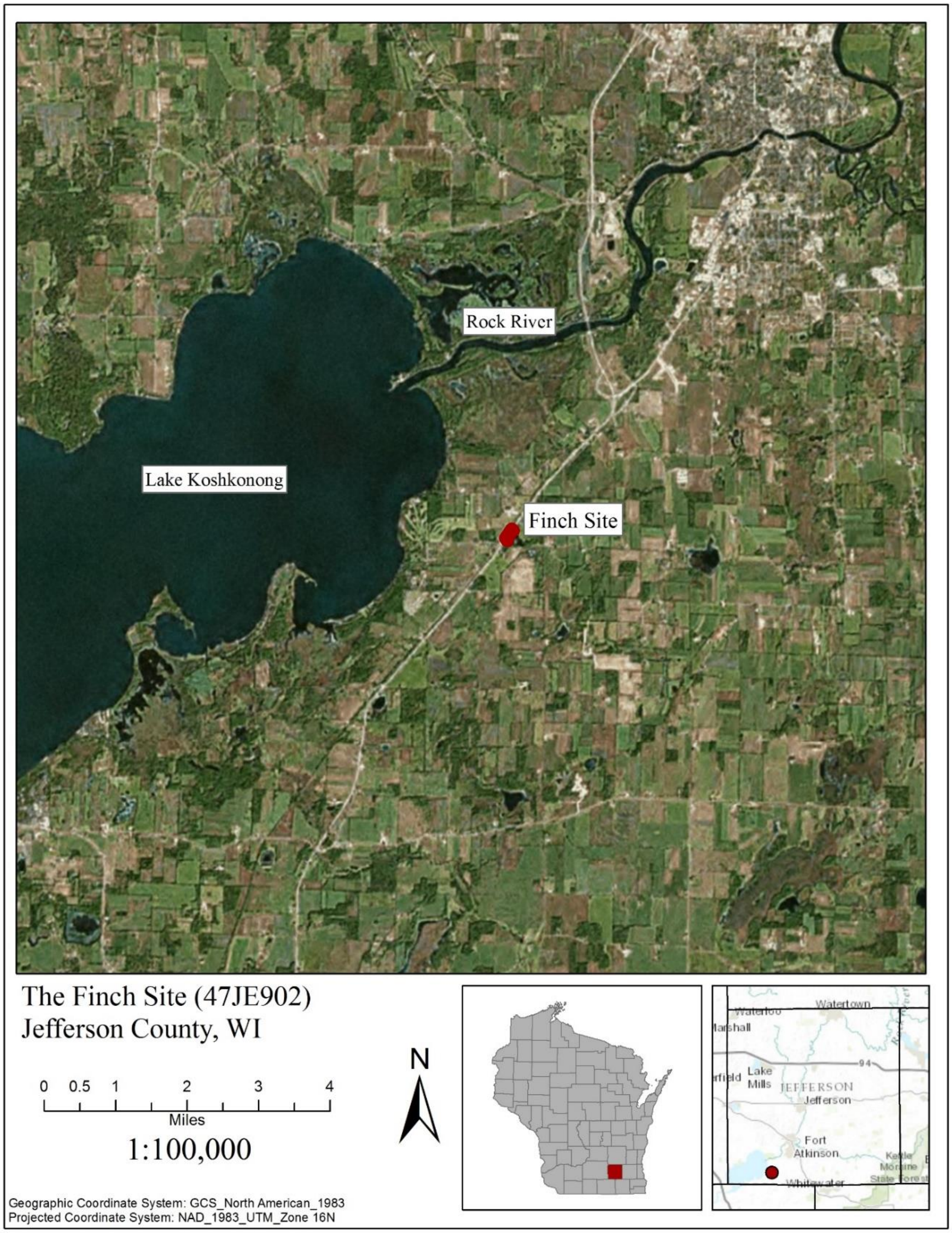


Figure 2.1: The Finch site, located in the southwest corner of Jefferson County, Wisconsin.

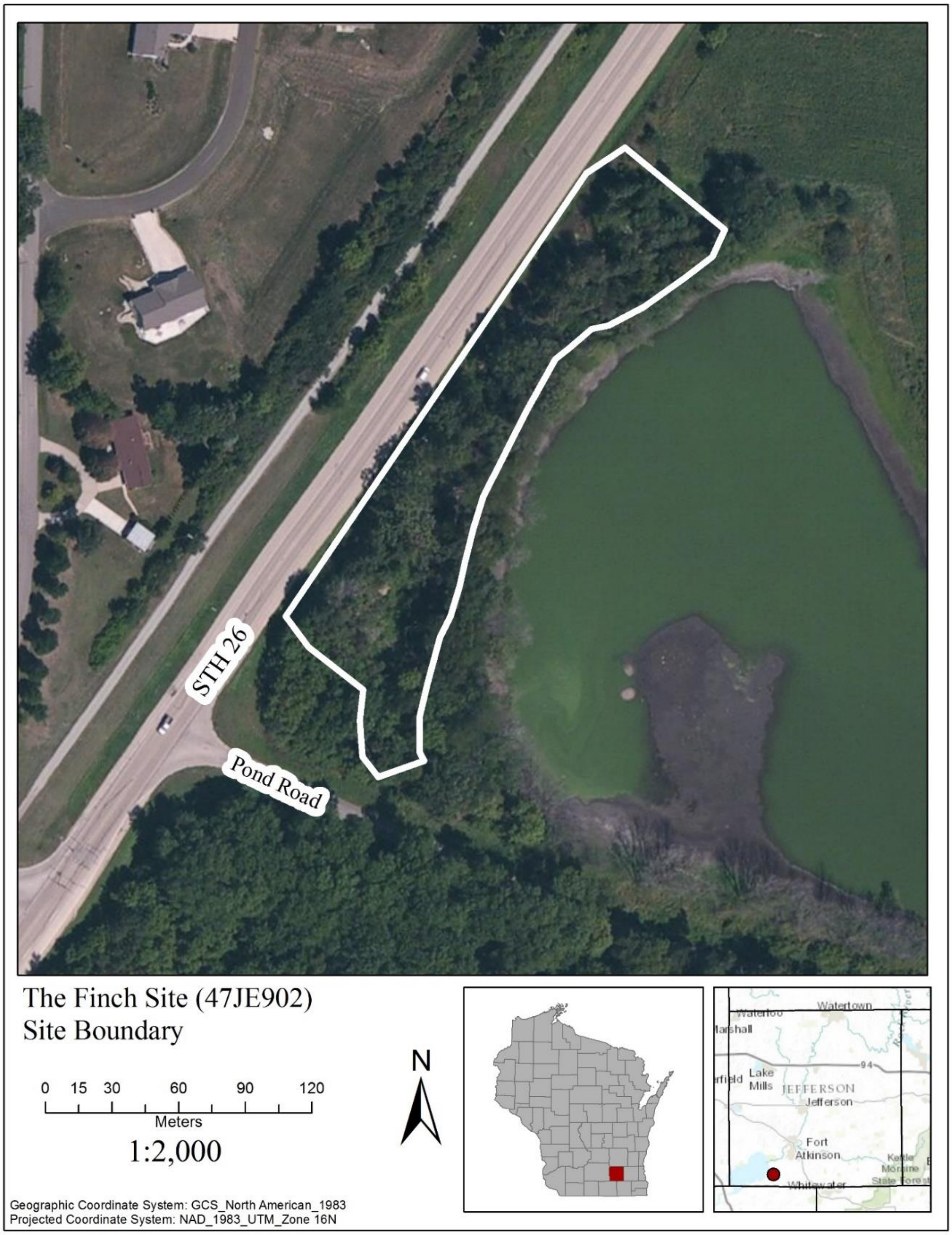


Figure 2.2: The Finch site boundaries.

A compilation of early pioneer tales entitled The Fighting Finches: Tales of Early Pioneer Freebooters in Rock and Jefferson Counties, makes reference to "The Finch Burying Ground" as being an unmarked family cemetery on highway 26 between Fort Atkinson and the town of Koshkonong. The area marked on the "Finch Land" map as "First Home" is equivocal to the location of the Finch Site (see Figure 2.3 in comparison to Figure 2.1). The cemetery was noted as being atop a prominent hill which was bisected by the highway, and on the eastside of STH 26 was a small pond, called Pritchard's Pond.

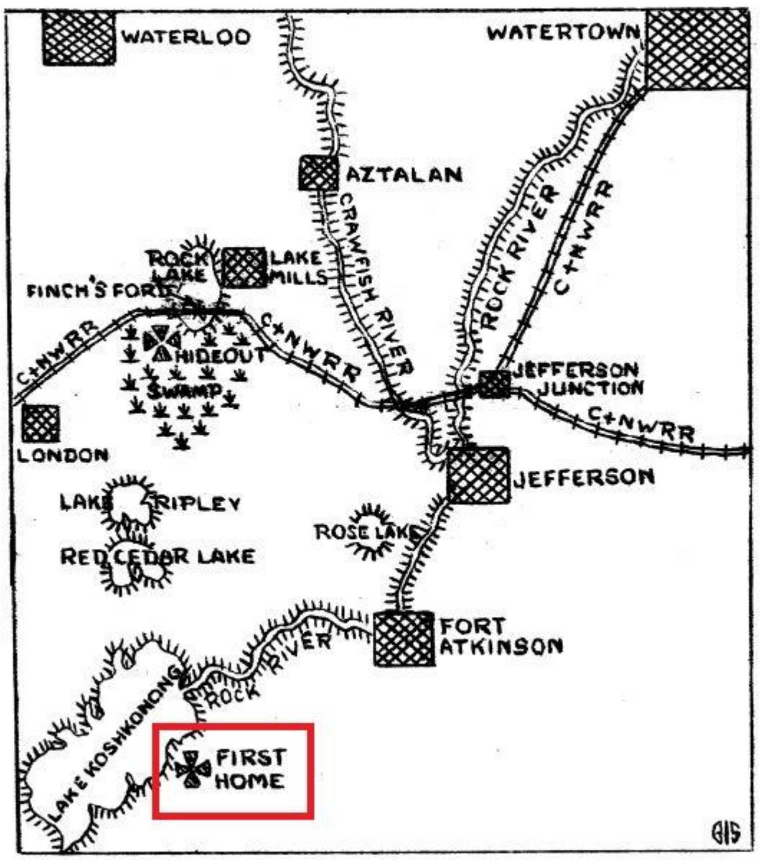


Figure 2.3: "Finch Land" (From Miller and Brown 1937)

The pond's name comes from another local family, the Pritchard family, whose claim to the land, including the pond, can be seen on the 1870 Koshkonong Township plat map (Swart 1975: 225), (see Figure 2.4). Thus, the reason for the initial investigations in 1989 was this very evidence, which was brought to the attention of WisDot and the State Historic Preservation Office (SHPO) in 1987 (Rusch 1989). It is an interesting aside that the Finch "family business" was eventually put "out of business" by the Jefferson County Anti-Horse Thief Society (Swart 1975: 233).

The remnants of the Finch family cemetery were eventually discovered in 2013, after phase III excavation had been completed, during STH 26 road re-widening and backhoe stripping. A total of four historic burial features were discovered and excavated.

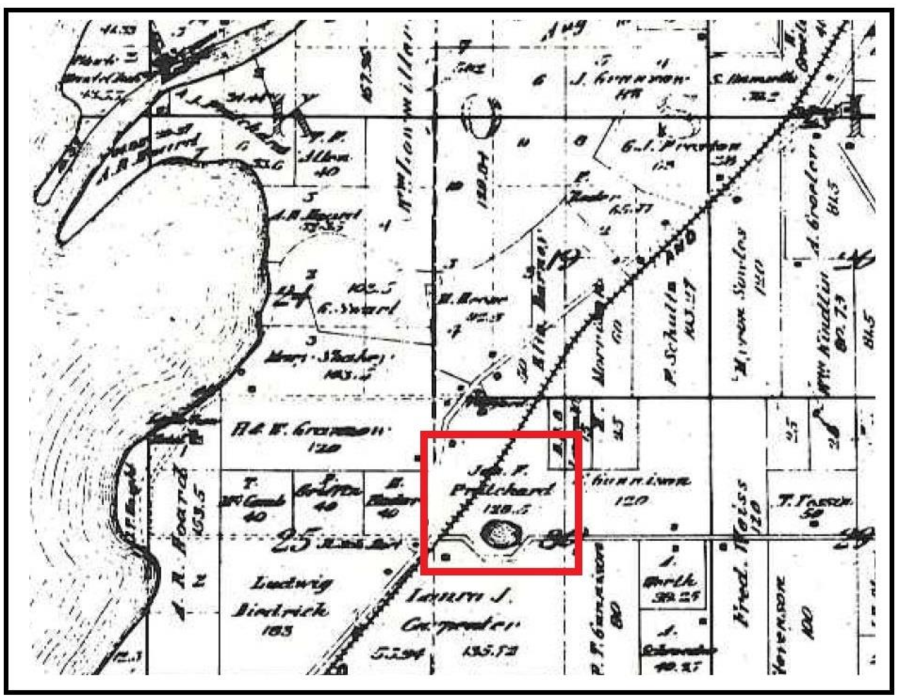


Figure 2.4: Location of Pritchard's Pond on the 1870 Plat Map of Koshkonong Township (from Swart 1975)

Within the features were the remains of 4 partially intact individuals, 3 adults and one sub-adult, along with historic artifacts such as metal hinges, square cut nails, and other various metal fragments (Haas, personal communication 2015). The four burials were located just northwest of the excavation units atop the knoll in the southern part of the Finch site boundaries, near their originally described location (Rusch 1989).

Physical Setting

The Finch Site is located in southeastern Wisconsin in the SW ¼ of the SW ¼ of the NW ¼ of Section 30, T-5N R-14E in the Township of Koshkonong, Jefferson County, Wisconsin. The site is 1.15 miles east of the southeastern shore of Lake Koshkonong, part of the Lower Rock River Watershed. The Rock River eventually joins the Mississippi River in the city of Rock Island in northwestern Illinois. The site is also less than a mile southeast of the Jefferson County Indian Mounds and Trail Park, a five acre parcel that is the location of the remaining 11 effigy mounds of the General Atkinson Group, which is believed to have been originally composed of roughly 72 effigy mounds at one time (Highsmith 1997: 150; Morse-Kahn 2003: 87).

The site runs along the eastside of STH 26 just north of Pond Road and borders the western edge of Pritchard's Pond. According to the General Land Office Survey (GLO) in the early 1830's, Pritchard's Pond may have been more marsh than actual open water pond (Brink 1835). The GLO notes and supplementary sketch map (see Figure 2.5) identify the southeast corner of section 30, T-5N R-14E, as a marsh rather than an open-water pond. It is likely that the creation of STH 26 and Pond Road altered the drainage of this marsh area, working to plug up the spring water into what has come to be known as the open-water Pritchard's Pond. This is very important to keep in mind when attempting to recreate the prehistoric surroundings of the Finch site.

The northern edge of the site is bounded by agricultural fields. The original construction of the Chicago and North Western Railroad, connecting Janesville and Fort

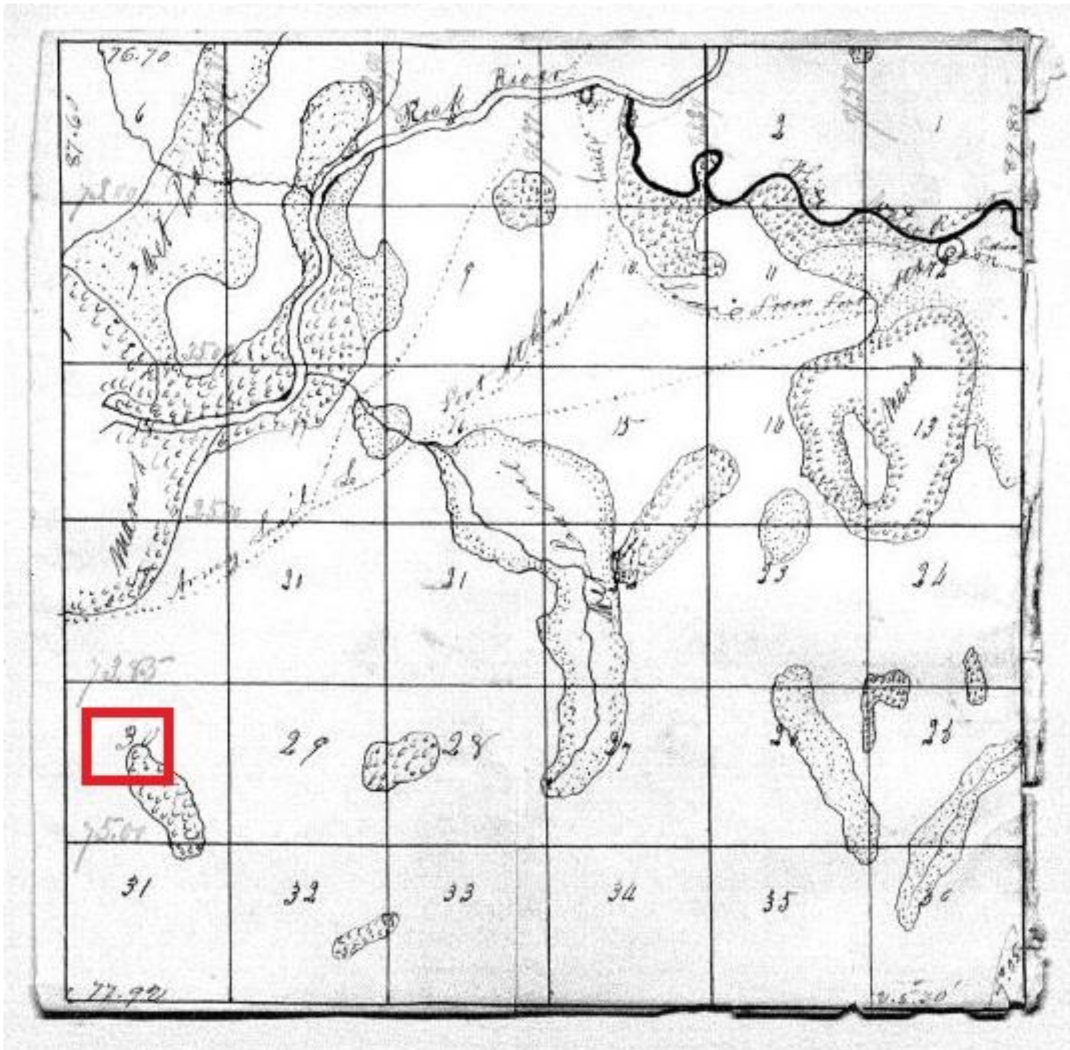


Figure 2.5: Sketch map of T-5N R-14E in the Township of Koshkonong, with the location of the Finch site outlined. (from Brink 1835).

Atkinson in 1859, as well as the original two-lane STH 26 construction corridor in 1926 most likely would have destroyed any previously existing westward extension of the site (Swart 1975: 226; Haas 2012).

In order to contextualize the Finch site in its Southeastern Wisconsin locale, and fully understand its various prehistoric cultural-period occupants and their place in prehistory, a significant discussion of the site’s geography, topography, pedology, and various prehistoric vegetation habitats is in order.

Geography

The Finch Site is located within the Eastern Ridges and Lowlands geographical province within the lowland of Galena-Black River limestone which also contains Green Bay, Lake Winnebago, and the Rock River (Martin 1965: 211). The topography of this geographical province is dominated by the Magnesian escarpment (also known as the Galena-Platteville escarpment), composed of Black River Limestone; and the Niagara escarpment, composed of Silurian strata with a dolomitic limestone cap-rock (Schultz 1986: 102; Dott and Attig 2004: 238). These two escarpments each form their own uplands and lowlands. Uplands are termed cuestas (Spanish for hill/sloping ground) and lowlands are termed vales. The Magnesian cuesta runs roughly southwest to northeast through Dane County, WI. Cuestas typically have a steep escarpment to one side, with the opposite side having a longer and more gradual slope. The steeper Magnesian cuesta escarpment is to the west, while the gradual slope into the lowlands sweeps east. The Niagara escarpment extends south through the Door Peninsula through the Bayshore Blufflands DNR State Natural Area, and south past Milwaukee into Illinois. The Niagara cuesta gradually slopes into Lake Michigan with its steep escarpment facing west (Schultz 1986: 100; Martin 1965: 227).

The lowland between the Magnesian and Niagara cuestas is in the belt of Galena-Black River limestone and St. Peter sandstone and slopes eastward from the Magnesian cuesta, descending roughly 350 feet in elevation until it reaches the steep incline of the Niagara escarpment. The lowland also slopes south to north, from the Illinois state line up towards Green Bay, descending approximately 300 feet (Martin 1965: 220). The eastern area of the lowland, consisting of Walworth, Jefferson, and a section of Rock

County, is a plain covered with glacial deposits and scarred with glacial moraines and drumlins.

The evidence for glaciation in the area is extensive. In southeastern Wisconsin alone there are more than 1,400 glacially formed oval hills or drumlins. Drumlins are used as telltale markers that indicated the directional movement of glacial ice sheets (Martin 1965: 235). The longer axis of a drumlin is always parallel to the direction of glacial movement. Moraines are described as an aggregated accumulation of glacial debris, both soil and rock alike, and are used to distinguish the maximum extent of a glacial lobe (Dott and Attig 2004: 24-25; Schultz 1986: 172-173). Quaternary period (the last 1.8 million years) glaciation has molded and shaped the surface of southeastern Wisconsin through countless episodes of glacial advance and retreat. The most recent glaciation event in the area was the retreat of the Green Bay, Delavan, and Michigan Lobes of the Laurentide Ice Sheet. These lobes reached their maximum advance into southeastern Wisconsin roughly 18,000 years ago; by 11,000 years ago they had completely receded out of Wisconsin and Lake Michigan (Dott and Attig 2004: 245-248).

The Finch site sits in an area of ground moraine outwash where several drumlins and recessional moraines are present. The drumlins in the area can be as tall as 140 feet or as low as 5 feet, with an average width of a quarter mile (Martin 1965: 257; Crowns 1976: 121). Topographically, the site resides on an area of high-ground within the southern section of the site boundary, sloping downward and then back upward as it extends north (see Figure 2.6), creating a middle-low ground that was termed “the saddle” during excavations. The Finch site’s strategic location near Lake Koshkonong and atop high-ground would have provided site occupants with an advantageous access to

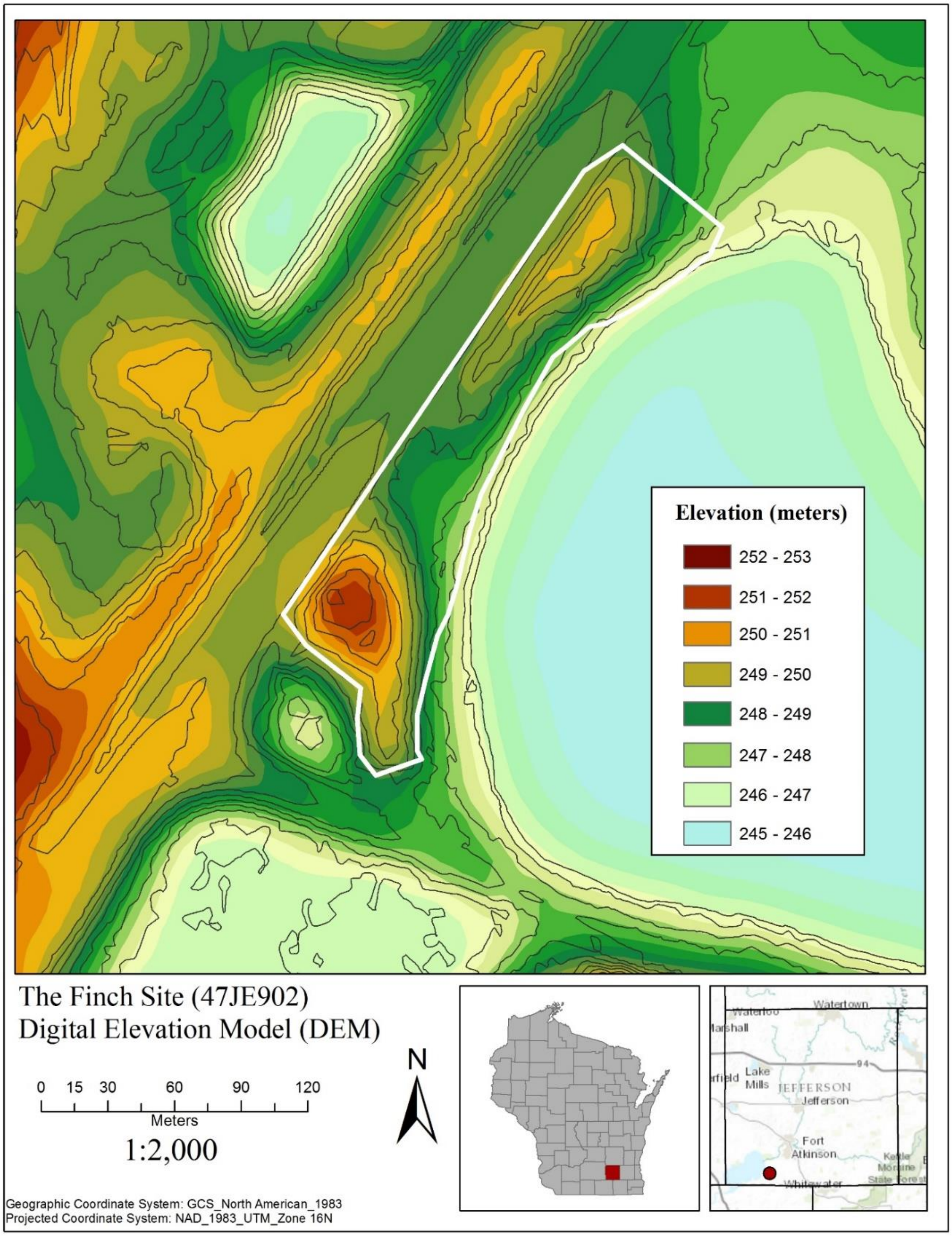


Figure 2.6: Finch Site Digital Elevation Model based off of USGS two-foot contour lines.

aquatic resources, fresh water from an adjacent spring and pond, and a high-place upon the landscape for defensive and hunting positioning.

Pedology

An understanding of the soil stratigraphy and composition is crucial to understanding the significance and context of excavated artifacts and ecofacts. The surficial deposits of Jefferson County include an amalgamation of glacial till, melt water outwash deposits, clay, silt, and sand from lake-laid deposits, as well as wind-blown silty or loess deposits and peat buildup (USDA-NRCS 2007: 8). Specific soil typologies from the Finch site were compiled from United States Department of Agriculture Natural Resource Conservation Service official soil surveys and mapped (see Figure 2.7) using the USDA Web Soil Survey program in conjunction with the National Soil Survey (http://websoilsurvey.nrcs.usda.gov/app/). Using the Web Soil Survey it was possible to identify six different soil series types beneath the bounds of the Finch Site.

Aztalan Fine Sandy Loam (Aza), located in the northern area of the site, is part of the Aztalan series which consists of deep, moderately permeable soils that are poorly drained and were formed by lake-laid silts and clays in loamy material. Aztalan series soils are located on terraces in or near old lake basins and their slopes range from 0% to 3% (USDA-SCS 1979: 70). Keowns Silt Loam (Kb), located in the saddle area of the site and making up the composition of Pritchard's Pond, also is a deep, moderately permeable, poorly drained soil series formed in old lake basins, underlain by silt and fine sand. Kidder Sandy Loam (Keb), located in the northwest area of the site, is a well-drained, deep, moderately permeable soil that was formed in loamy deposits and the underlying loamy glacial till. Kidder series soils are typically found on till plains and glacial drumlins and have an eroded slope of 2% to 6%. Fox Loam (FoC2) is located in the southwestern area of the Finch Site and is a well-drained, deep soil that increases

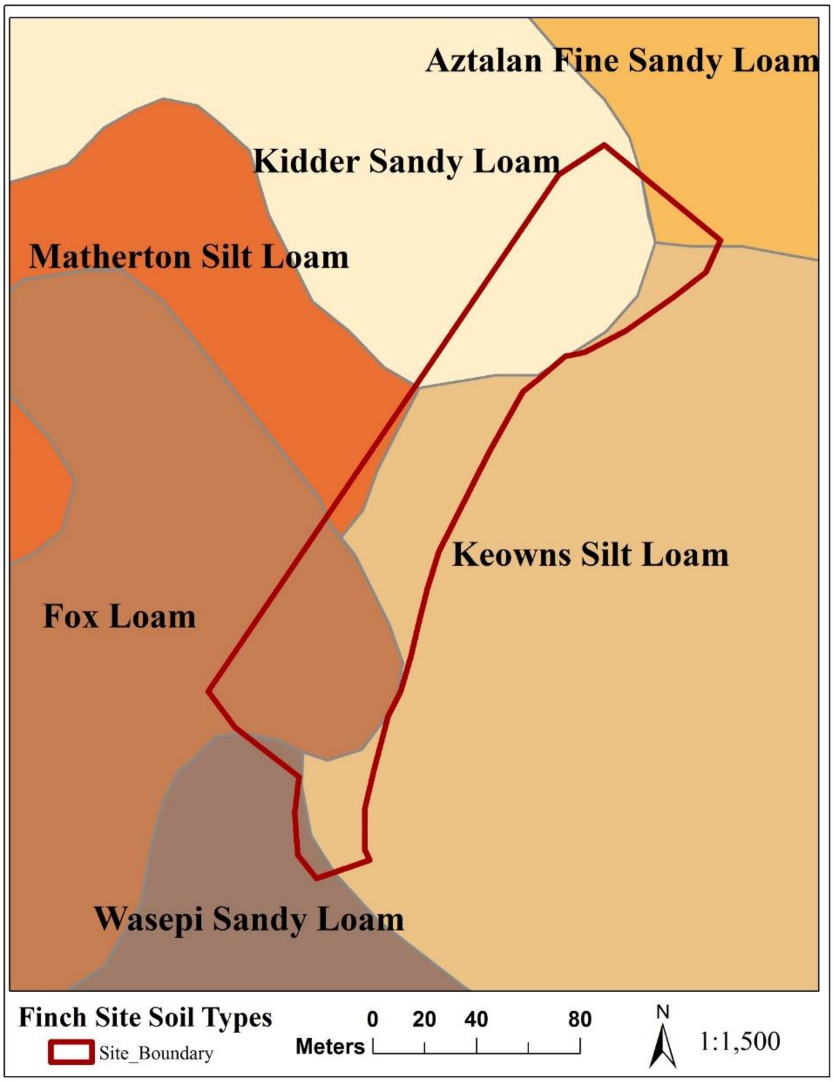


Figure 2.7: Soil-type map, compiled from United States Department of Agriculture Data.

in permeability in its deeper substratum. The Fox series soils are formed in silty and loamy deposits on outwash plains and terraces and have an eroded slope range from 6% to 12%. Matherton Silt Loam (MmA) is found in a sliver of the western saddle area. This soil series consists of slowly permeable, poorly drained, deep deposits of stratified silt and clay. Matherton series silt loam is found on low terraces of old lake basins and have an eroded slope range of 0% to 3%. Finally, Wasepi Sandy Loam (WmA) is located in a small area in the extreme south end of the site. The Wasepi series consists of poorly drained, deep soils that are rapidly permeable in deeper substratum and moderately rapidly permeable in the upper stratum. Wasepi soils form in loamy and sandy deposits over gravelly sand on stream terraces. Their eroded slope range is from 0% to 3% (USDA-SCS 1979: 70, 74, 77-79, 87).

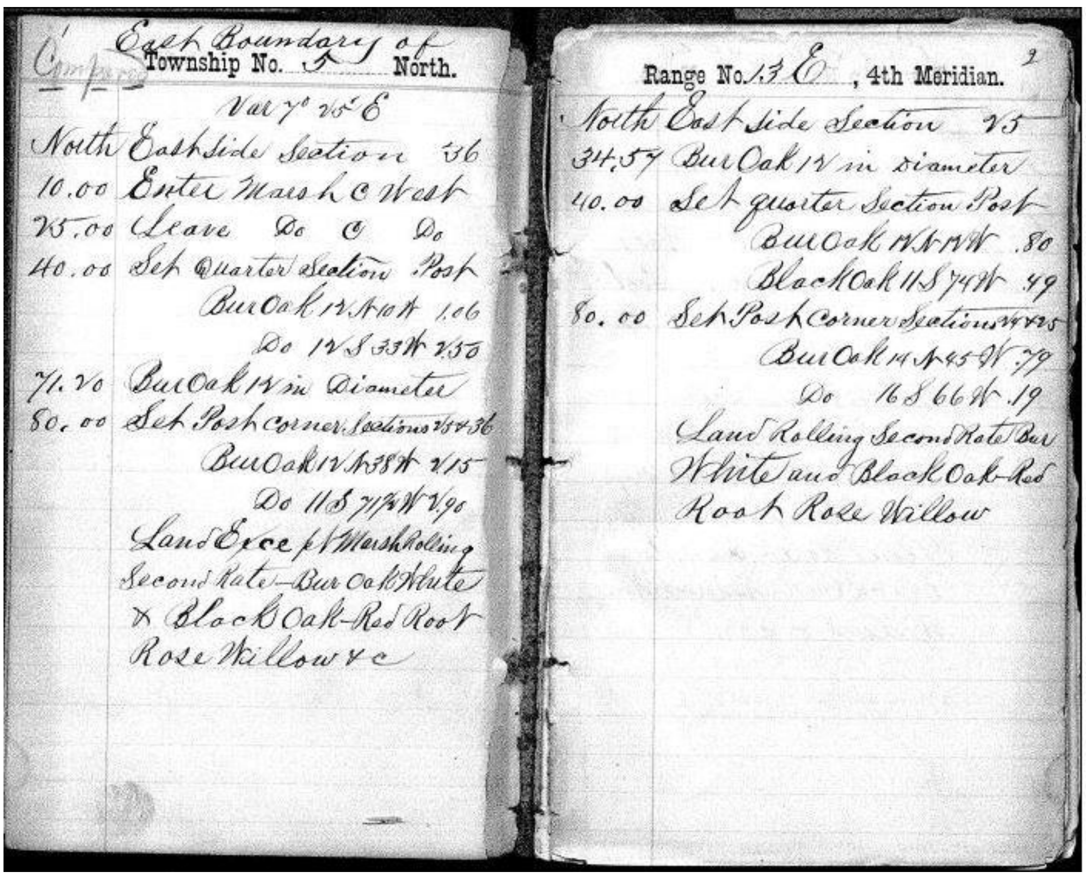
Soil examinations at the Finch site during initial Phase I and Phase II investigations revealed that cultural deposits are contained within a stratigraphically intact A horizon of 10YR2/1 deep black loamy sand to silt loam and a B horizon of 10YR3/1-4/1 very dark brown and very dark grayish brown 10YR3/2 sandy loam to clay loam (Watson 2004: 10). The presence of an intact biomantle offers the possibility for stratigraphic integrity, and thus the possible identification of different vertical temporal cultural components and intact cultural features.

Environment

In order to anticipate the types of fauna that would have been utilized by prehistoric occupants, it is important to understand and discuss the unique environments and ecosystem communities that would have been available in and around the Finch site. Previous archaeological studies of sites within Wisconsin's Eastern Ridges and Lowlands province (Jeske 1999; Jeske 2000; Warwick 2002; Koziarski 2004) have relied heavily upon the works of Curtis (1959), Martin (1965), Finley (1976), and Goldstein and Kind (1987) to examine and reconstruct the prehistoric environment. These works focused on recreating the "pre-settlement," or pre-European contact, environment and have been used to describe the ecological zones of SE Wisconsin during the Late Woodland, Middle Mississippian, Oneota, and Historic periods: from roughly A.D. 400 through modern times. These contributions will briefly be summed and applied to the study area. Because the Finch site hosts a deeper temporal period, reaching back into the Early Paleoindian period, a discussion of paleo-environmental reconstruction will also be included.

The earliest environmental data for the region comes from historic documentation generated by the General Land Office Survey (GLO) in the early 1830's. The GLO was an agency of the Treasury Department from 1785 – 1849 and was in charge of dividing newly annexed territories to be sold to settlers and investors. Using the Public Land Survey System (PLSS), land was divided into six-mile square townships and one-mile square sections. Township lines run east-west every six miles, and range lines run north-south every six miles, thus creating the township lattice that geometrically divides up the state (Curtis 1959: 63-64; Land 2005). Section lines were created east-west and north-south every mile within each township, further dividing the land into square mile sections, 36 per township. Data about the prehistoric environment comes from the notes that the surveyors kept while out in the field. Section line notes offer the most detail as surveyors recorded a variety of information at every section corner and quarter section corner. Data included distance measurements and direction as well as vegetation types, stream crossing, land surface description, soil quality, vegetation undergrowth, and dominant tree species (Land 2005). General descriptions were also recorded in the form of township summaries, which were useful in describing the type of land available and for sale to settlers and investors.

John Brink (1835) surveyed the area around the Finch site in 1835 and kept a detailed notebook of his progress traversing township, range, and section lines. The north-south section line that divides T-5N R13-E section 25 to the east, and T-5N R14-E (the location of the Finch site) to the west bisects the Finch site (see Figure 2.8). Brink describes the vegetation of this one-mile stretch of section line by mentioning the presence of a marsh, bur oak trees, black oak trees, rose willow, and white oak trees. The use of GLO notes to reconstruct prehistoric environments gave ecologists and geographers a starting point, however, because of the nature of PLSS survey techniques,


East Boundary of Township No. 5 North.
Var 7° 25' E
North East Side Section 36
10.00 Enter Marsh & West
25.00 Leave Do & Do
40.00 Set Quarter Section Post
Bur Oak 12 N 10 W 1.06
Do 12 S 33 W 2.50
71.20 Bur Oak 12 in Diameter
80.00 Set Post corner Sections 25 & 36
Bur Oak 12 N 38 W 2.15
Do 11 S 71½ W 1.90
Land Except Marsh Rolling Second Rate – Bur Oak White & Black Oak – Red Root Rose Willow &c

Range No. 13 E, 4th Meridian.
North East Side Section 25
34.57 Bur Oak 12 in diameter
40.00 Set quarter Section Post
Bur Oak 14 N 14 W .80
Black Oak 11 S 74 W .49
80.00 Set Post Corner Sections 24 & 25
Bur Oak 14 N 45 W .79
Do 16 S 66 W .19
Land Rolling Second Rate Bur White and Black Oak Red Root Rose Willow

Figure 2.8: Notebook entry along north-south survey line bisecting the Finch site from John Brink's original survey notebook (Brink 1835).

only a single square-mile lattice of data could be collected, the land inside of each section was still void of description.

Limitations of GLO survey maps and notes have been identified and discussed as part of various archaeological studies investigating prehistoric environments as part of survey work and site investigations. King (1978) discussed the bias and limitations of using GLO survey records positing that they neglect to account for the effects of natural and anthropogenic fires on the distributions and compositions of tree species and forest vegetation. Jeske (1988: 19) discusses several cautions to interpreting GLO survey data including errors in hand-copying, mistakes in the use of abbreviations for tree species, and changes in the common names of trees through time. Other errors identified in translating GLO data include early surveyor's limited botanical knowledge of tree species, and the fact that distinctions were seldom made between wet and dry prairie ecozones (Jeske 1999: 23).

Understanding the limitations of GLO historic documents, their use when combined with modern floristic studies, topography, and the distribution of identified tree species has still allowed for the creation of several maps that recreate likely prehistoric environmental habitats in Wisconsin. These include, for example, Finley's (1976) map of Wisconsin prehistoric vegetation cover, which uses mainly tree species to differentiate the ecological landscapes, and Goldstein and Kind's recreation of the major vegetation zones in southeastern Wisconsin (1987: 19-20). These maps estimate the distribution of the broad ecological zones, focusing on major vegetational features, and have been used to estimate floral and faunal resources available during prehistoric periods.

Other studies have utilized GLO survey maps and notes specifically to note tree species and vegetation descriptions and then combined them with soil survey data maps to refine their environmental analyses (Edwards 2010; Hunter 2002). Using soil-series data aided in recreating prehistoric vegetation zones at a more fine-grained resolution. These local studies of the Crescent Bay Hunt Club site (47 JE-0904), located on the northwest shore of Lake Koshkonong, investigated the environmental placement of the site through a catchment analysis. These studies focused on the immediate surrounding environment utilizing a one-mile catchment area (Hunter 2002) and a one and two kilometer double catchment area (Edwards 2010). The radii of these catchment studies was chosen to reflect the area required to analyze the foraging and gardening distances associated with the agricultural subsistence strategy identified at the Oneota Crescent Bay Hunt Club site (Hunter 2002: 59; Edwards 2010: 46). The Finch site lacks definitive evidence for agriculture, and I did not use soil data. My goal was to estimate the broad ecosystems available within a day's foraging distance of the Finch site and to use these to build a list of expected fauna.

Expected Fauna

To map the relevant ecosystems I compared both the Finley and Goldstein maps, and reviewed their interpreted "pre-settlement," or pre-European, vegetation zones. Identified vegetation zones were used to predict the kinds of fauna available within a reasonable daily walking/foraging distance of the site. To do this, I created a circular boundary denoting a resource catchment area around the site.

It was not the aim of this thesis to complete a catchment analysis of the Finch site; however, it was important to understand the basic concepts of this approach to determine likely boundaries of potential resource acquisition. The term catchment is borrowed from geomorphology to reference the drainage basin or watershed area that replenishes a stream or river (Roper 1979: 120). Archaeologically, the term is used to denote the size and location of a site's exploitable resource base under the assumption that as the distance from a habitation site increases, the amount of energy expended to gather and bring back resources increases until eventually, the effort is not worth the energy return. Catchment analysis areas are determined either by creating fixed radii distances around a site, or by creating "cost catchments " using walking distance time contours that take into effect variations in terrain and environment (Surface-Evans 2012: 139; Roper 1979: 123).

In order to choose a relevant radial distance for the catchment area, several different forager catchment studies were reviewed. R. B. Lee's ethnographic work with the !Kung people of the Kalahari Desert, as referenced by Donna C. Roper, describes a normal foraging distance of 10 km from a basecamp (Roper 1979: 121, 123). Another study, using Robert L. Kelly's Marginal-Value Theorem, models forager base camp movements and posits that foragers typically do not move until an effective foraging patch within a 6 kilometer radius is depleted (Kelly 1995: 144). Kelly's study used ecological factors such as resource abundance, availability of fresh water, and energy return rates to quantify foraging distance (Kelly 1995: 134, 147). Binford posits that a foraging radius is linked to group size and the seasonal variation in available daylight based on his ethnographic work with the Nunamiut (Binford 2001: 234). Binford calculated the distance, duration, and rate of travel for various sized groups of foraging Nunamiut women and hunting Nunamiut men, and calculated a mean foraging radius for each group. He then combined these figures with other ethnographic studies of hunter-gatherer groups of men and women such as the !Kung, Pume, Anbarra, Alyawara, and Pitjandjra and averaged their daily foraging distance, duration, and rate of travel. In combination, Binford's sample includes arid environments, tropical environments, and arctic/subarctic environments. The results he produced give an average foraging radius of 8.28 km (Binford 2001: 238). For this study I chose a 10 km radius for the Finch site to encompass a generous foraging range of vegetation zones.

I used both Finley's "Vegetation in Wisconsin in the Mid-1800's (1976) and Goldstein and Kind's "Generalized Vegetation Reconstruction for Southeastern Wisconsin" (1987) to map the catchment area around the Finch site (see Figures 2.9 and 2.10).

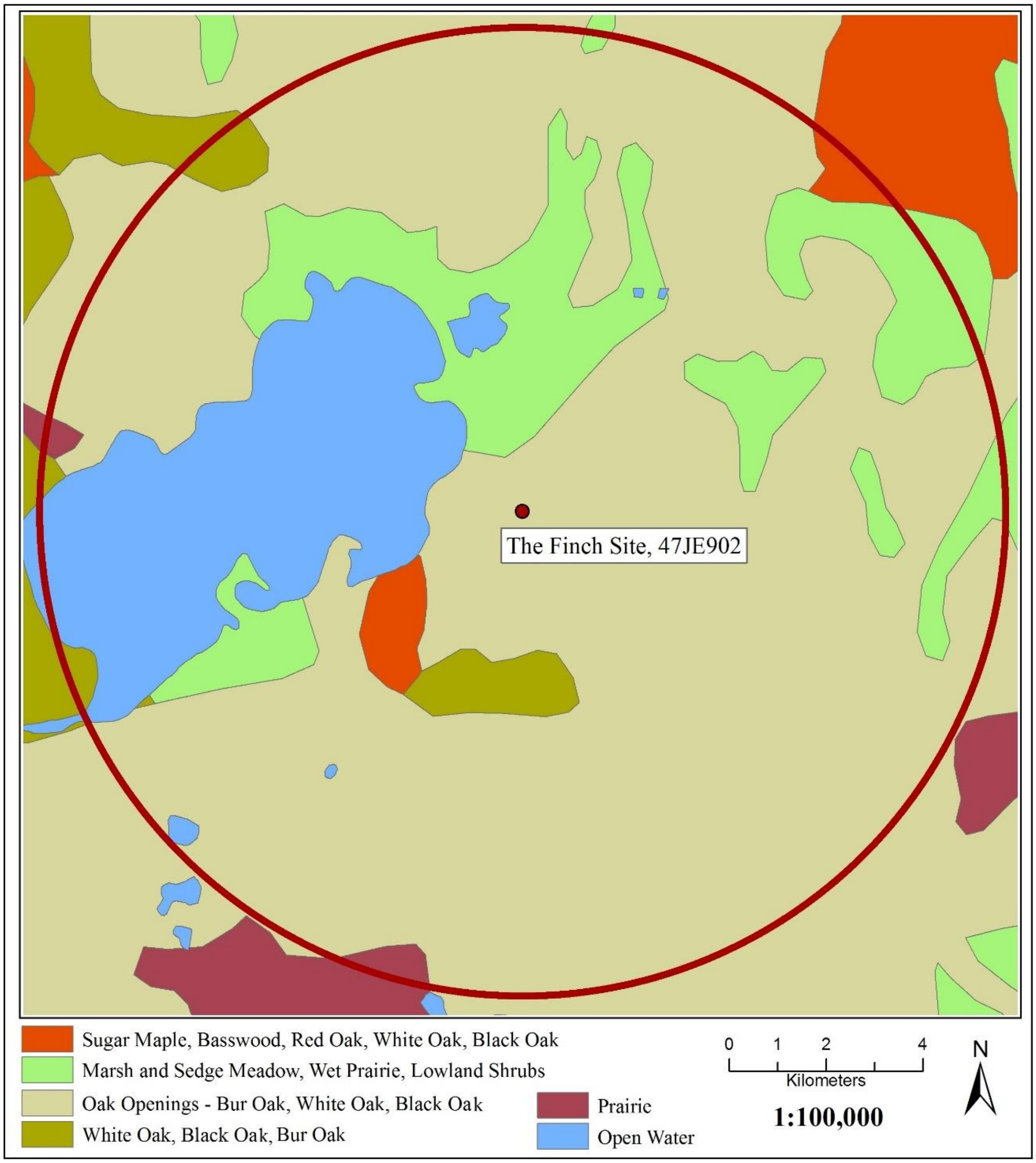


Figure 2.9: Ten kilometer catchment ring using Robert W. Finley's 1976 "Vegetation of Wisconsin in the mid – 1800's" (digitized data from WDNR).

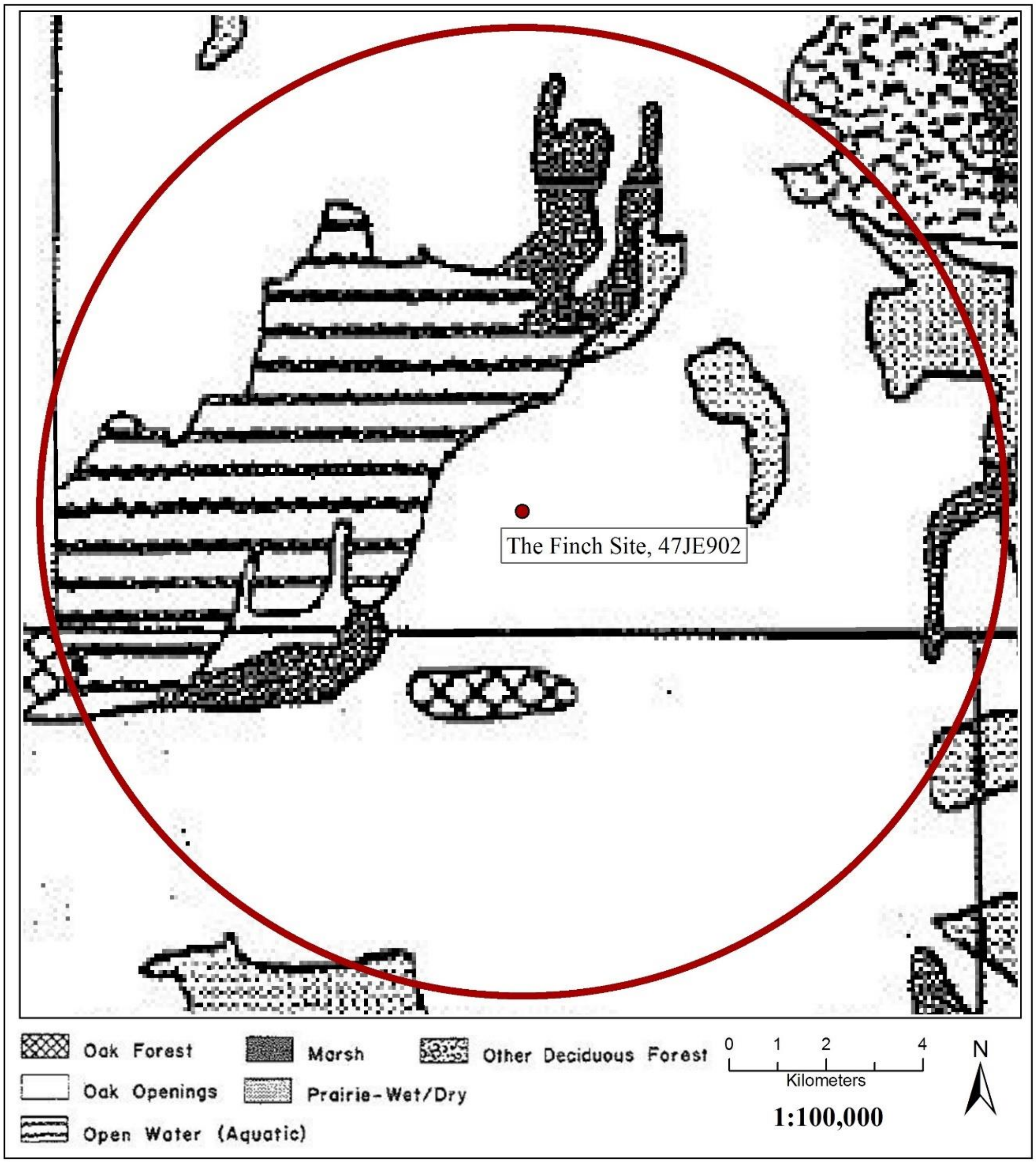


Figure 2.10: Ten kilometer catchment ring using Lynn Goldstein and Robert Kind's 1987 "Generalized Vegetation Reconstruction for Southeastern Wisconsin" (modified).

The two maps show little difference in the spatial layout of their vegetation zones though neither map identifies the open water/marsh area that is Pritchard's Pond. Both maps identify a large area of oak savanna, more modest zones of open water and marshlands, and small amounts of oak forest and prairie. Labeling differs slightly, for example, what Finley calls the "marsh and sedge meadow-wet prairie-lowland shrubs" vegetation area, Goldstein and Kind break into two parts: the "marsh" area and the "prairie-wet/dry" area. This study uses a combination of Finley's (1976) and Goldstein and Kind's (1987) works to identify the six vegetative zones within the 10 kilometer catchment area surrounding the Finch site. These six vegetative zones in order of their percent-land coverage are: oak openings or oak savannahs (69.3%), open water or aquatic (13.7%), marsh and wetlands (13.1%), oak forests (2.1%), deciduous forests (1.3%), and prairies (0.5%), (Goldstein and Kind 1987; Finley 1976; Curtis 1959).

Oak Openings / Oak Savannas

The oak opening, or oak savanna, community dominates the pre-settlement landscape of the Finch site catchment area as represented by both Finley's (1976) and Goldstein and Kind's (1987) separate works. The openings are covered by a combination of mesic prairie grasslands interspersed with clusters of bur oak, black oak, and white oak. Other tree species such as shagbark hickory, large-toothed aspen, and black cherry were also less commonly present. All of the trees in a stand are usually of the same age and size to varying degrees (Curtis 1959: 326-32). The most common of these tree species found in the oak openings in southeastern Wisconsin is the bur oak.

Oak Savannas rely heavily upon the regenerative properties of fire, and quickly would close off and change into an oak forest habitat once human intervention prevented large-scale burning. Bur oak and white oak are specifically more fire resistant because of their thicker bark. The advent of agriculture and livestock in the area has since made the oak savanna a rare habitat. According to Goldstein and Kind (1987: 26 and 34) oak openings would have offered a "good" food potential, the best season for exploitation during winter months (hunting deer, elk, and bison). Goldstein and Kind also mention a rather sparse amount of vegetable foods, other than acorns from oak trees, but that the area would be satisfactory for agricultural use during the growing season. Appendix "A" offers an extensive list of the expected and available fauna found in oak savanna habitats.

Aquatic Zones

John Curtis (1959) insists that Wisconsin's aquatic resources are not to be confused with the abundance of emergent plants that populate the marsh communities surrounding lakes, rivers, and streams. Though a number of plant species are capable of floating on the surface to photosynthesize, Curtis maintains that the aquatic resource zone is typically reserved for the acquisition of faunal resources attracted to open-water (Curtis 1959: 386). The exception in this case is that Lake Koshkonong is not a typical deep-water Wisconsin lake, with a present-day average depth of only six feet, and a maximum depth of seven feet. Lake Koshkonong is historically well known for abundant wild-rice harvests. Lucien Caswell, a Wisconsin State Assembly member in 1863, moved to Fort Atkinson in 1851 and portrays Lake Koshkonong as a meadow of wild rice:

> As the water receded in the lake (late summer), the wild rice made its appearance, and soon literally covered the entire surface. It looked like a vast meadow. We could see nothing in it for us but from what we could learn, it was everything for the Indians and waterfowls. The Indians far and near depended largely on gathering the rice for their winter food. And the ducks, no one can tell or half describe the varieties. This great field of rice of which the ducks seemed so fond,

> brought millions and millions of them. They would light down all over the vast rice fields and feed on the unlimited quantity till they were fat and most delicious food. [1900's: 2]

Increase Lapham also described Lake Koshkonong in a similar light, depicting the waters as more meadow than lake (Lapham 1850:35). However, there still remain different faunal species of waterfowl, turtles, shellfish, aquatic mammals, and of course a variety of fish species that utilize the open-water aquatic zone in a different capacity over those species that inhabit marsh peripheries, which are treated as their own vegetation zone (Goldstein and Kind 1987: 23) That being said, Lake Koshkonong, the Rock River, Otter Creek, as well as several other small streams and ponds within the catchment area of the Finch site would have offered a large variety of faunal resources available for exploitation. Specifically, fish species such as bass, pike, walleye, catfish, panfish, bullheads, and perch. (See Appendix "A" for expected fauna list). According to Goldstein and Kind (1987: 23 and 34) aquatic zones would have offered a "high" food potential, the best season for exploitation during spring months when fish are spawning.

Marshes and Wetlands

Lake Koshkonong is surrounded by an extensive area of wetlands consisting of marsh, sedge meadows, wet prairies, and encroaching lowland shrub habitats, all of which offer a diversified abundance of floral and faunal resources. An estimated 3,080 acres of wetlands encompass the lake, the Rock River, and the mouths of tributary streams at present day times (Johnson 2005: 3). The Finch site is situated in a prime location for access to a variety of wetland resources. Flora such as joe-pye weed, boneset, meadow rue, goldenrod, sedges, aster, cattail, a variety of pondweeds, reeds, marsh fern, and meadow bedstraw would have attracted a multitude of fauna such as raccoons, muskrats, migratory waterfowl, turtles, frogs, deer, and fish (Goldstein and Kind 1987: 23; Curtis 1959; 367). (See Appendix “A” for a full list of expected fauna).

Before the construction of the Indianford dam in 1851, roughly four miles south of the lake on the Rock River, Lake Koshkonong had been described as more marsh than lake, with an abundance of wild rice, wild celery, migratory waterfowl such as coots and canvasbacks, and many other wetland resources. The presence of the dam created an ecological chain reaction, inundating a large area of marsh and sedge meadow with water. In 1917 an extra two feet was added to the Indianford dam and was reported by C. W. Threinen in his *History, Harvest and Management of the Lake Koshkonong Fishery* (from Johnson 2005: 11) as having a dramatic effect upon the lake’s ecology, changing it from a marsh to an unstable lake. The dam all but drowned-out the wild rice that had once been described as a meadow, and left only a few shallow bays and edge-water areas for it to propagate. The dam also affected fish species; hindered from swimming upstream to spawn. Species such as catfish, pickerel, sucker, bass, and pike were all reported as having greatly reduced in number after the construction of the Indianford dam (Kumlien 1877: 629-630; Haglund, personal communication 2015).

The richness and diversity of floral resources, and thus faunal resources, within a wetland habitat depends upon the seasonal fluctuation of water levels. The growth, reproduction, and establishment of wetland plant species are influenced by the presence or absence of standing water (van der Valk 1981: 689). Seasonally, the natural hydro period, the period of time that wetland soils are waterlogged, of Lake Koshkonong’s surrounding marsh area varies between seasonal flooded to permanently flooded (Johnson 2005: 34). The spring thaw of winter's cached precipitation, combined with spring rains, floods the Lower Rock River Watershed and with it Lake Koshkonong's marshes. The Indianford dam has altered the natural hydroperiod, but it can be inferred that pre-1851 Lake Koshkonong water levels fluctuated more greatly with the seasonal abundance or lack of precipitation, influencing the bio diversity of the habitat. According to Goldstein and Kind (1987: 23 and 34) marshes would have offered a "high" food potential best exploited in autumn and winter due to bird migration and wild rice ripening.

Oak Forests

Oak forests are the most common vegetation zone in all of southeastern Wisconsin according to Goldstein and Kind (1987: 26), however, they are rarer within the vicinity of the Finch site. Black oaks, red oaks, white oaks, bur oaks, swamp white oaks, and even other species of trees such as shagbark hickory, black walnut, boxelder, and hack berry are present in the oak forests of the southeast. A common feature of oak forests in the southeast is a thick shrub layer, so thick in fact that it easily creates an impassable barrier. Woody-thorny shrub species such as blackberries, gooseberries, prickly ash, gray dogwood, hazelnut, and poison sumac have been measured at densities as high as 21,000 individual plants per acre (Curtis 1959: 143).

Faunal species, specifically bird species, within oak forests vary their niches based on the amount of moisture available, which effects the type of ground cover and, in effect, the types of available food sources. Oak forests with low moisture levels, xeric forests, included the abundance of such species as the scarlet tanager, black-capped chickadee, downy woodpecker, turkey, rose-breasted grosbeak, cardinal, blue jay, pigeon, oriole, red-eyed towhee, red-headed woodpecker, and many more. In contrast, oak forests with an intermediate moisture level, mesic forests, are home to the wood thrush, least flycatcher, redstart, blue-gray gnatcatcher, yellow-throated vireo, ruby-throated humming bird, and the veery (Curtis 1959: 145). Mammal species include the woodchuck, porcupine, fox, elk, and even bison, with an abundance of deer and squirrel. Goldstein and Kind (1987: 34) list the oak forest as a "high" food potential zone best exploited in autumn and winter months. (See Appendix "A" for expected fauna list).

Deciduous Forests

Deciduous forests vary in composition throughout southeastern Wisconsin. Upland deciduous forests are commonly found on glacial till plains of well-drained loamy soils (Epstein 2002). Sugar maple, basswood, red oak, white oak, black oak, and beech trees are found in combinations lacking a clearly dominant species. The forest composition changes with the amount of available moisture; the drier areas, or xeric forests, are composed of oaks; the mesic areas with an intermediate moisture content are composed of sugar maples, basswood trees, and even red oaks; areas of greater moisture such as floodplains and areas adjacent to major rivers and streams are made up of elm and silver maples (Curtis 1959: 90-91; Goldstein and Kind 1987: 29).

Because no single tree species dominates these southern forests, their success rate depends upon several factors including: high reproductive rate, long life, and most importantly: shade tolerance. A tell-tale sign of a hardwood deciduous forest is the great number of seedlings and saplings spread out on the forest floor. The sugar maple, for example, is an extreme example of a shade tolerant tree, able to suppress its growth rate for an extended period of time in order to wait for an opening in the canopy: a ½ inch in diameter tree can be as old as 40 years (Curtis 1959: 107).

The understory of deciduous forests vary in coverage as: brushy gooseberry and buckthorn; to more open expanses of leaf-litter; a variety of herbs such as trillium, violet, mayapple, and Virginia waterleaf; seedlings and saplings competing for sunlight. Tree sapling leaves are a common food source for white-tail deer and elk. Other deciduous forest faunal species include: turkey, porcupine, gray squirrel, raccoon, woodchuck, fox, grouse, coyote, bobcat, gray wolf, and black bear (Epstein 2002). Deciduous forests offer a "good" food potential best exploited in spring when herbs are in bloom and animals are feeding (Goldstein and Kind 1987: 29 and 34). (See Appendix "A" for expected fauna list).

Prairies

The prairie habitats within the vicinity of the Finch site are a mix of xeric and mesic prairies interspersed among the oak savannas. A true prairie is defined by Curtis (1959: 262) as being an open area of land covered in low-growing plants, dominated by true grasses, with no more than one mature tree per acre. An area with more than one tree per acre covering less than half of the total area with its canopy is defined as a savanna, which is why the oak savanna and the prairie zones of southeastern Wisconsin literally alternate with each other. The aggregation of plant species varies between either completely random to extremely aggregated (Curtis 1959 280). Prairie zones in southeastern Wisconsin are located either on glacial outwash areas of very porous sub-soils or on gently rolling hills created by recessional moraines of glacial till, very similar to the formations around the Finch site.

Floral variation is seasonal as different plant species attain full growth and maturity throughout the early, middle, and late summer while other varieties such as big bluestem, indiangrass, and prairie panic grass mature into October (Curtis 1959: 278). Goldstein and Kind (1987: 29 and 34) rate the overall food potential of the prairie zone as "low-limited" and being best exploited in winter months. This is due in large part to their assertion that the only resource prairie zones offered in abundance was bison. However, other faunal resources such as elk, rabbit, and various birds would have been available in prairie zones. In contrast to Goldstein and Kind's (1987) claim of a "low-limited" resource zone, Wisconsin prairies near the upper Fox River were described as abundant by Father Dablon in 1670 (from Curtis 1959: 262-263):

> All this prairie country extending…affords ample subsistence to the elk not infrequently encountered in herds of four or five hundred each. These, by their abundance, furnished adequate provision for whole villages, which therefore are not obliged to scatter by families during the hunting season, as the case with the savages elsewhere.

The availability of prairie zone faunal resources to the occupants of the Finch site would have offered an alternative source of large game, bison, than would have been available in marsh and wetland environments. (See Appendix "A" for expected fauna list).

For this study, the use of vegetation zone reconstruction maps serves the purpose of identifying all possible habitats that would have been accessible to prehistoric occupants of the Finch site, and thus can be used to account for the expected fauna that would have been utilized in the area.

The Paleo-Environment

A brief discussion of postglacial through pre-settlement vegetational changes in southeastern Wisconsin is necessary in order to account for all possible fauna that would have been available to the earliest occupants of the Finch site. Evidence for the late Pleistocene to early Holocene environment is available through pollen profile analysis of deep stratified deposits of organic material, which is available from the botanical deposits found in bogs formed by streams dammed by glacial outwash deposits, or in deep deposits of peat moss (Curtis 1959: 447). One such deposit, a peat bed with a well-developed soil profile, was discovered in Dane County, Wisconsin within a recessional moraine (the Milton Moraine) roughly 50 kilometers northwest of the Finch site (Curtis 1959: 448). The deposits were dated to roughly 12,000 years ago and reflect a pollen depositional sequence of a mixed conifer and hardwood forest, preceded by a dominant spruce-fir forest and open spruce parklands. Stratigraphically collected pollen evidence from the Volo Bog in Lake County, Illinois (less than 100 kilometers southeast of the Finch site) also yields evidence for vegetational changes from 11,000 years ago to the present. These results display a slow progressive increase in temperatures, and a shift from open spruce woodland, to pine dominated forests, to birch dominated, to mixed hardwoods (King 1981: 49-51). This same transition is also reflected in more regional studies of Holocene vegetation changes, which describe a movement of spruce-fir boreal forests northward, replaced by birch groves, oak forests and savannas, and mixed hardwood deciduous forests (Webb et. al. 1983: 147; Bartlein et. al. 1984: 363; Baker et. al. 1992: 385; Curtis 1959: 448). Although the mosaic of environmental habitats in the vicinity of the Finch site would have shifted through time starting in the post-glacial late Pleistocene, the available fauna would have remained relatively unchanged from those present in the previously discussed six "pre-settlement" vegetation zones, with the exception of late Pleistocene megafauna (Kuehn 1998: 450).

Evidence for an early human presence and interaction with the late Pleistocene to early Holocene environment is directly correlated to radiocarbon dated faunal remains in southeastern Wisconsin. The remains of a woolly mammoth (*Mammuthus primigenius*) was excavated at the Schaefer site near the town of Paris in Kenosha County, southeastern Wisconsin. The skeletal remains were 75% complete, associated with stone tools, and displayed butchery cut marks. However, the identification of cut marks as being a cultural taphonomic result, as well as the validity of the stone tools has been debated (Overstreet 1998; Johnson 2005; Grayson and Meltzer 2002: 332). Bone collagen and associated wood fragments returned radiocarbon dates between 12,400 – 11,000 yr B.P. (Overstreet and Kolb 2003: 94). Another woolly mammoth was excavated at the Hebior site less than two miles southwest of the Schaefer mammoth. The Hebior mammoth was 85 – 90% complete, discovered in association with stone tools, and was also butchered as evident by cut marks, which, like the Schaefer site, is also debatable (Overstreet 1998; Johnson 2005; Grayson and Meltzer 2002: 337). Bone collagen from the Hebior mammoth was radiocarbon dated to roughly 12,500 yr B.P. Pollen analysis was conducted at both sites, identifying the same trends in spruce dominant arboreal forests and open spruce parklands transitioning into oak and mixed hardwood deciduous forests as witnessed in the Milton Moraine deposit, and the Volo bog deposit (Overstreet and Kolb 2003: 99; Curtis 1959: 448; King 1981: 49-51). Both sites are roughly 100 km southeast of the Finch site, warranting the availability of large mammoths extremely likely to Early Paleoindian occupants of the site.

Woolly mammoths, mastodons, and more than 20 genera of megafauna (>45 kg.) became extinct at the beginning of the Holocene in North America (Elias and Schreve 2007: 3207). Many examples come from the Great Lakes Region. A Pleistocene epoch stag moose (*Cervalces scotti*) was found outside of Ansonia, Ohio with a piece of wood in situ with the vertebrae radiocarbon dated to 10,300 yr B.P. In Darke, Ohio a Jefferson ground sloth (*Megalonyx jeffersonii*) was discovered and was radiocarbon dated to 12,190 yr B.P. (Meltzer and Mead 1985; Guilday 1967). A stilt-legged deer (*Sangamona fugitive*) was discovered in Toronto, a piece of antler radiocarbon dated to 11,315 yr B.P. At Welsh Cave, Kentucky a flat-headed peccary (*Platygonus compressus*) was radiocarbon dated to 12,950 yr B.P. Near Scotts, Michigan a woodland musk-ox (*Bootherium bombifrons*) was discovered and radiocarbon dated to 11,100 yr B.P. (Meltzer and Mead 1985; Guilday 1967). The list of extinct megafauna dating to the late Pleistocene in the Great Lakes region is extensive, however, Paleoindian sites with associated megafaunal assemblages are rare (Schroeder 2007: 65). Any possible identified extinct megafauna specimens associated with the Paleoindian component at the Finch site would be brought to the analytical expertise of a more qualified zooarchaeologist.

Archaeological Work at the Site: Survey and Excavation

Initial survey work was carried out at the site in 1987 by Lynn A. Rusch of the Wisconsin State Historical Society. Rusch interviewed local resident Gus Fisher who, as previously mentioned, raised his concerns about the location of a historic cemetery at the site belonging to the Finch family. Fisher described seeing human bone at the site in 1949 during a road widening project and had done his own initial research. Rusch also interviewed the STH 26 project design engineer Tim Diebels at the same time, and the three of them did an initial inspection of the site looking for signs of the historic cemetery (Rusch 1989: 1-2). Rusch monitored the mechanical stripping of the slopes on either side of STH 26 on June 21st, 1989 alongside WisDOT construction engineer Tim Verbage, but no evidence of the cemetery was discovered. Rusch initially concluded that the original construction of STH 26 had resulted in the destruction and removal of all human burials and evidence of the historic Finch family cemetery from the hill top (Rusch 1989: 3) though the cemetery was eventually discovered in 2013.

In 1999 the Great Lakes Archaeological Research Center (GLARC) conducted Phase I archaeological survey through the STH 26 route design corridor. Prehistoric artifacts were discovered while shovel testing at 15 meter intervals in the location of the previously reported Finch family cemetery on both sides of STH 26. In total 26 of the 52 shovel tests were positive for prehistoric cultural material: 187 chert flakes, 37 grit-tempered pottery sherds, and single fragment of burned animal bone (Watson 2003: 192). Based on this initial Phase I survey, the Finch site occupied an area 40 meters wide by 260 meters along STH 26. The initial interpretation of the site was that it was a "likely locale for a habitation site or campsite containing subsistence and technology data," (Watson 2003: 192). The absence of a plow zone, presence of intact sub-surface stratigraphy, and density of artifacts provided enough evidence for the possibility of intact cultural features.

Phase II evaluations were conducted in 2001. The goal of Phase II investigation was to further define the boundaries of the site and to determine if the Finch site was eligible for listing on the National Register of Historic Places, maintained by the National Park Service in the U.S. Department of the Interior. An additional 198 shovel tests were excavated at five meter intervals, 54 of which were positive for cultural material (Watson 2004: 5). Lithics included a single biface, 1 core, 14 pieces of fire-cracked rock (FCR), and 221 debitage flakes of which the majority were of local Galena chert. Seventy pieces of ceramic were discovered, all grit tempered, with three rim sherds. Two of the rim sherds were identified as Havana Cordmarked and Havana Plain types associated with a Middle Woodland occupation (Watson 2004: 10). In addition to the shovel tests, 13 one by two meter test units were excavated. A total of 1,797 lithics, 1,442 ceramics, 56 faunal remains, and 27 historic artifacts were recovered from the 13 Phase II test units. A single feature was discovered and described as a shallow basin yielding 29 pieces of grit tempered pottery and four lithic flakes.

Phase III excavation took place during the 2009, 2010 and 2012 field seasons. A total of 420 units covering 1264 square meters were excavated, revealing 168 cultural features. The excavation units were spaced between STH 26 and Pritchard's Pond initially based on shovel test artifact density. Additional units were placed in areas of continued artifact density extending from the southern knoll north to the extent of the pond (see Figure 2.11) (Kubicek et al. 2011; Haas 2012). Diagnostic artifacts were

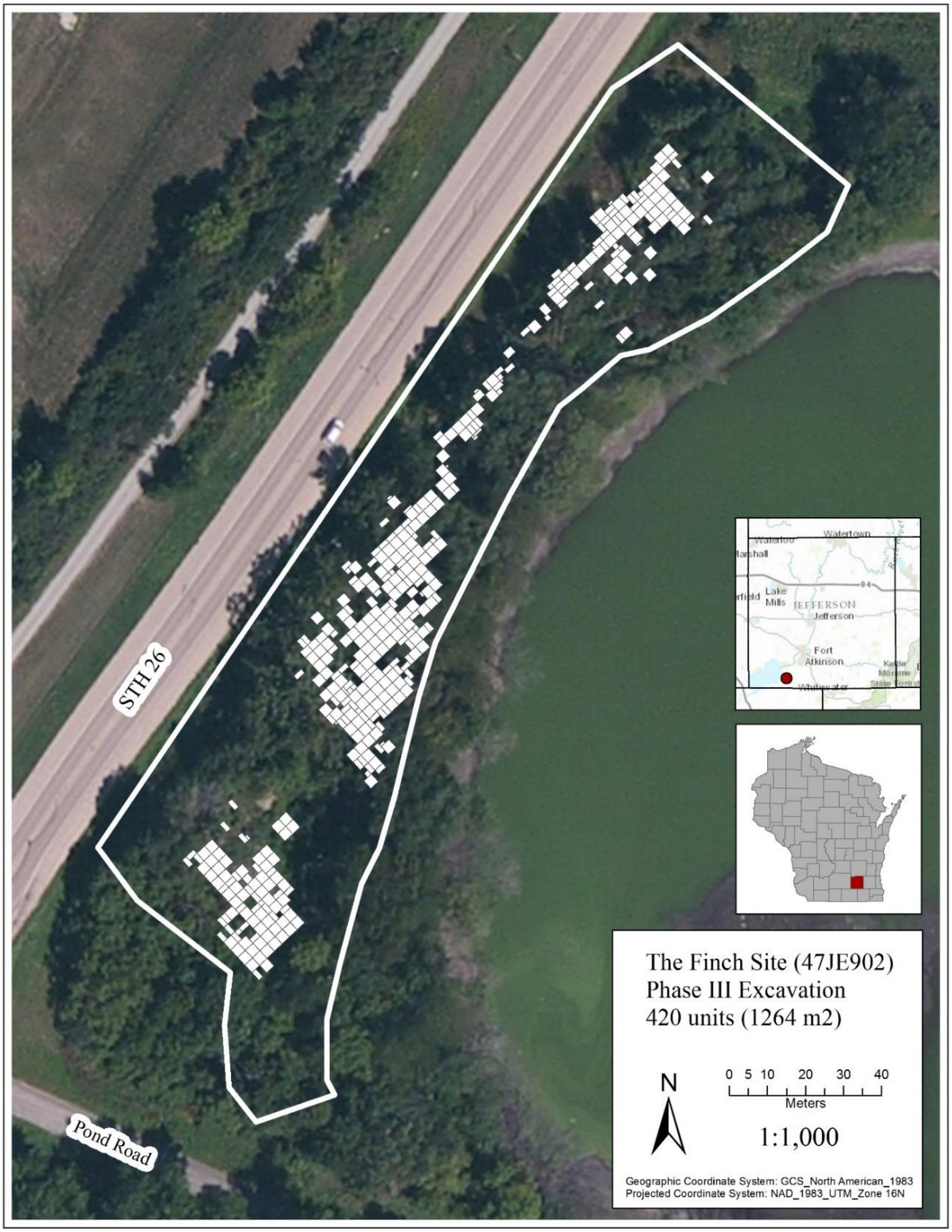


Figure 2.11: Phase III excavation at the Finch site – 420 excavation units (1264 m²).

recovered from periods encompassing the Early Paleoindian through the Late Woodland, suggesting that the Finch site remained an important re-visited location on the landscape.

Artifacts were collected from excavation units of varying sizes (2x2, 2x1, 1x1 square meters) that were excavated in arbitrary 5cm levels to a depth of at least one sterile level. Soil from each unit was dry-screened using ¼" hardware mesh. A water-screened sample was recovered from every arbitrary level of each excavation block (an excavation block consisted of a group of four, two by two meter units) totaling 589 samples. Artifacts and ecofacts were recovered with 1/8" mesh from each of these samples.

The cultural features were bisected and recorded for profile shape and depth. A one liter flotation sample was collected from one half of every feature and processed using 1/16" mesh. The remaining feature matrix from this feature half was collected for water screening through 1/8" screen. A total of 208 flotation samples and 197 water-screen samples were collected from the 168 features. The other half of every feature was excavated by hand in order to piece plot any and all artifacts. This feature matrix was dry-screened through ¼" mesh. The inclusion of various sampling strategies and their different mesh sizes for both units and features will the used to examine possible biases in the recovery methods of different sized taxa at the Finch site (Shaffer and Sanchez 1994).

Artifacts recovered from Phase III excavations include lithics, ceramics, faunal remains, flora, and various historic artifacts of glass and metal. Roughly 98,000 lithic artifacts were initially sorted as cores, core tools, flake tools, formal tools, ground stone, and waste flakes. Lithics were further sorted by GLARC archaeologists and technicians as informal and formal tools. Formal tools were further sorted based on objective morphological criteria and standard functional classification such as hafted biface, patterned biface, biface, hafted uniface, uniface, uniface/biface, and diagnostic formal tools (Haas, personal communication 2013). Although this thesis focuses on questions utilizing the faunal assemblage, future research could be aimed at integrating other parts of the extensive artifact assemblage.

Diagnostic stone tools were used to identify temporal distinction in various excavated proveniences at the Finch site. The temporal range identified by diagnostic lithic tools at the Finch site spans from Early Paleoindian through the Late Woodland cultural tradition.

The early Paleoindian period is represented by a single Folsom point (see Figure 2.12), made from Burlington chert and was recovered in level 7 (30-35 centimeters below surface (cmbs)) of unit #9. Folsom points are dated from 11,500 – 10,000 yr B.P. (Benchley et. al. 1997: 62). Late Paleoindian is represented by an Agate Basin point as

Figure 2.12: Folsom type Paleoindian projectile point from the Finch site.

well as two Scottsbluff Eared points. Early, Middle, and Late Archaic temporal periods are represented by the recovery of many projectile points including Kirk Corner-Notched, Thebes, Raddatz, Matanzas, Durst, Kramer, and Waubesa points (see Figure 2.13). Woodland temporal periods are represented by Snyders, Steuben, Madison Triangular, and Cahokia points (see Figure 2.14). A more formal review of cultural temporal periods in southeastern Wisconsin and their diagnostic artifacts will follow in the next chapter.

Figure 2.13: Late Archaic points.
(from Haas 2012: 10).

Figure 14: Middle Woodland points
(from Haas 2012: 11)

Over 24,000 pieces of prehistoric ceramics were recovered from the Phase III excavations. A total of 104 vessels were recovered and identified to reflect a diagnostic temporal period. Early Woodland ceramics are represented by Marion Thick ware ceramics, diagnostic of incised over-cord marked varieties such as Beach Incised, Dane Incised, Deer Creek Incised (see Figure 2.15), (Haas 2012: 9). The Early Woodland period in Wisconsin is associated with the Marion culture and, emergence of ceramic technology and the eventual transformation of Marion Thick ceramics to grit-tempered, thinner walled vessels. The period is dated 5,000 yr B.P. to 2,300 yr B.P. (Brown 1986: 600). Middle Woodland ceramics are composed of Havana wares such as Havana Plain, Havana Zoned (see Figure 2.16), and Kegonsa Stamped; all present at the Finch site. Middle Woodland in southeastern Wisconsin is dated to roughly 100 – 300 A.D. to 500 A.D. (Stevenson et. al. 1997: 164-165). Late Woodland ceramics make up the majority of the

Figure 2.15: Early Woodland Beach/Dane Incised Zoned (from Haas 2012: 12)

Figure 2.16: Middle Woodland Havana (from Haas 2012: 14)

identified diagnostic pottery in the assemblage. Madison wares such as Madison Plain and Madison Cord-Impressed (see Figure 2.17) as well as collared vessels including Aztalan, Starved Rock, and Point Sauble varieties are present; Aztalan collared are the most abundant. The Late Woodland in southeast Wisconsin is roughly dated from 500 A.D. to 1200 A.D. (Benchley et. al. 1997: 120). Again, a more formal review of cultural temporal periods in southeastern Wisconsin and their associated diagnostic artifacts will follow in the next chapter.

Figure 2.17: Late Woodland Madison Cord-Impressed (from Haas 2012: 15)

Previous Faunal Study

An initial inventory of faunal remains from the 2009 and 2010 field seasons was completed by E. M. McCarthy, contracted by Great Lakes Archaeological Research Company (GLARC), with the goal of identifying specimens to taxonomic class: mammal, bird, reptile, amphibian, fish, and unidentified. Weights were recorded using a digital scale to the nearest 0.01 of a gram. Specimens were evaluated for modifications, the presence of cut marks, and whether or not there was evidence for burning. McCarthy also made several species level identifications using B. Miles Gilbert's Mammalian Osteology and UW-Milwaukee's comparative faunal collection under the supervision of Dr. Jean Hudson. (McCarthy, personal communication 2014). In total, McCarthy analyzed the faunal remains collected from dry-screen, water-screen, and flotation samples from 384 units and 159 features. This sampled has a NISP (number of identified specimens) of 10,985 and a weight of 2135.60 grams. McCarthy compiled her results into an excel workbook data set.

The remaining faunal assemblage from the 2012 field season (36 units and 9 features) was analyzed by various GLARC lab technicians for specimen counts and weights, as well as burned or unburned (Kubicek et al. 2011; Haas 2012). The NISP of this sample is 3,594 with a combined weight of 228.5 grams. The results of this assessment were added to McCarthy's dataset as part of the GLARC phase III analysis.

My objective in this thesis is to combine data from all three years of excavation into a single analysis, standardizing the database, and re-evaluating the assemblage more thoroughly for species level identifications and burned and modified bone. I will then use the full data set to examine the intrasite spatial relationships between faunal remains and their associated cultural periods using a GIS analysis. In the process I will focus the analysis on diet and food processing evidence and the ways in which these vary over time and within the space of the site as per my research questions.

Chapter 3: Cultural Background

Diagnostic lithic and ceramic artifacts indicate that early prehistoric populations occupied the Finch site (47 JE-0902) from the Paleoindian periods through the Late Woodland periods of prehistory. A brief overview of the prehistoric cultural components represented at the site is necessary to contextualize this study within the larger cultural framework of the region. An understanding of southeastern Wisconsin prehistory will support the explanations of this analysis, which relies on the associated diagnostic material culture to subdivide the faunal assemblage into cultural components.

Early Paleoindian Period

The subsistence strategies of Wisconsin's Early Paleoindian occupants were dictated by the availability of animals and plants adapted to the post glacial environment. Traditional subsistence models describing Paleoindian behavior have typically focused their attention upon the hunting and scavenging of large mammals (Overstreet 1991b: 280). Extinct mega fauna (> 45 kg) such as mammoth, mastodon, stag-moose, giant beaver, ground sloth, short-faced bear, horse, camel, peccary, musk ox, and many others would have shared an environment with early Paleoindians (Boulanger and Lyman 2014: 37; Lorensen et. al. 2011: 3; Elias and Schreve 2007: 3209). Modern taxa such as white-tailed deer, elk, and bison, as well as smaller animals such as rabbits, squirrels, muskrats, beaver, raccoon, and turtles were also utilized (Schroeder 2007: 65; Kuehn 1998: 469). Stoltman (1998) posits that berries, fruits, and edible plants would have been available also, but they would have been seasonal "munchies," not staples (1998: 55). Stoltman also posits that cold-water glacial drainage lakes and streams would not have been capable of supporting fish and shellfish with enough nutrients to adequately support a large part of the Paleoindian diet (1998: 56). Hunting and scavenging large mammals was to remain the dominant form of prehistoric subsistence for many thousands of years.

The earliest Paleoindians in Wisconsin were a hunting intensive society, composed of small, family-based egalitarian groups, equipped with a limited yet multifunctional toolkit to facilitate a highly mobile lifestyle fluctuating between short-term habitation sites based upon their needs for subsistence and tool resources (Schroeder 2007: 65; Mason 1981: 184; Koldehoff et. al. 1999: 106; Gibbon 2012: 37).

The Early Paleoindian period is dated to roughly 11,500 B.P., though radiocarbon and AMS bone collagen dates from two mammoth kill sites in Kenosha County, southeastern Wisconsin exhibit dates as old as 12,520 B.P. The Hebior site and Schaefer site mammoths, as mentioned earlier, are examples of possible pre-Clovis Paleo sites. Each mammoth showed signs of probable butchery via cut marks and were discovered in situ with stone tools such as bifaces and local chert flakes (Overstreet 1998: 42-43; Overstreet and Kolb 2003: 94-95: Johnson 2006: 75). These two sites, as well as the Mud Lake Mammoth site and the Fenske Mammoth site, seemingly identify a pre-Clovis presence (Johnson et. al. 2007: 14). No diagnostic artifacts were recovered from these two other sites, however, Overstreet has made a claim for an association of mammoth kill site activity in the region with a Chesrow complex, whose type site he dates to pre-Clovis using Nipissing phase Lake Michigan shoreline glacial geochronology (Overstreet 1998: 46). However, the Chesrow complex is most likely not Paleoindian, as the tools used by Overstreet to define the complex typologically fit a number of Archaic point styles (Stoltman 1998). Since the points used by Overstreet to form his complex are found in plowzone contexts, and none are dated or associated directly with extinct fauna, Chesrow is not yet a generally accepted pre-Clovis archaeological manifestation (Jeske, personal communication 2015). Moreover, Stoltman argues that the Chesrow complex points are typologically similar to Price Stemmed points, a thick lanceolate point with laterally projecting ears and a concave base found in the Mississippi River Valley (Stoltman 1998: 62). Price Stemmed points are considered morphologically similar to Archaic period Matanzas points (Justice 1990).

The Early Paleoindian period in Wisconsin is recognized almost exclusively by a limited number of lithic tool types. In fact, there are very few Paleoindian sites reliably dated using chronometric means in Wisconsin (Stoltman 1998: 53). The Early Paleoindian period ranges from 11,500 B.P. to 10,000 B.P. (Mason 1981: 190; Benchley et. al. 1997: 62). Clovis points are large lanceolate projectile points characterized by a narrow flute usually less than half the total length of the blade. Flutes are present on one or both sides, and multiple flutes are sometimes present on the same side (Schroeder 2007: 67). Clovis points also have concave bases, sharp corner “ears,” and evidence for edge grinding, the combination of which is assumed to benefit hafting. Material used for Early Paleoindian points ranges from locally sourced glacial till cherts, to high quality cryptocrystalline non-local materials such as Moline chert, Hixton silicified sandstone, Gunflint Silica, Cochrane chert, and many more. Gainey and Folsom points post-date Clovis points, radiocarbon dated on the Great Plains from 10,900 B.P. to 10,200 B.P., an accepted date range used in Wisconsin as well (Stoltman 1998: 58). Gainey points are smaller, generally have longer flutes than Clovis points, and are more concave at the base. Folsom points are generally shorter and thinner than either Clovis or Gainey points. Fluted Folsom points have a flute usually longer than 3/5 the blade length, though some

Folsom points lack fluting altogether. The base usually has a deep concavity, though sometimes they are recurved, with a basal projection (Mason 1981: 184; Schroeder 2007: 67).

An example of an Early Paleoindian presence in the area comes from the Schmeling site (47 JE-0833), located just on the opposite side of Lake Koshkonong from the Finch site on the northwest shore. The Paleoindian presence at the site is represented by a collection of Clovis hafted bifaces collected by Mr. Kevin Schmeling over the past 40 years (Jeske and Winkler 2008: 100). Twelve Clovis points were recovered in total, five of which are of Hixton Silicified Sandstone, the other seven were made from locally available cherts. The presence of the Hixton material, long-distance sourced from western Wisconsin, lends insight into Paleoindian mobility and resource acquisition.

Late Paleoindian Period

The Late Paleoindian period in Wisconsin is roughly dated to the interval of 10,000 B.P. through 8,000 B.P. (Mason 1997: 192; Benchley et. al. 1997: 64). The continuing deglaciation of northern Wisconsin combined with a drop in Lake Michigan's water levels opened up previously uninhabited territories for Late Paleoindians to explore. Late Paleoindian subsistence would have differed dramatically by the disappearance of many large mammal megafauna. The cause of the extinction of mammoths, mastodons, and a plethora of other large mammals is still not fully understood, but is highly contested. It is usually conceded that environmental factors due to climate change combined with over overexploitation by Paleo-hunters led to the Late Pleistocene extinctions (Kelly 2007; Martin 1984; Martin 2005; Dansgaard 1993; King 1984). The resources that remained available to Late Paleoindians more closely resemble modern assemblages of flora and fauna, with several species of large megafauna available for hunting such as moose, bison, caribou, elk, and white-tailed deer (Kuehn 1998: 450). In Wisconsin, Late Paleoindian sites such as the Deadman Slough site (47 PR-0046) in Price County, offer evidence for a wide variety of utilized fauna. While large and medium-sized mammals make up the majority of the assemblage, turtle and bird remains are still adequately represented (Kuehn 1998: 456).

Late Paleoindian sites are recognized by the first appearance of ground stone adzes, as well as flute-less diagnostic projectile points such as Agate Basin, Scottsbluff, Eden, Plainview, Hi-Lo, and the Cody tanged knife. Agate Basin points are long, narrow, straight-based lanceolate points named for the type site, the Agate Basin site in eastern Wyoming (Justice 1987: 33). Scottsbluff points have wide, straight stems with flat to concave bases and weak shoulders that exhibit transverse parallel flaking patterns across the blade. Eden points are similar to Scottsbluff points, except they are narrower, with less pronounced shoulders, with a diamond-shaped cross section (Justice 1987: 46-49). These points, combined with the presence of Cody knives, an asymmetrical tanged knife with a straight stem, made up the tool kit of the Cody Complex first recognized from sites in the Great Plains. The Cody Complex was recognized in Wisconsin at the Renier site just northeast of Green Bay. Eden and Scottsbluff points and point fragments were discovered at Renier in the context of what Mason terms as a "crematory site" (Mason 1981: 118).

Salzer divides the Late Paleoindian period into two distinct cultural phases, the Flambeau and later Minocqua phase, based upon excavations from sites such as Squirrel Dam (47 ON-0021) and the Robinson site (47-ON-0027). Flambeau phase sites include

Agate Basin points, while Minocqua sites include Scottsbluff points. Still, the Late Paleoindian period in Wisconsin, like the Early Paleoindian period, relies heavily upon the analogy of dates and typologies from stratified assemblages in the Great Plains (Benchley et. al. 1997: 65; Schroeder 2007: 68). More carefully excavated sites and reliably dated provenience are needed to clarify Paleoindian behavior in post glacial Wisconsin.

Regionally, the Lake Koshkonong area boasts numerous examples of a Late Paleoindian presence. An investigation at the Hoard Museum in Fort Atkinson by Winkler and Jeske (2009: 126) identified 11 Late Paleoindian bifaces and biface fragments typed as Agate Basin, Dalton, Eden, and Scottsbluff points obtained by collectors from the local area. Late Paleoindian points from the Kelly North Tract at Carcajou Point (47 JE-0812), a site that sits on the northwest bank of Lake Koshkonong, are represented by two Plainview points, one Hi-Lo, and one Dalton point (Jeske 2003: 155-156; Jeske et. al. 2002: 11). A lithic mass analysis comparison carried out by Winkler (2011: 232-233) between the two site assemblages from the Dalles site (47 IA-0374) and the Kelly North Tract at Carcajou Point (47 JE-0002) looked to compare raw material types. Based on these lithic raw material types and point morphology Winkler suggests that the two sites demonstrate different resource use patterns. The Kelly North Tract occupants likely utilized an abundance of local food resources, while curating their non-local lithic materials for repeated re-use and re-sharpening. This study successfully challenges the established concept of the nomadic Paleoindian.

Early Archaic Period

The Archaic environment in Wisconsin is characterized by a mid-Holocene climactic shift toward a more stable, drier period called the Hypsithermal interval (King 1981: 57). The increasing temperatures resulted in significant vegetational changes (King 1981: 58). The mesic deciduous forests flourished as a result, and hardwood species such as basswood, elm, sugar maple, and oak trees spread northward.

As a result of the deglaciation of Lake Michigan's northern edge, waters from Lake Superior and Lake Michigan drained into Lake Huron and out the St. Lawrence River, instead of flooding out in the opposite direction via the Illinois Valley. Lake Michigan water levels receded by more than 100 meters in elevation during what has been termed the Chippewa low-water stage (Larson and Schaetzl 2001: 531). Water levels remained at maximum lows until roughly 4000 B.C., meaning that any and all evidence for Early Archaic period lakeshore activity would currently reside underwater, completely inundated for the past 6000 years.

By 3500 B.C. a pre-contact environment was relatively achieved, with an abundance of oak savannah and prairie habitats spread out across southern Wisconsin's environmental mosaic (Mason 1981: 132; Pleger and Stoltman 2009: 704). Flora and fauna resources available to Archaic Tradition Wisconsinites reflect present time ecological assemblages with the exception that moose, woodland caribou, and bison are rarely present in the southeastern region, a likely result of human hunting. Large fauna such as white-tailed deer and elk would have made up a large part of the Archaic diet in the region, supplemented by smaller mammals, plants, birds, turtles, and fish, though evidence for fish is less common in the Early Archaic period (Kuehn 1998: 469-470;

Theler and Boszhardt 2003a: 69). Evidence for plant consumption comes from strontium/calcium and barium/calcium ratios from human bone discovered at the Reigh site, the Price III site, and the Oconto site, in some cases suggesting that plants made up close to 40 percent of the diet (Pleger and Stoltman 2009: 711). Regionally, Mason (1981) accounts for evidence of plant collecting and processing by the presence of milling and nutting lithic tools, as well as midden evidence for the presence of wild grapes, acorns, pecans, hazelnuts, walnuts, hickory nuts, smartweed, goosefoot chenopod, and sunflower (1986: 144).

Though firm dates transitioning the Late Paleoindian period into the Early Archaic period are ineffectual, given multiple examples of cultural overlap such as the Reiner site (Mason 1981: 121; Stoltman 2009: 701) in the Door Peninsula, the Early Archaic is generally agreed to date from roughly 8000 B.C. to 4000 B.C. in Wisconsin (Stoltman 1997: 116). Other evidence for cultural overlap comes from the Deadman Slough site in northern Wisconsin where Late Paleo and Early Archaic point typologies were found in association (Kuehn 1998: 464).

Early Archaic sites are recognized in southern Wisconsin and northern Illinois based on biface typologies established from various sites. Projectile points come in a variety of side notched, corner notched, and stemmed manifestations with beveled edges and/or bifurcated bases. Typologies recognized in northern Illinois such as Thebes cluster St. Charles and Thebes Expanded Notched often exhibit deep notching, as well as Kirk Corner Notched and asymmetrical Fox Valley Truncated Barb points (Lurie et. al. 2009: 778). Other points, such as the Hardin Barbed, are also found in northern Illinois, for example at the McHenry County site (11 Mh-0124), an Early Archaic camp site (Lure et. al. 2009: 771). The Bass site, in Grant County Wisconsin is considered Early Archaic. The site was lithic workshop/quarry utilized for its outcroppings of Galena chert. Over 38 Hardin Barbed points and knives signaled the Early Archaic typology, however, this site also showed evidence for cultural overlap by the presence of a Scottsbluff base fragment (Stoltman 2009: 702; Theler and Boszhardt 2003: 72).

The Early Archaic period in southern Wisconsin is underrepresented in the archaeological record. Mason posits that it is a result of the Ritchie-Fitting Hypothesis, which supposes that the environment, as closed coniferous forests gave way to advancing deciduous hardwood forests from the south, would have been lacking in adequate resources until roughly 6500 B.C. (Mason 1981: 132). This is in addition to the fact that low Lake Michigan water levels would have lured game and hunters into areas now presently flooded by high water. Kuehn's work with the Deadman Slough site (47 PR-0046) and Sucices site (47 DG-0011) faunal assemblages, however, identified that a wide range of different animal taxa was utilized, reflective of a generalized foraging subsistence strategy. Generalized subsistence suggests that resources were spread out among a variety of different habitats and exploitable environments (Kuehn 1998: 469). Whatever the reason why Early Archaic sites are not common, it is not due to a lack of resource availability and variety.

Middle Archaic Period

The Middle Archaic period in Wisconsin dates from roughly 6000/4000 B.C. to 1500/1200 B.C. (Stoltman 1997: 121). Point typologies for the Middle Archaic are represented by a plethora of side notched points such as Raddatz, Godar, and Reigh Side Notched (all present at the Finch site). Shallow side notched Matanzas, Madison Side

Notched, and Osceola Side Notched points are found between Middle and Late Archaic assemblages (Pleger and Stoltman 2009: 705-706; Lurie et. al. 2009: 778; Kuehn 2002: 29; Justice 1987: 68; Jeske et. al. 2002). The Raddatz Rockshelter, the type site for the Raddatz Side Notched, is located in Sauk County Wisconsin in the Driftless Area. The Raddatz Rockshelter offered deep, stratigraphically well preserved Archaic Tradition deposits which were successfully radiocarbon dated to provide precise dates to the Middle Archaic period in southern Wisconsin (Stoltman 1997: 121). Other rockshelters such as Governor Dodge, Lawrence I, and Brogley also yielded radiocarbon dates useful in regionally defining and dating the Middle Archaic (Benchley et al. 1997: 79). Locally, the Kelly North Tract (47 JE-0812) produced several radiocarbon dates from feature context. Two features are dated to roughly 2800 – 1800 B.C. (Jeske et al. 2002: 17), well within the bounds of the Middle Archaic as defined by Stoltman (1997). The site also produced a Middle Archaic Vosburg-like point, as well as others dating to the transition between Middle and Late Archaic, and is thus defined as a manifestation of Middle-Late Archaic transition (Jeske et al. 2002; Winkler 2004).

The Middle Archaic is also recognized by evidence for the domestic dog, ground-stone grooved axes, bannerstones, copper smithing, and cemeteries. Copper smithing, the copper industry, or the Old Copper Complex are all used to express the regional cultural phenomenon of Middle Archaic period copper use (Pleger and Stoltman 2009: 707). Evidence from the Duck Lake site in the upper peninsula of Michigan, suggests that Archaic occupants of the site retrieved copper nuggets in their raw form from glacial deposits (Hill 2006: 240). A study completed by Hill and Jeske utilizing laser ablation techniques compared the trace elements of copper artifacts from the Archaic components of the Kelly North Tract at Carcajou Point (47 JE-0812) and the Jaco site (47 JE-1192) (Hill and Jeske 2006: 3). Their results concluded that Archaic copper at the Kelly North Tract site was similar to copper from sites near the Michigan Upper Peninsula/Wisconsin border and in eastern Minnesota. Copper from the Jaco site, however, was similar to copper from farther south, near the Reigh site west of Lake Winnebago. Archaic copper was likely sourced from multiple locations, perhaps indicating multiple groups with multiple networks (Hill and Jeske 2006: 4). Copper was manipulated by a repetitive process of cold hammering – heating – cooling – cold hammering – repeat. The mastery of this process allowed for the creation of a variety of tools, ornaments, and various accessories. Copper manufacturing sites are identified by cold hammering by-products – flakes and chips of non-reuseable copper (Pleger and Stoltman 2009: 708). Copper artifacts typically produced in the Middle Archaic include socketed spear points, hooks, harpoons, gorges, awls, drills, blades, celts, adzes, axes, and many more (Mason 1981: 185-187).

Group burials in the form of cemeteries also make their appearance in the Middle Archaic period. Accompanying grave goods identify the connection of long linking exchange networks which brought goods from far south and west into Wisconsin. The Oconto site, in Oconto County Wisconsin just north of Green Bay, was AMS dated to roughly 4000 to 3000 B.C. and included the excavation of approximately 50 individuals from 20 burial features arranged in a variety of positions including bundle burial, primary flexed, primary extended, and even cremation (Pleger and Stoltman 2009: 709; Mason 1981: 191). A Marine shell artifact was present along with other grave goods, signaling evidence for long distance trade. The Reigh site, just west of Lake Winnebago, is another

Middle/Late Archaic burial site composed of 44 interred individuals, present as extended, flexed, bundle, and cremation burials. Along with copper artifacts that include points, knives, and a probable copper strip headband (belonging to an interred male), there were also two marine shell artifacts, again, signaling some connection to the Atlantic or the Gulf of Mexico by travel or trade. Other Middle Archaic burial sites, including the Osceola site, the Price III site, and the McGraw site (11L-0386) in northern Illinois give evidence for mass Archaic burials accompanied by a variety in grave good artifact assemblages, an absence of preferential associations of artifacts by age or sex, and an absence of earthen mound structures in association with mortuary practices (Pleger and Stoltman 2009: 710-711; Lurie et. al. 2009: 764; Benchley et. al. 1997: 79).

Faunal material from the Middle Archaic period is represented by subsistence refuse as well as bone tools and grave goods. Faunal artifacts present at the various Middle Archaic burial sites discussed include shell artifacts, elk antler handles, antler points, worked swan humeri, pearl beads, bone harpoons, eagle talons, a tundra swan bone flute, a perforated bear canine, and other various bone tools. New tools directly associated with fishing also emerge during the Middle Archaic including copper fishing hooks and copper harpoons (Pleger and Stoltman 2009: 710-711; Mason 1981: 192-193).At the Crow Hollow site in southwestern Wisconsin a single component Middle Archaic assemblage was discovered complete with intact pit features. Walnut shell, hawthorn seed, goosefoot seed, acorn, and hickory nutshell were all carbonized within three of the features as well as white-tailed deer bone and fragmented freshwater mussed shell. An analysis of the ethnobotanical remains identified a xeric oak savanna habitat, and a relatively seasonal occupation of the site (Kuehn 2007: 40). Faunal evidence from the Raddatz Rockshelter and other southwestern Wisconsin rockshelters indicate that white-tailed deer dominate the diet of the Middle Archaic and also signals that rockshelters were seasonally occupied during late fall and winter months (Pleger and Stoltman 2009: 712; Parmalee 1959: 85). Faunal and floral data from the Middle Archaic features at the Kelly North Tract site, located on the western shores of Lake Koshkonong across from the Finch site, offer evidence for a wider subsistence base such as turtle, fish, small mammal, bird, and hazel nut remains (Jeske et al. 2002: 27-28).

Late Archaic Period

Dating to approximately 1500 B.C. to 500 B.C., the Late Archaic period is hallmarked by notched and stemmed points such as Matanzas, Vosburg, Durst Stemmed, Preston Notched, Merom Expanding Stem, and Turkey-tail points (Justice 1987: 119, 128, 130; Pleger and Stoltman 2009: 712; Gibbon 2012: 79). Late Archaic projectile point types transition from shallow side-notched to stemmed forms: Durst replaces Matanzas (Lurie et. al. 2009: 778). Radiocarbon dates from rockshelters in the Driftless Area of Wisconsin have identified a Preston Phase dating roughly to 1500 B.C. – 1000 B.C. followed by a Durst Phase dating 1000 B.C. to 500 B.C. These phases work to differentiate typologies in the southwestern region of Wisconsin, but not necessarily for southeastern Wisconsin.

The Kelly North Phase, named after the type site Kelly North Tract (47 JE-0812), is radiocarbon dated from roughly 2290 B.C. to 1100 B.C. from controlled provenience within cultural features (Winkler 2004: 63; Jeske et. al. 2002: 17). Matanzas Side Notched, Vosburg Notched, and Bottleneck Stemmed points were all discovered there and date to the transitional Middle to Late Archaic. The provisionally named Carcajou

Notched projectile points, along with a T-drill, copper awls, and socketed copper spear point typify tools associated with the Kelly North Phase (Winkler 2004: 64; Jeske 2003: 158). This southeastern Wisconsin phenomena is also recognized at sites in northern Illinois and West Central Illinois, and identifies a Middle to Late Archaic transition on the northeastern edge of the Prairie Peninsula (Jeske et al. 2002: 26; Winkler 2004: 9) displaying evidence for a regional difference in lithic technology and artifact form.

The Red Ocher Complex, so named after the crushed hematite-covered burials and grave goods present at these hallmarked Late Archaic mortuary sites, marks a transition period from the Archaic Tradition into the Woodland Tradition. Burials were commonly pit burials with individuals in a flexed position, but they could also be in the form of bundle reburials, cremations, and even multiple burials. Unlike Middle Archaic burials, individuals are rarely interred in the extended position. (Pleger and Stoltman 2009: 715). Grave goods are differentiated from Middle Archaic burials and include exotic caches of bifaces such as Turkey-tail blades, Adena bifaces, and lanceolate-shaped knives from a variety of exotic and local cherts. The Beake site (11L-0003) in Lake County northern Illinois is a classic example of a Red Ocher Complex mortuary expression. The site consisted of flexed burials covered in red ocher, interred with Turkey-tail points also covered in red ocher, Hixton quartzite blade fragments, and no associated overlying earthen mounds (Lurie et. al. 2009: 763).

Red Ocher Complex burials display evidence for the development of a hierarchical social organization expressed in the inclusion of high-status mortuary artifacts including exotic chert blades, marine-shell beads, copper beads, and copper tools (Pleger and Stoltman 2009: 716; Mason 1981; 224). Non-egalitarian burial practices are hallmarked at the Riverside Cemetery site in northern Michigan, near Marinette Wisconsin, where evidence for a lavish male burial is present in the form of an abundance of grave goods including copper points, Knife River Flint scrapers, dog skulls, and a variety of chert projectile points. There is also evidence at the site for preferential treatment of a young woman's and an infant's remains by the presence of exotic burial goods such as a block of Obsidian, sourced from Wyoming. This raises several possible interpretations as to the nature of the Red Ocher Complex social organization and how it had changed from the Copper Complex of the Middle Archaic (Pleger and Stoltman 2009: 717). In fact, women and children are disproportionately represented in Red Ocher burials.

The Jaco site (47 JE-1192) is located just east of Fort Atkinson. The site has a Late Archaic / Early Woodland Red Ocher Complex mortuary expression. The remains of four individuals was disturbed by gravel quarrying operations. The remains were covered in red ocher, with evidence for copper staining as well. (Jeske et al. 2010: 36). Artifacts found in association include a thermally altered Galena chert Red Ocher mortuary biface, a Wyandotte chert expanding stem biface, two copper awls, six copper beads, and two antler tools.

The Convent Knoll site in Waukesha County, southeastern Wisconsin, offers another regional example of Red Ocher Complex expression. Excavated in 1978 as part of an Emergency Recovery plan, Overstreet (1980) identified four cultural features containing the remains of eight individuals stained with red ocher and associated with various grave goods including a Hixton bifacial blade, a copper celt, ceremonial chert blades, antler tools, and shell beads. One feature contained the remains of five individuals, several of which were decapitated and dismembered, with projectile points imbedded in them, as well as cut marks on the bone (Overstreet 1980: 51). This raises interpretive questions about the nature of violence and territoriality towards the end of the Archaic Tradition.

Subsistence practice in the Late Archaic did not change noticeably in the archaeological record. The environment, habitats, and availability of exploitable resources remained relatively constant from the Middle Archaic period, and would remain as such until the pre-contact era. Evidence for an increase in fish consumption is manifest by the presence of toggle-headed harpoons, fixed-barb harpoons, and fishhooks. Pleger and Stoltman describe Late Archaic subsistence to be a generalized hunting and gathering strategy, as it was in the Middle Archaic (Pleger and Stoltman 2009: 718). It would remain as such until the inception of early horticulture, a hallmark of the succeeding Woodland Tradition.

The Early Woodland Period

The Early Woodland period in both the southwest and southeast regions of Wisconsin is roughly dated to 500 B.C. to 100 A.D. (Stevenson et. al. 156). Early Woodland projectile points at the Finch site are represented by Kramer stemmed, Adena stemmed, Waubesa Contracting Stemmed, and Dickson Contracting Stemmed (Justice 1987: 184, 191-192; Haas 2012). Early Woodland ceramic wares are represented by Marion Thick, various Prairie wares, Dane wares, and Beach Incised (Picard et. al. 2013: Haas 2012: 9).

Woodland Tradition sites in southern Wisconsin (including the Beach site, the Bachman site, Mill Pond, Cooper's Shore, Highsmith, and many others) offer evidence for subsistence strategies that have continued relatively unchanging from the Late Archaic period (Stevenson 1997: 153, 157; Wiersum 1968: 153-154; Salzer 1965: 154; Salkin 1986: 112; Mason 1981: 232). A reliance on mammals, including white-tailed deer, elk, muskrat, and raccoon, was complimented by other various fauna including turkey, migratory waterfowl, turtle, fish, and wild plants such as walnuts, hazel nuts, acorns, wild rice, wild grapes, raspberries, blackberries, sunflower, goosefoot, and ragweed. A noticeable increase in the utilization of freshwater mussels is apparent in the Woodland Tradition, for example the composition and stratigraphy of a shell midden at the Mill Pond site, though this site is located in western Wisconsin (Theler and Boszhardt 2003: 104-105).

The Red Ocher complex transitions out of the Late Archaic period into the Early Woodland period in various localities of Wisconsin. Evidence from the Tillmont site, in Crawford County, Wisconsin, comes in the form of Marion Thick ceramics and Kramer Stemmed projectile points associated with red ocher stained features and obsidian flakes radiocarbon dated to roughly 600 B.C. (Pleger and Stoltman 2009: 717). The Riverside Cemetery site north of Marinette, Wisconsin showed evidence for Early Woodland ceramic Dane Incised pottery within the Red Ocher burial area (Mason 1981: 226; Stevenson et. al. 1997: 150). The Henschel site in Sheboygan County also produced ceramics and contracting stemmed projectile points within a red ocher burial context (Pleger and Stoltman 2009: 718).

In southern Wisconsin the Early Woodland period is divided into several phases, particular to their regional and cultural expression. In southwestern Wisconsin, the Indian Isle phase is defined by the presence of Marion Thick ceramics: a thick, grit tempered ware often cord roughened and decorated with finger nail impressions, dating from roughly 500 B.C. Ceramics of southwestern Wisconsin are related to Black Sand Incised and Morton Incised ceramics from the Quad-State region of southeastern Minnesota, northeastern Iowa, northwestern Illinois, and of course southwestern Wisconsin (Stoltman 1986: 123). The succeeding Prairie phase dates from roughly 250 B.C. to 100 A.D. and is typified by Prairie Ware ceramics such as Prairie Incised. Kramer Stemmed and Waubesa Contracting Stemmed points are also diagnostic of this region and period (Stevenson et. al. 1997: 153).

Southeastern Wisconsin Early Woodland, coterminous with the Indian Isle phase of the southwest, is represented by a scarce presence of Marion Thick ceramics and Kramer Stemmed points. It is not until the Lake Farms phase, from 250 B.C. to 100 A.D., that the Early Woodland in the southeast becomes more visible. Excavations from the Lake Farms Archaeological District on the shores of Lake Waubesa in Dane County at the Beach site and the Canoe site typify the Lake Farms phase. The Beach site (47 DA-0459) represents stratigraphically distinct Late Archaic and Early Woodland cultural levels (Salkin 1986: 95). The Early Woodland level produced roughly 72 ceramic vessels similar to the incised-over-cordmarked ceramic wares of the upper Midwest. Diagnostic Beach Incised ceramics were used to typify the Beach site series as similar to, yet distinct from, Fettie Incised ceramics of central Illinois, possibly signaling a South-to-North cultural diffusion from Illinois to Wisconsin (Stevenson et. al. 1997: 156). Beach Incised and Waubesa Incised ceramics are also similar to the Dane Incised and Prairie Incised ceramics from the southwest, yet remain a locally southeastern diagnostic manifestation. Diagnostic Waubesa Contracting Stemmed and Kramer Stemmed points were also recovered from the Beach site's Early Woodland component (Salkin 1986: 102, 104). Early Woodland evidence from the multicomponent Highsmith Site, located roughly 15 kilometers northwest of the Finch site, is represented by Dane Incised pottery and Outlet Ware as described by Salzer, which could relate to regional Beach Incised ceramics (Salzer 1965: 173). Finch site Early Woodland ceramics include Beach Incised, Dane Incised, Marion Thick, and Prairie series wares (Haas 2012: 9).

Early Woodland manifestations in southwestern and southeastern Wisconsin are distinct in their site distribution. Prairie phase sites in the southwest are proximal to the aquatic resources of the Mississippi and Wisconsin rivers, as evident from the Mill Pond site and its accompanying mussel shell midden (Stevenson et. al. 1997: 153). Sites in the southwest are located either in the uplands, the terraces, or the river flood plains and probably relate to a seasonal resource round (Stoltman 1986: 133). Lake Farms phase sites in central and southeastern Wisconsin are present in wetland and shallow-lake environments and illustrate a continuation of hunter-gatherer subsistence practices supplemented by horticulture (Salkin 1986: 112, 116).

The Middle Woodland Period

The Middle Woodland period in southern Wisconsin dates from 100 A.D. to roughly 400 or 500 A.D. at several locales (Stevenson et. al. 1997: 166). Evidence for the Middle Woodland component of the Finch site is typified by both lithic and ceramic diagnostics. Projectile points include Steuben Expanding Stemmed, Lowe Flared Base, Snyder’s Cluster points, and Chesser Notched (Justice 1987: 208, 213-214). Diagnostic ceramic vessels include Havana ware, Deer Creek Incised, Naples Stamped, Kegonsa Stamped, Shorewood Cord Roughened, Douglas Net-Marked, and Sister Creek Punctate (Haas 2012: 9).

The Middle Woodland Period in southern Wisconsin is again regionally represented by different cultural phases in the southwest and the southeast. The southwest Middle Woodland is divided into two phases: the Trempealeau Phase, from 100 to 200 A.D.; and the Millville Phase, dating from 200 to 500 A.D. The Trempealeau Phase is characterized by diagnostic ceramic wares including Kegonsa Stamped, Shorewood Cord Roughened, and Havana wares from the Havana series in the Quad-State Region (Stevenson et. al. 1997: 158; Benchley et. al. 1997: 111). These ceramics, as their names imply, are decorated by various surface treatments including dentate stamping, cord wrapped stick impressed, and smoothing. The decorations on these Middle Woodland ceramics were usually restricted to the upper half of the vessel (Mason 1981: 273; Theler and Boszhardt 2003a 111). The Millville phase succeeded the Trempealeau phase by 200 A.D. in the southwest and is identified by diagnostic Linn Ware ceramics. The Millville site (47 GT-0053) in Grant County Wisconsin was located on a terrace overlooking the Wisconsin River and consisted of a single component occupation with evidence for several house features and storage pits. The site was radiocarbon dated from 130 to 370 A.D. (Benchley et. al. 1997: 112). Diagnostic lithics from the southwest include Steuben Expanded Stemmed and McCoy Corner-Notched points (Stevenson et. al. 1997: 164; Justice 1987: 208-209).

The Middle Woodland in southeastern Wisconsin is more difficult to define due in part to a lack of adequate radiocarbon dates and few adequately excavated sites (Stevenson et. al. 1997). Identification of Middle Woodland in the southeast is defined by projectile point typologies from isolated finds or thin cultural deposits between Early and Late Woodland periods (Stevenson et. al. 1997: 164-165). The Waukesha phase, though not securely radiocarbon dated within the region, has been dated from roughly 100 to 300 A.D. by the aid of ceramic comparisons from the North Bay phase in northern Wisconsin, the Millville phase in the southwest, and the Steuben phase in the upper Illinois River valley (Jeske 2006: 293). The Waukesha phase is identified by diagnostic ceramics including nonlocal Havana types such as: Naples Ovoid-Stamped, Neteler Crescent-Stamped, Steuben Punctated, Sisters Creek Punctated, Baehr Neteler Crescent Stamped, Havana Zoned Dentate, and Classic Hopewell. Local types such as Kegonsa Stamped, Shorewood Stamped, Shorewood Cord Roughened. Local Highsmith Plain ceramics are derived from Havana pottery present in Illinois (Salzer n.d.), though lack the full expression of Havana decorative techniques. Dentate and rocker stamping decoration is more common in the southeastern Trempealeau phase, while cord-wrapped-stick impressions are more widespread in Waukesha phase ceramic assemblages (Jeske 2006: 293; Stevenson et. al. 1997: 165; Benchley et. al. 1997: 113). Diagnostic lithics from Waukesha phase Middle Woodland provenience include stemmed and corner notched points such as Gibson, Manker Corner Notched, Waubesa Contracting Stemmed, Adena, Norton, Snyders, Steuben Expanded Stemmed, and Monona Stemmed points, all usually manufactured from local cherts (Stevenson et. al. 1997: 165; Jeske 2006: 294; Justice 1987: 191, 192, 203, 204, 208). Evidence for exotic cherts is not uncommon to this temporal period, and denotes Middle Woodland participation within a larger exchange network.

The Hopewell culture is regarded as one of the “most materially elaborate, socially intricate, and ideologically complex of any of the indigenous cultures of eastern North America,” (Mason 1981: 238). The Hopewell Interaction Sphere in essence is a connecting ideological network, made manifest by the expression of elaborate burial mound construction, artifact production, ceremonial recreation, and exotic material trafficking assimilated by local elite lineages who are well adapted to their region’s social and environmental conditions (Jeske 2006: 288-289; Theler and Boszhardt 2003: 109-110). The Hopewell culture developed as the Ohio Hopewell in the Scioto River valley of southern Ohio; and the Illinois Havana Hopewell in the lower Illinois River valley of central Illinois (Mason 1981: 239). Southern Wisconsin boasts an abundance of archaeological evidence for a Havana Hopewell influence during the Middle Woodland period. Nicholls mound, near Trempealeau, Wisconsin on the Mississippi River, is an example of a Middle Woodland Hopewell conical mound. The twelve foot tall mound was built over a log-covered burial tomb containing multiple burials, as well as Havana Zoned pottery, copper celts, freshwater pearls, a Knife River Flint chert knife, silver beads, a catlinite pipe, and more (Stevenson et. al. 1997: 158; Theler and Boszhardt 2003: 115).

Large conical Middle Woodland Hopewell mounds are present across southern Wisconsin. At the Outlet site (47 DA-0003), located in Dane County overlooking Lake Monona and the Yahara River, a large conical mound was excavated, unearthing the remains of 13 individuals interred in a rectangular sub mound pit (Bakken 1950: 43;

Benchley et. al. 1997: 113). At the Alberts site, in Jefferson County, an excavated conical mound (47 JE-0887) produced evidence for Middle Woodland ceremonial context with the remains of a ritually Havana-Hopewell vessel crushed under a 25 kg boulder, associated white clay and river pebble filled features, and the presence of exotic artifacts such as a Hopewell platform pipe, Burlington chert artifacts, and more Havana-like ceramics (Jeske 2006: 302, 306).

Several Middle Woodland sites, including mounds and mound groups, are present in southeastern Wisconsin. The Highsmith site's artifact assemblage contains possible Kegonsa Stamped ceramic sherds, as well as the remains of likely ceramic figurines, similar to figurines from Hopewell sites in Illinois and Ohio (Salzer n.d.). The Cooper's Shore site (47 RO-0002), located roughly 10 kilometers west of the Finch site, is a Middle Woodland component habitation site (Wiersum 1968). The artifact assemblage from the site contains Steuben Punctated, Weaver Cordmarked, Weaver Plain, and Havana Plain Ware ceramics and offers a robust faunal assemblage dominated by large mammal, fish, and reptile remains. Local mound groups include the Rock River group, the Schaefer Mounds, the Fulton Enclosure, and the Big Bend mound group (Stevenson et. al. 1997: 165). Middle Woodland mounds and mound groups were placed upon prominent spaces in the landscape, including lakes, streams, and on terraces overlooking major rivers (Mason 1981: 224). These spaces, often used by previous Red Ocher complex burials, were in turn incorporated into Late Woodland effigy mound groups, which makes the identification of Middle Woodland conical mounds difficult without associated diagnostic artifacts recovered from excavation. The General Atkinson Group, one mile west of the Finch site and present today at the Jefferson County Indian Mounds

& Trail Park, contain several conical mounds. A large conical mound at the site was excavated in 1958 by a high school student who discovered five buried individuals along with ceramics, projectile points, and scattered bone. Unfortunately, the evidence was not handled properly as to validate a Middle Woodland component to the mound group (Highsmith 1997: 149-156). However, the effigy mounds present in the mound group, and its proximity to the Finch site warrant, at minimum, an additional Late Woodland association.

The Late Woodland Period

The Late Woodland in southern Wisconsin is dated from roughly 500 A.D. to between 1100 to 1200 A.D. (Stevenson et. al. 1997:, 174; Richards and Jeske 2002: 33). Late Woodland projectile points from the Finch site include Chesser Notched, Madison Triangular, Honey Creek, and Cahokia Cluster points (Justice 1987: 214, 224, 233; Boszhardt 2003: 73-74). Ceramic vessels include Madison ware, Aztalan Collared, Starved Rock Collared, and Point Sauble Collared (Picard et. al. 2013: 17; Haas 2012: 9).

The end of Hopewell mortuary ritual, expressed by the exotic grave good deposits in large conical mounds, signals the beginning of the Late Woodland period of southern Wisconsin. Mounds continued to be constructed throughout southern Wisconsin, though in different shapes such as linear, animal, and human forms associated to the Effigy Mound Culture (Mason 1981: 297). Effigy mounds were not primarily used as burial mounds. However, those that were varied in composition and internment organization. An excavated burial effigy mound in the shape of a bird at the Luedke site in Dodge County contained an extended burial surrounded by several bundle burials (Salkin 2000: 533). The various animal and humanoid forms of these mounds are believed to reflect spirit-beings from American Indian religious beliefs, for example: bird forms reflect a belonging to the “upper world” and panther forms reflect the inhabitants of a “lower world,” (Stevenson et. al. 1997: 166). Other interpretations suggest that mound groups were meeting grounds, where dispersed foragers could congregate for ceremony or funerary ritual. Others interpret their array across the landscape as territory markers signaling ownership of various resource areas by certain corporate groups (Goldstein 1991: 99, 110; Birmingham 2010: 202). Whatever their function, they are a unique form of monumental earthen architecture, and a temporal marker for the southern Wisconsin Late Woodland Effigy Mound cultural expression.

Dating from roughly 500 to 1200 A.D., the Late Woodland has been traditionally divided into phases based upon the radiocarbon dated provenience of diagnostic artifacts that differ from the southwest to the southeast in Wisconsin (Stevenson et. al. 1997: 166; Benchley et. al. 1997: 118; Clauter 2012: 183). In the southwest, the Mill phase dates from 500 to 750 A.D. and introduced Lane Farm Cord-Impressed ceramics, vessels decorated by pressing fabric or cords into the upper surface of the vessel, while the lower portion was often decorated with various rocker-stamp designs. Also introduced into the archaeological record during this phase is the bow and arrow, evident by small corner-notched projectile points (Stevenson et. al. 1997: 171). The Eastman phase followed at roughly 750 A.D. with the inclusion of Madison ware ceramics. Madison vessels, such as Madison Cord Impressed and Madison Fabric Impressed, were thinner, narrower necked, and had outward-flaring rims. Diagnostic lithics include Madison Triangular points, used with the bow and arrow (Justice 1987: 224).

Southeastern Wisconsin has also been divided into two separate cultural phases, though recent dissent offers alternative explanations for the Late Woodland cultural phenomenon in the region (Richards and Jeske 2002; Clauter 2003; Rosebrough 2010; Clauter 2012). Traditionally, the Horicon Phase is dated from 700 to 1200 A.D. and represents the Effigy Mound Culture. Effigy mounds are present throughout southeastern Wisconsin. One mile west from the Finch site, the remains of the General Atkinson mound group contains several effigy mounds including a long-tailed turtle, a lizard, birds, and other animal shaped earthen mounds (Highsmith 1997: 151). The Panther Intaglio Mound (47 JE-0028) in Fort Atkinson, just northeast of the Finch site, is an example of a concave effigy mound, dug into the earth (Lapham 1855: 36). Other mound groups which contain effigy mounds around Lake Koshkonong in Jefferson County include the Le Sellier Group, the Kumlein Group, the Draves Group, the Altpeter Group, and the Lookout Group (Stout and Skavlem 1908: 56-68; Brown 1909: 126-129).

Horicon phase occupation sites are usually represented by small seasonal camps, with minimal evidence for house features, such as the Sanders site in Portage County. Horicon Phase ceramics consist of grit-tempered Madison wares such as Madison Cord Impressed and Madison Plain. Projectile points include small triangular points such as Madison Triangular (Salkin 2000: 536; Stevenson et. al. 1997: 175; Justice 1987: 224). Horicon subsistence is identified as a continuation of Middle Woodland hunter-gathering in the southeastern region, lacking evidence for domesticates (Salkin 2000: 536; Stevenson et. al. 1997 175).

Unlike the Eastman phase of southwestern Wisconsin, the Kekoskee phase of southeastern Wisconsin is present almost concurrently with the Horicon phase.

Diagnostic ceramics of this phase differentiate from Madison wares by their thickened rims, known as collared ware. These ceramic types include Aztalan Collared, Hahn Cord-Impressed, Starved Rock Collared, and Point Sauble Collared, though Madison ceramics are often present at Kekoskee phase sites (Salkin 2000: 528; Stevenson et. al. 1997: 175). Diagnostic lithics include triangular projectile points, though they are present throughout the Late Woodland and are difficult to discern as specifically relating to the Kekoskee phase. In contrast to Horicon phase sites, Kekoskee phase sites show evidence for cultigens, such as maize and squash. Evidence from the Weisner III site (47 DO-0399) and Weisner IV site (47 DO-0400) reveals large storage pits containing maize, as well as the presence of stockade defenses. Fortifications and collared ceramics are also present at the Hamilton-Brooks site in Green Lake County (Salkin 2000:530).

Several studies call into question the utility of the southeastern Late Woodland division of Kekoskee and Horicon phases and suggest alternative explanations. Rosebrough (2010: 115, 523) illustrates the temporal overlap of the phases and suggests that they are both associated with effigy mound construction, divisible by collared ware ceramics. Clauter's investigations at the Klug Site (47 OZ-0226) and Klug Island (47 OZ-0267) lead her to conclude that dividing the period by phases at all is futile and confusing (Clauter 2003: 146). The Klug site complex instead offers evidence for an overlap of Horicon and Kekoskee phase artifacts with only proportional differences in phase-associated artifacts, which is not distinct enough to define the sites to either phase absolutely. Many other Late Woodland sites offer similar assemblages with combined traits from both phases temporarily overlapping, including the Statz site, Stockbridge

Harbor, and the Bethesda Lutheran Home site (Clauter 2003: 35; Hendrickson 1996: 19-20).

To further complicate southeastern Wisconsin's Late Woodland cultural expression, Emergent Oneota appear on the western shores of Lake Koshkonong postdate 1150 A.D., followed later by Middle Mississippians at Aztalan (47 JE-0001) on the Crawfish River by roughly 1100 A.D. (Richards and Jeske 2002: 33; Salkin 2000: 538; Richards 1992: 418). No Oneota or Middle Mississippian artifacts were recovered from the Finch site, with the exception of four grit-tempered ceramic fragments that resemble Hyer Plain, a vessel form found at Aztalan (Picard, personal communication 2015; Richards 1992: 348). Richards and Jeske (2006) used the Wisconsin Archaeological Site Inventory files, compiled and managed by the Wisconsin State Historical Society, to show that Late Woodland effigy mound builders (Horicon and Kekoskee phases alike), maize horticulturalists, and collared ware potters all utilized the same environmental ecozones, which is further evidence for probable cultural overlap in the region.

However, Oneota horticulturalists in southeastern Wisconsin appear to be restricted spatially. Shell tempered ceramics, hallmark of Emergent Oneota in southeastern Wisconsin, are predominantly concentrated on the northwest shore of Lake Koshkonong, with only a few shell tempered ceramic sherds found elsewhere in Dodge and Milwaukee Counties (Richards and Jeske 2002: 39). The Crescent Bay Hunt Club is an Oneota habitation site with radiocarbon dates from roughly 1200 to 1400 AD (Jeske 2003: 93) although an earlier component dated to 1050 AD may be present (Jeske 2014).

Aztalan, by comparison, offers radiocarbon dates from roughly 800 to 1600 AD though the Mississippian components show up circa 1100 AD and are present until roughly 1200 to 1250 AD (Richards and Jeske 2002: 44). The two site occupation periods overlap temporally, however, the lack of Oneota ceramics and artifacts at Aztalan suggests that the two groups did not interact in a mutually beneficial manner, considering their close proximity. Richards and Jeske propose a political motive for the spatially restricted nature of Emergent Oneota settlement in the Koshkonong locality (2002). Fortifications at Aztalan suggest a defensive stance upon the landscape (Richards and Jeske 2002: 43).

Evidence for other Late Woodland fortified settlements are present in Wisconsin at such sites as the Weisner III (47 DO-0399) and the Weisner IV (47 DO-0400) sites in Dodge County (Stevenson et al. 1997: 175), the Stockbridge Harbor site in Calumet County, the Hamilton-Brooks site in Green Lake County (Salkin 2000: 530), and the Bethesda Lutheran Home site (47 JE-0201) in Jefferson County (Hendrickson 1996). Fortified Late Woodland settlements are likely a reaction to a rise in sedentary lifestyles associated with an increased reliance on stored plant foods and the need to protect those stores.

By roughly 1200 A.D. Effigy Mound building stops in southeastern Wisconsin (Salkin 2000: 538). Oneota phases continue temporally, but do not expand territorially south or east (Richards and Jeske 2002: 48). It has been suggested that Oneota cultural groups either displaced or absorbed Late Woodland and Middle Mississippian peoples of the area (Stevenson et al. 1997), one of many possible explanations for the end of Effigy Mound and Kekoskee phase Late Woodland cultural evidence in the archaeological record.

Chapter 4: Methods

The methods for this project are framed by several analytical goals. The first goal is to report the faunal assemblage data from the Finch site excavations, this includes a comparison of the different recovery techniques. The next goal is to conduct an intrasite comparison of faunal subassemblages with known temporal association. Lastly, this project looks to investigate the comparison of faunal subassemblages relevant to cultural expressions of food processing and waste discard.

Excavation Methods

Phase III excavations at the Finch site took place during the 2009, 2010, and 2012 field seasons. The site encompassed an area of roughly 0.3 acres. A 25% sampling of the site was excavated in accordance with the proposed data recovery plan (Watson 2004: 27). In total, 420 units of varying sizes were excavated, totaling to 1264 square meters. Excavation units were dug at 5 cm levels to arbitrarily stratify any and all artifacts removed from the ground. Unit levels were excavated until two sterile five centimeter levels were produced. A 12.5 liter water-screen sample was recovered from each level of every excavation block (Watson 2004: 28), which consisted of four adjacent excavation units, and processed through fine water screening with 1/8" mesh. Water-screen samples were recovered for more specialized analyses including the identification of micro-faunal, paleo-ethnobotanical remains, and samples to process for radiocarbon dating. In total, 589 water-screen samples were taken from excavation units. The remaining excavation unit matrix was dry-screened through ¼" hardware mesh for the retrieval of artifacts and ecofacts. Upon completion of every unit level, the base of the unit was photographed and mapped to isolate cultural features as they appeared through the stratigraphic soil transitions.

Within those excavation units 168 in situ cultural features were uncovered. Features were identified by the clustering of cultural materials, the identification of soil staining, and/or their revealed basin shapes in cleaned/photographed excavation unit walls. Features were mapped and photographed before and after excavation. They were excavated in bisected halves. Various sized flotation samples (dependent upon feature size) were collected from one half of every feature and processed using 1/16" mesh. From the same feature half, various sized water-screen samples were collected and processed through 1/8 inch mesh. A total of 208 flotation samples and 197 water-screen samples from features were collected and processed. Once half of the feature was excavated, the other half was cleaned, photographed, and mapped for its profile. Upon completion of this task, the remaining half was excavated by hand in order to piece plot artifacts. The remaining matrix was then dry-screened through ¼" mesh.

The majority of flotation samples were processed on site in a flotation tank. Samples were separated from soil matrix into light and heavy fraction, collected in 1/16" mesh, dried, tagged with provenience, and then returned to the GLARC office lab for processing. Using size sorting cylinders, samples were separated into separate size categories by mesh sizes: 0.355mm (0.014 in), 1mm (0.04 in), and 2mm (0.08 in).

Defining the Temporal Components

In order to compare subsistence across time, it was necessary to differentiate the faunal remains associated with the different cultural temporal periods present at the Finch site. The temporal periods are represented by the presence of culturally specific diagnostic artifacts (Haas 2012). Roughly 850 diagnostic lithic projectile points and fragmented ceramic rims and body sherds were identified stretching across the site. I first attempted to stratigraphically separate the diagnostic artifacts to see if the temporal periods were divisible vertically. Arbitrary levels were excavated at five centimeters below surface (cmbs). Level 1 represents all soil from zero to five cmbs, level 2 consists of five to ten cmbs, and so on. The deepest diagnostic artifact was excavated from level 12, at 55 to 60 cmbs. All diagnostic lithic and ceramic artifacts were divided by cultural component association, and then separated stratigraphically by excavation level (see Table 4.1).

Table 4.1: Total numbers of diagnostic artifacts by cultural period and excavation level.

	Level	1	2	3	4	5	6	7	8	9	10	11	12
Temporal Period	Diagnostic												
Early Paleoindian	Lithic							1					
	Ceramic												
Late Paleoindian	Lithic				4	1	1	2					
	Ceramic												
Early Archaic	Lithic				2								
	Ceramic												
Middle Archaic	Lithic			1	1	3	7	9	7	1		1	
	Ceramic												
Late Archaic	Lithic			3	4	6	5	4		1	1		
	Ceramic												
Early Woodland	Lithic		1		8	16	19	8	5	2	2	1	1
	Ceramic		1	3	18	73	71	25	5	4	1		
Middle Woodland	Lithic				5	7	7	5	2	2			
	Ceramic	1	4	18	80	87	61	15	12	4	3	1	
Late Woodland	Lithic		1	5	16	16	5	1		1			
	Ceramic		7	22	50	49	21	6	4	3	2		

The temporal periods did not separate stratigraphically, however, but are mixed between levels 1 and 11 with the greatest concentration in level 5 (20-25cmbs). The stratigraphic mixing of artifacts is not uncommon, aided in large part by bioturbation processes such as burrowing rodents, insects, worms, and even plants (Vogel 2012: 84; Bocek 1986: 591, 600). Bioturbation, as explained by Vogel (2012: 86), works to:

> …move large artifacts and natural clasts downward in relation to the soil surface. As insects, worms and mammals tunnel through the soil, all clasts larger than the burrows constructed are undermined and moved downward, while soil matrix and clasts smaller than the burrows are moved both laterally and ejected onto the soil surface behind the burrower. The end result of these clast segregation dynamics is a profile with three distinct zones: an upper layer of relatively fine sediment, an accumulation of coarser particles at the base of the biomantle (the "stone zone"), and a relatively unaffected zone beneath the effects of burrowing.

The "stone zone" at the Finch site is represented by the concentration of the largest number of diagnostic artifacts between levels four, five, and six (15-30 cmbs).

Other attempts to separate the cultural temporal periods at the Finch site have focused on the horizontal distribution of diagnostic artifacts. Jennifer Haas (2013) conducted a spatial analysis to describe the diagnostic artifact densities using mean centers and standard elliptical distances. These methods highlight broad horizontal averages of temporal diagnostic densities. Haas also utilized a variety of statistical analyses such as Getis-Ord Gi statistics, Nearest Neighbor Index, and Kernel Density Estimations to identify and describe clustered areas of correlated temporal diagnostics, for example, the location of Early Woodland diagnostic artifacts (see Figure 4.1) (Haas 2013: 27).

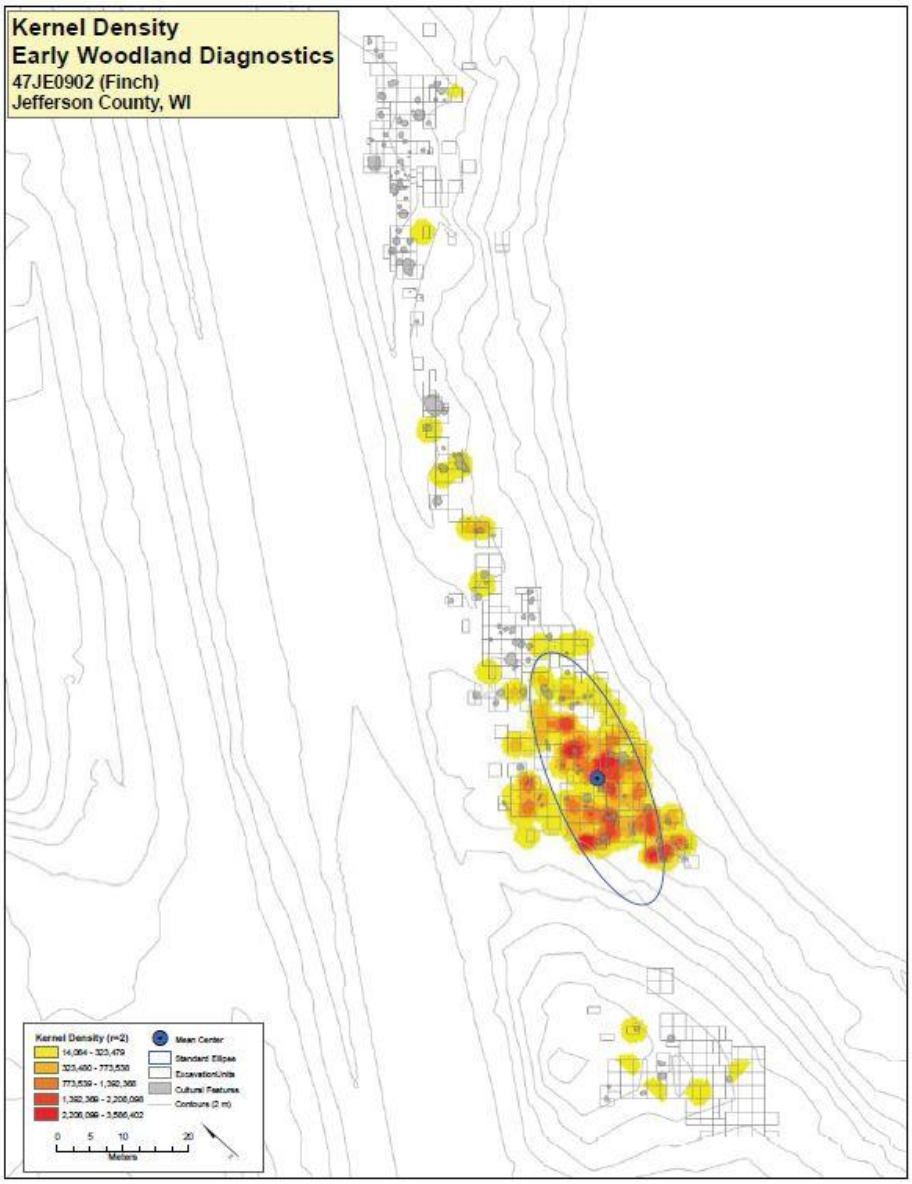


Figure 4.1: Early Woodland diagnostic Kernel Densities and Mean Center distribution (from Haas 2013: 27).

This work delineates specific cultural-temporal spatial “zones” across the site horizontally and identifies statistically significant positive and negative autocorrelated temporal patterns. Haas illustrated that spatially, the temporal periods do differentiate into separate sections, however they also overlap in multiple places (Haas 2013: 15).

For this thesis I took a different approach. Given my goal of comparing chronologically discrete faunal assemblages, I decided to restrict my component samples to units and features with only a single temporal association. This conservative approach limited the sample sizes per component period, but made for a more confident differentiation between period assemblages. Diagnostic lithic and ceramic artifacts were identified and associated to their temporal and spatial provenience using ESRI’s ArcMap program (ESRI 2012). These units were mapped and labeled by their cultural and temporal affiliation (see Figure 4.2). Excavation units containing diagnostic artifacts from a single component were separated from those that overlapped temporally. Any units associated to Paleoindian or Archaic components that contained ceramic fragments were not included. Since stratigraphy was an issue of contention, given the mixing of diagnostic artifacts, all faunal remains from levels 1, 2, and 3 (0-15 cmbs) that were located within Paleoindian period proveniences were not included in this study. Paleoindian diagnostics are present, however, in level 4 and so faunal material from that level was included. All faunal remains from levels 1 and 2 (0-10 cmbs) present within Archaic period proveniences were also not included in this study. Diagnostics from Archaic periods are present, however, in level 3 and so faunal material from that level was included as well. Out of 420 total excavated units, only 138 could be separately

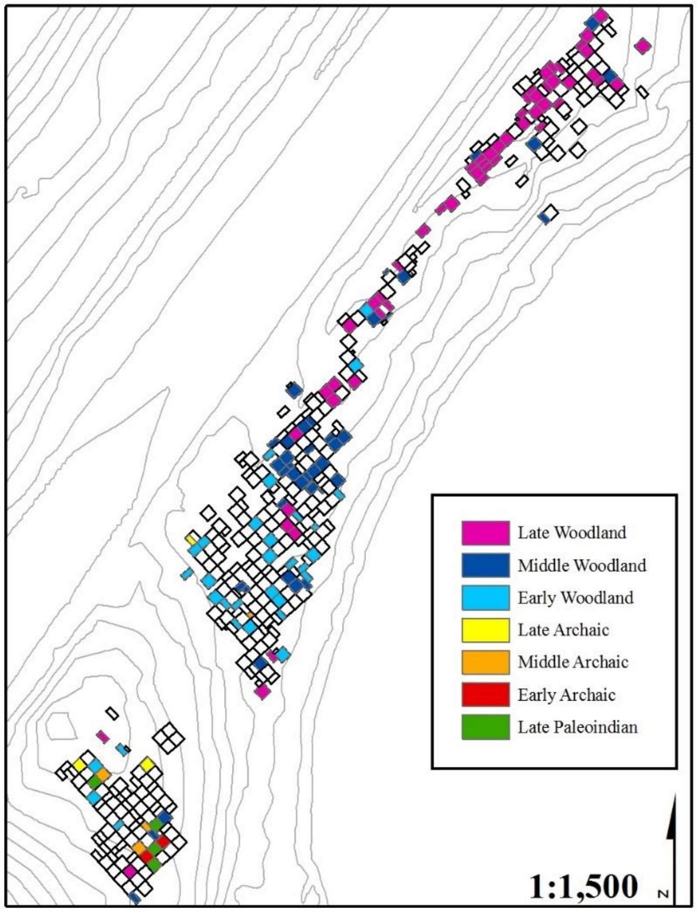


Figure 4.2: Single temporal component excavation units.

associated with a single temporal component based on the presence/absence of diagnostic artifacts.

Once the excavation units were separated into single component classifications, the presence or absence of faunal remains was considered. Of the 420 excavation units, only 170 (40.5%) produced faunal remains. Out of those 170 units, only 64 (37.6%) were associated to a single temporal component based on the presence of diagnostic artifacts (see Figure 4.3). The faunal remains from these 64 units were grouped by their cultural temporal association into comparable assemblages. Of the 64 units, one unit was

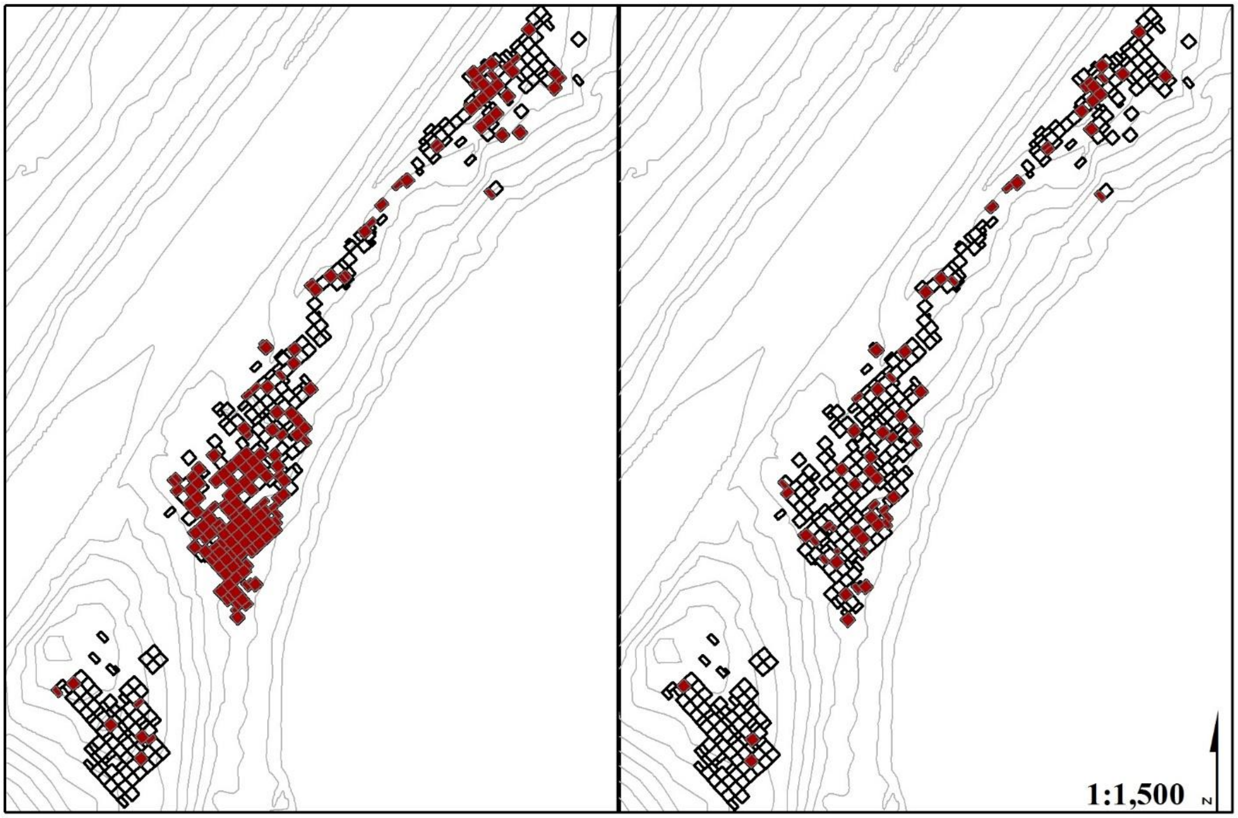


Figure 4.3: The map on the left represents all excavation units with faunal remains. The map on the right illustrates all units with a single temporal component and faunal remains.

associated with the Late Paleoindian period. No units from the Early Archaic period contained faunal remains, one unit from the Middle Archaic period contained fauna, and two units from the Late Archaic contained faunal remains. For the Woodland periods 18 units were associated with the Early Woodland, 17 units were associated with Middle Woodland, and 25 units were associated with the Late Woodland period that contained faunal remains. These units were separated and mapped (see Figure 4.4).

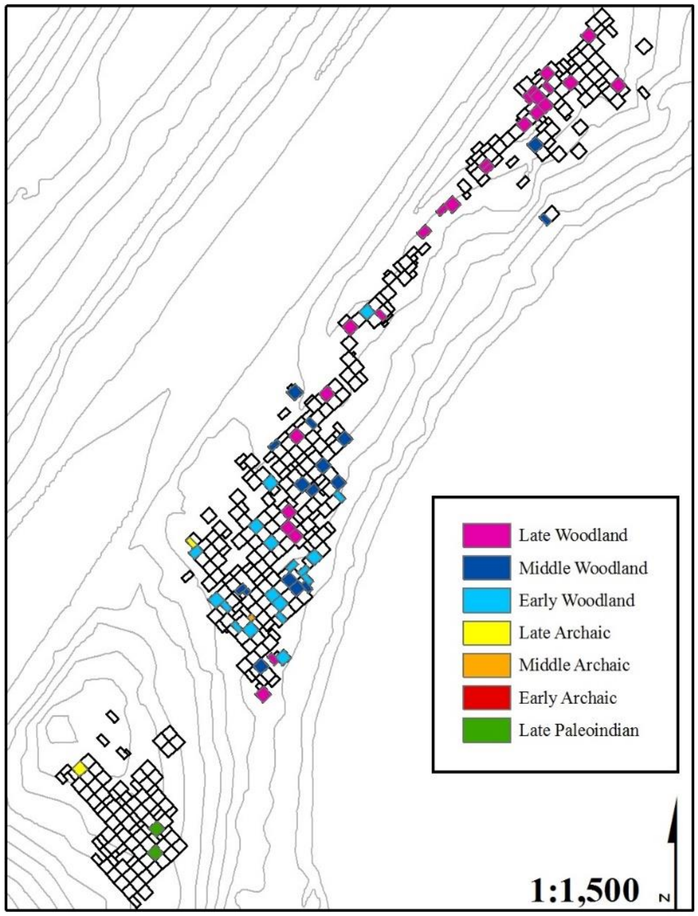


Figure 4.4: Single component excavation units with faunal remains.

Cultural features were identified and defined to associated cultural temporal periods by Haas (2012: 16; personal communication 2015). Of the 168 total features, 119 (70.8%) contained faunal remains. Only 38 of the total 168 features were dated to a single cultural period, and only 32 (26.9%) contained faunal remains (see Figure 4.5). Of those 32 features, three were associated to the Early Woodland, seven were associated to the Middle Woodland, and 22 were associated to the Late Woodland. No features associated with the Late Paleoindian or Archaic periods were identified. No storage pits or large midden features have thus far been identified at the Finch site. The majority of

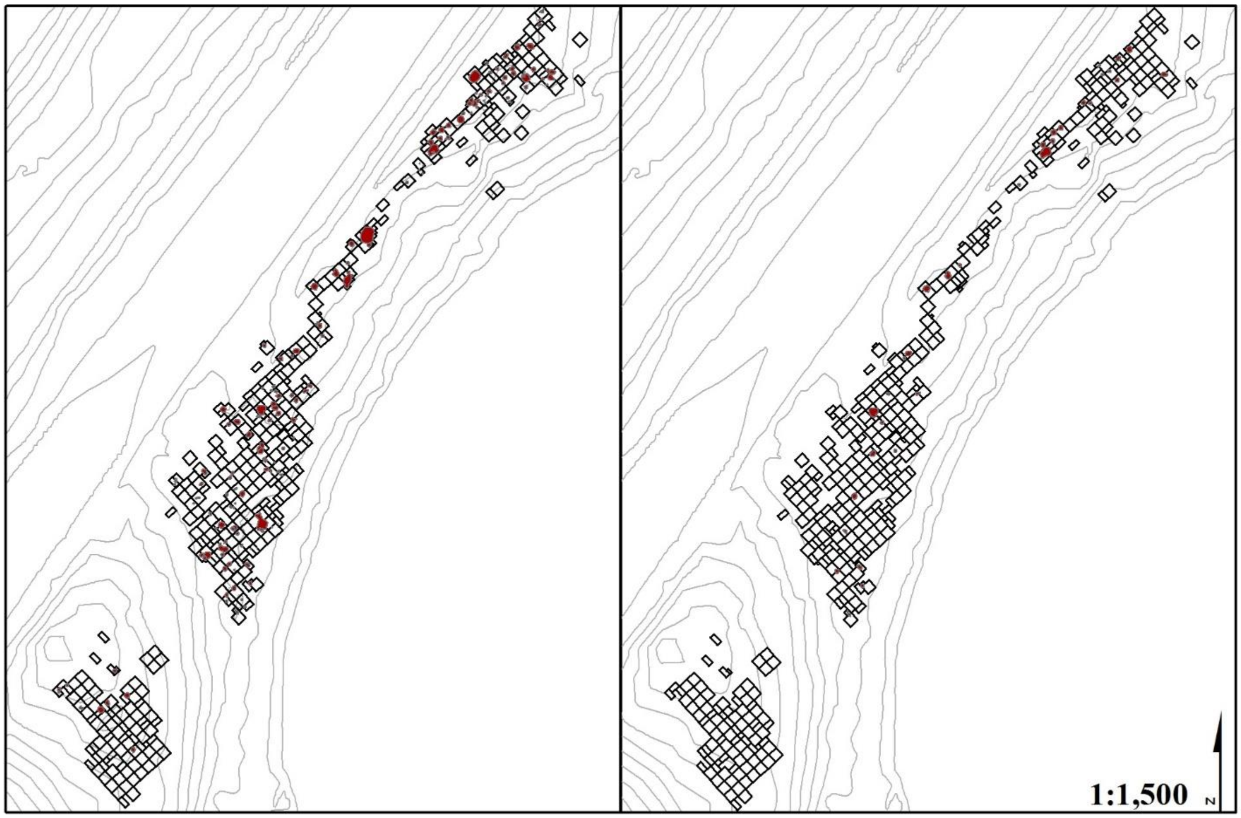


Figure 4.5: The map on the left represents all features with faunal remains. The map on the right illustrates all features with a single temporal component and faunal remains.

features have been classified preliminarily as refuse pits and hearth features, though it is likely that refuse pits were created with an alternative original function (Haas, personal communication 2015). A more complete feature analysis is being conducted by Haas as part of her future dissertation work, including a more detailed spatial explanation of Finch site features and their function. No features identified to a single component with faunal remains were present atop the knoll in the southern section of the site. The knoll is the location of concentrated Paleo and Archaic period single component excavation units.

Identification

The initial analysis of this assemblage was completed by multiple GLARC lab technicians from 2009 through 2012. The assemblage was inventoried to varying levels of completeness. For this project I re-evaluated, re-analyzed, and re-inventoried the total site assemblage in order to standardize a complete inventory. In the process I was able to add more identifications to taxonomic class and species, as well as modification identifications for burning and cut marks. This resulted in a single standardized database for all 14,544 vertebrate specimens.

Identifications were completed using comparative collections from the UW-Zooarchaeology lab under the supervision of Dr. Jean Hudson. Several comparative texts were utilized including Mammalian Osteology (Gilbert 1990), Avian Osteology (Gilbert et. al. 1996), and Fish of Wisconsin (Becker 1983). Additionally, the University of Wisconsin - Madison Zoology Museum collection was used to identify several specimens not present in the UW-Milwaukee comparative collection. Specimens from all recovery techniques were identified to the most specific taxonomic level possible. The term "specimen" is preferred over "fragment" or "element" since specimen makes no distinction as to the completeness of the bone piece recovered, and does not differentiate the type of skeletal element being quantified (Lyman 1994: 101).

Specimens that could not be identified to species-level were, if possible, identified to taxonomic class: mammal, bird, fish, reptile, amphibian, and bivalve. Any specimen that could not be identified to taxonomic class, due to fragmentation or a lack of diagnostic characteristics, was labeled "unidentified." Unidentified specimens were inventoried for modification, including burning, cut marks, gnaw marks, and evidence of working for ornamental or tool use. These were incorporated in spatial analyses of processing and site utilization. An age assessment was given to identified specimens based on various applicable age markers such as: epiphyseal fusion, tooth eruption, and tooth wear (Davis 1987: 79; Reitz and Wing 2008: 194). Age was divided into three categories: juvenile, sub-adult, and adult. In addition, identified specimens were recorded as complete or fragmented. Identified fragmented specimens were recorded by the section of the element that remained intact, for example, "the distal 1/3 of a femur" or "articular process of a vertebra."

Familiarity with the general anatomical and skeletal characteristics of mammals, birds, fish, reptiles, amphibians, and bivalves was necessary in order to identify fragmented specimens to a taxonomic class. It was possible to identify a specimen to taxonomic class based upon the identification of morphological variations in dentition, locomotion, size, and unique tissue structures such as bivalve shell, turtle (Testudines) plastron/carapace, and antler (Reitz and Wing 2008: 44-62). Differentiated vertebral element type was a useful distinction: amphiplatyan (flat anterior and posterior centrum surfaces) is characteristic of mammals, procoelous (concave anterior centrum surface) is characteristic of reptiles and amphibians, and amphicoelous (concave anterior and posterior centrum surfaces) is characteristic of most bony fish, except for *Lepisosteidae*, gar fish (Reitz and Wing 2008: 42). A 10-power magnifying lens was used to distinguish bone surface structure and size for taxonomic classification. Fish bone fragments can be readily identified by their thin, flat, fibrous, angular, and, at times, translucent nature (Lyman 1994: 436; Beisaw 2013: 20; Wheeler and Jones 1989: 90). Bird bones are differentiated from mammal bones by their thin cortex, light-weight, and thinner internal trabecular bone structure (Davis 1987: 60; Beisaw 2013: 18, 20). Mammal bone by comparison has a thick cortical bone as well as a dense trabecular bone at bone epiphyses. The surface of mammal bone is also distinctive, resembling a wood-grain-like texture compared to the smooth luster of bird bone (Beisaw 2013: 18).

When possible, mammal-class specimens were differentiated by size-class into three: large, medium, and small. Large-mammal taxa consist of species equal to or greater in size (average adult weight) than white-tailed deer (*Odocoileus virginianus*). Small-mammal taxa consist of species equal to or less in size (average adult weight) than the eastern cottontail rabbit (*Sylvilagus floridanus*). Medium mammals consist of all taxa that fall in between these large and small taxa distinctions. During analysis, mammal specimens that could not be differentiated into the small, medium, or large size groups but were assuredly not part of the small-mammal size group (based on cortical thickness and general specimen dimensions) were assigned a medium/large distinction. It was not the goal of this study to discuss the differentiation of medium/large mammals from small mammals; however, for definitive purposes, assigning a medium/large mammal group distinction contributed a more refined interpretation of the analysis than simply leaving those particular fragments without a size distinction.

Quantification

NISP

All vertebrate specimens were tallied using NISP (number of identified specimens) quantification. NISP values are used extensively to examine the relative taxonomic abundances and frequencies of assemblages (Grayson 1984: 17). Archaeologically recovered NISP values are not above misrepresentation or reproach.

Criticisms of using NISP as a quantitative unit include such arguments as: NISP varies from species to species as some taxa, such as fish, have greater numbers of skeletal elements (Reitz and Wing 2008: 212); NISP can be affected by differential fragmentation; NISP is affected by differential recovery techniques (Grayson 1973: 201; Shaffer and Sanchez 1994: 526). Grayson posits, however, that no criticism of NISP quantification is specifically fatal to its overall use as a measure of taxonomic abundance (Grayson 1973: 201) and that most of these criticisms can be addressed through studies of an assemblage's taphonomy and/or comparable recovery methods. NISP is used in this study because it is a useful quantification in statistical testing, and can thus be used to provide a measure of the relative contributions of species and over all abundance of taxonomic classes for subsistence and diet comparisons.

Bone Weight

Bone weight was recorded to the nearest 0.01 gram using an Ohaus digital scale. Bone weight, combined with NISP quantifications, are among the most standardized primary data collected in faunal analysis. Bone weight has been demonstrated to have a distinct correlation to meat weight and thus can provide quantitative measurements to estimate the dietary contributions between identified taxa (Uerpmann 1973: 310; Chaplin 1971: 68; Hudson 1990: 140). Opponents of using bone weight to quantify faunal assemblages posit that bone weight can be affected by differential taphonomic processes such as weathering and mineralization, and that bone weight should not be used as a sole method of quantification (Lyman 1979: 538; Chaplin 1971: 69). However, bone weight avoids fragmentation bias and has been used as a comparative measure in a number of studies, complemented by NISP, and can be used to gauge the relative importance of taxa within a faunal assemblage (Peres 2010: 27).

Seasonality

Specimens were assessed for their indication of season of occupation at the site to determine site function. Investigating the season of occupation is an integral part of determining the function of a site: differentiating between a seasonal camp and a permanent settlement, and comparing the results temporally can illustrate trends in nomadism and sedentism through time (Davis 1987: 75; O'Connor 2000: 145; Reitz and Wing 2008: 264). Season of occupation data was collected from the presence of fish species documented as being more accessible and exploitable dependent upon seasonal spawning (Yerkes 1980: 274; Yerkes 1981: Becker 1983; Wheeler and Jones 1989: 155, 159). Additionally, the seasonal availability and ease of exploitation for migratory bird species was examined and correlated to the presence of identified species in the Finch site faunal assemblage (O'Connor 2000: 139; Temple et. al. 1997; Speth 1987).

An absence of intact deer mandible, maxilla, and attached antler-to-crania specimens disallowed investigations of tooth eruption aging and antler growth stages for seasonality identifications. Studies of fish scale incremental growth have been used to determine the "age at death" and thus their seasonal abundance as reflective in the archaeological record, however, this technique was beyond the scope of this project and thus was not utilized (Yerkes 1980: 274; Yerkes 1981). Other techniques such as the measurement of fish otolith increments, tooth cementum increments, and bivalve shell growth were beyond the expertise and scope of this project (O'Connor 2000: 80; Wheeler and Jones 1989: 114; Davis 1987: 85; Milner 1999). Seasonality evidence may not substantively define a site's season of occupation however, and the absence of seasonality evidence from a specific season does not equate to a site's abandonment at that particular time either (Davis 1987: 75; Milner 1999).

Bone Modification

Cut Marks

Cut marks appear on bone as an inadvertent effect, or combination of effects, from butchery events such as skinning, removing meat before or after cooking, or segmenting a larger body for transport and/or dispersal (Reitz and Wing 2008: 128). Cut marks created by stone tools have distinct morphological traits distinguishable from marks left by carnivore and rodent gnawing and gouging. Butchering cut marks made by stone tools leave elongated, V-shaped to U-shaped cross-sectioned fine striations that are often grouped in multiple parallel cuts (Lyman 1994: 297). Cut marks were identified with the aid of a 10X power hand lens. The absence of cut marks on bone is not necessarily evidence that butchery did not take place. Cutting into bone would have undoubtedly dulled the edges of stone tools, and been avoided to preserve edge sharpness (Beisaw 2013: 105).

Gnaw Marks

Gnaw marks were recorded as a single modification for all animal gnawing, biting, chewing, pitting, puncturing, gouging, perforation, and other damage which is diagnostic of animal modification (Lyman 1994: 206). Rodent gnaw marks are common among archaeological assemblages and are easily identified by the characteristic parallel grooved channels left by their constantly growing incisors. Rodent gnaw marks are found along the edges and surfaces of skeletal specimens. Carnivores typically target proximal and distal epiphyses of bone, removing marrow and even digesting cancellous bone and diaphysis fragments (Reitz and Wing 2008: 135-136). Ungulates also occasionally chew and gnaw on bone and antler to alleviate calcium deficiencies. Gnawing and other animal modification damage may imitate human modifications such as cut marks or drilled holes, necessitating a more precise taphonomic distinction (O'Connor 2000 48-51; Milner 1999: 54).

Worked Bone

Bone, teeth, and antler are commonly used as raw materials to manufacture tools and ornaments. Bone and antler are tough, malleable, and able to absorb shock when used as punches, awls, projectile points, or needles. Teeth are often found with holes drilled through their roots, interpreted as threaded pendants or ornaments. (Reitz and Wing 2008: 132, 275). Worked bone is identified by morpho-functional shape, for example, a worked bone projectile point or a metapodial bone awl. Worked bone tools and ornaments are also identified by wear polish from abrasive use-wear or from manufacturing abrasion, resulting in a reflective surface lacking visible scratches or gouges (LeMoine 1994: 320; Beisaw 2013: 109).

Fragmentation

To investigate spatial locations of different food processing activities, the degree of bone fragmentation was evaluated. While the fragmentation of bone in an archaeological assemblage can be the result of non-cultural forces such as weathering, trampling, and/or carnivore and rodent gnawing, it also can be attributed to cultural practices of butchery and food preparation techniques such as boiling, baking, roasting, marrow extraction, and the production of bone grease (Reitz and Wing 2008: 131, 141; Binford 1978: 155; Leechman 1951: 355). Various approaches have been proposed to identify what mix of cultural and non-cultural processes are at work in particular cases.

Bone fragments produced from rodent and/or carnivore gnawing leave distinct surface modifications such as grooved parallel marks, pitting, pit-like fractures, crenulated edges, and puncture marks which correspond to their dentition (Reitz and Wing 2008: 135; Lyman 1994: 206). Bone fragments are often consumed by carnivores and can display evidence of digestive corrosion. Bone fragments are also created by trampling. Trampling of bone can occur as a result of bone waste deposition within living spaces and activity areas of archaeological sites, and can also result from the compaction of bone within layers of sediment deposit after the site is no longer occupied (Gifford-Gonzalez 1989: 194). Trampling modifications on bone include randomly oriented scratch marks that are shallow relative to butchery cut marks (Reitz and Wing 2008: 139; Lyman 1994: 381). Weathering of bone is another taphonomic process that can result in the fragmentation of bone specimens. Bone weathering involves the natural abiotic processes (such as climate, temperature, soil pH, and moisture) by which bone is broken down and destroyed so that its organic nutrients are eventually recycled into the environment (Reitz and Wing 2008: 140; Lyman 1994: 354). Weathering acts upon bone in situ either on the surface or within the stratigraphy of the soil. Bone weathering indices are often used to describe observed macroscopic surface alterations such as bone exfoliation, splintering, cracking, and fragility (Behrensmeyer 1978: 161; Lyman 1994: 355). Though the degree of weathering depends upon the specific bone element, taxon, time of deposition, exposure duration, and the specific depositional microenvironment, it is assumed that bone specimens deposited in archaeological contexts are all acted upon by weathering to some degree.

Ethnoarchaeological studies have contributed to our understanding of cultural behaviors that result in the fragmentation of bone. Binford observed among the Nunamiut that the degree of dismemberment and fragmentation differentiates between activity areas such as kill locations from consumption locations (Binford 1981: 234). The greatest anatomical disorganization and fragmentation occurs at consumer locations where food is eaten and bone is processed for marrow and grease. Bone in consumer locations are rarely articulated and usually highly fragmented (Lyman 1994: 170; Binford 1981: 234). Fragmented bone from identified cultural contexts has been used for intra-site spatial patterning comparisons to delineate areas of intensive food processing, food sharing, and food waste discard; as well as to differentiate between settlement types such as short-term occupation camps and more permanent occupation sites (Vehik 1977; Todd and Rapson 1988: 309; Chapman 2000: 40).

Several studies have focused on the investigation of bone fragmentation in order to differentiate fragmented faunal assemblages created by non-cultural taphonomic fracturing, and those created by cultural practices of marrow and bone grease exploitation (Vehik 1977; Gifford-Gonzalez 1989; Outram 2001; Prince 2007; Stoessel 2014). Outram (2001) identified several archaeological bone assemblage patterns that, limited by identified taphonomic processes, can result from bone marrow and grease extraction activities. First, Outram posits that if bone marrow or bone grease processing has not occurred, then “the only human-induced damage to the bones will be the result of killing the animal, butchering it, and possibly processing some elements for craft purposes”

(2001: 402). Bones in this type of assemblage will be recovered more intact with minimal human modification. If bone marrow has been exploited but no bone grease production has occurred, there would be "evidence of deliberate long bone shaft fractures. The articulations will be deposited whole, as will the majority of axial elements," (Outram 2001: 402). If both marrow extraction and bone grease production took place, Outram posits that both cancellous and diaphysis bone will be fractured, the diaphysis bone in splinters, and the cancellous bone fragmented to varying degrees dependent upon the processing intensity (2001: 402; Stoessel 2014: 54).

Degree of fragmentation has been quantified by a variety of analytical techniques. Lyman discusses several common techniques to quantify bone fragmentation including the measure and comparison of diaphysis fragment lengths, as well as comparisons investigating ratios of NISP:MNE (Minimum Number of Skeletal Elements), (Lyman 1994: 334-337). Another method described by Prince (2007: 12) uses fragment lengths. This was done to test his hypothesis that a relationship exists between a bone specimen's size and its boiling efficiency: smaller fragments would require less boiling time to process and therefore require less fuel for fires. In this method Prince divided bone specimens into 10 size grades based on bone fragment maximum length. Bone fracture patterns are also used to identify bone damaged as a result of marrow extraction. Gifford-Gonzalez (1989: 196) investigated the fracturing patterns of broken zebra and cattle long bones to identify evidence for anvil use, including internal and external bone flaking, impact scars, and chop marks. Outram (2001: 405) further investigated bone fracture patterns to develop a Fracture Freshness Index (FFI) to investigate whether or not a bone was freshly fractured versus fractured as a result of taphonomic processes.

The FFI uses fracture angle, fracture surface texture, and fracture outline to score the freshness of bone fracture in determining its likelihood of fracturing as a result of anthropogenic food processing.

For this study, because bone specimens were too fragmented to offer an adequate investigation of NISP:MNE ratios or fracturing patterns, I chose a more expedient method, determining the average weight per fragmented specimen: weight / NISP. This method is discussed by Prince (2007) and Grimm (2010). As part of his study, Prince investigates the degree of fragmentation of bone assemblages from two late prehistoric sites located on Kitwancool Lake, British Columbia. Bone fragmentation is discussed by Prince as a result of bone grease production under the assumption that the "smaller the bone fragments are made, the more effective grease rendering will be," (2007: 11). While Prince supplemented his bone fragmentation analysis with an investigation of bone fragment size, dividing the fragmented bone assemblages by maximum length size grades, he posits that "the most expedient measure of the size of bone specimens is their average weight," (2007: 10). Though not all bones have the same density and thus weight, the degree of fragmentation quantified by weight/NISP also "escapes all the systematic problems associated with identifiability of fragments," (Outram 2001: 404) and is thus a useful measure when dealing with a highly fragmented faunal assemblage.

Burned Bone

The identification and quantification of burned bone within the Finch faunal assemblage was used to investigate the spatial patterning of vertebrate utilization and food processing. It is reasonable to expect that some portion of the burned assemblage directly corresponds to cooking and processing activities (Stiner et al. 1995: 225).

Burned bone accounts for roughly 60.2% of the total NISP and 46.9% of the total weight of the bone recovered from the Finch site and is thus one of the defining characteristics of the faunal assemblage. Studying the spatial variation of such a large burned bone assemblage can be used to explain human behavior and spatial patterning with regards to possible food processing and waste discard activities at the site (Clark and Ligouis 2010: 2550).

Several methods have been developed through experimental work in order to answer questions about the condition of bone before being burned such as: was the bone dry and weathered; was it freshly de-fleshed; was there flesh and other soft tissue still attached to the bone; was the bone already deposited beneath a fire pit or hearth and thus incidentally burned; how long was the bone burned for and what was the maximum temperature of the fire; was the bone used as fuel for a fire; was the bone burned in order to dispose of waste and deter scavengers and carnivores; was the bone burned by natural means such as brush fire or forest fire (Binford 1963; Shipman et al. 1984; Buikstra and Swegle 1989; Stiner et al. 1995; Bennett 1999; Cain 2005). Methods include both macroscopic and microscopic techniques to investigate burned bone specimens for changes in color, friability, infra-red spectra, crystalline structure, shrinkage, and surface texture modifications such as surficial fracturing, cracking, splintering, and warping.

Early studies of burned bone variation compared bone surface texture to differentiate dry, green, and fleshed bones in human cremation contexts. Binford's study of cremation burials (1963) evaluated the methods described by Raymond S. Baby's 1954 description of "Hopewell Cremation Practices" by investigating surface texture through experimentation. Binford concluded that bone burned already dry was distinguishable from green and fleshed bone by its superficial checking, longitudinal splitting, and lack of warping, while fleshed bone displayed deep transverse fracturing and longitudinal splitting (Binford 1963: 108). These experiments allowed Binford to infer that the "degree of bone calcining is a function of the length of time in the fire, the intensity of the heat," (1963: 101).

The more recent use of high-powered microscopy has furthered investigations of heat induced surficial and structural alteration on burned bone. Shipman et al.'s experimental work with sheep and goat remains identified specific surficial and structural changes correlating to incremental increases in temperature and exposure time using 1000x and 10,000x high-power SEM inspection (1984: 314). Their study also investigated changes in bone crystalline structure using X-ray diffraction analysis, concluding that bone crystal size increases with increasing temperature (Shipman et al. 1984: 319).

Bone fragmentation, or friability, has also been investigated and correlated to burned bone with regards to exposure intensity. Experimental work by Stiner et al. used bone burned to seven different levels of temperature intensity (0-6) to differentiate fragmentation as a function of burning intensity (Stiner et al. 1995: 229). They concluded that the mechanical strength of burned bone varied in correlation to the extent to which the bones were burned, more intense heat thus acting to weaken the internal structure of the bone (Stiner et al. 1995: 235). Cain (2005) investigated burned bone fragments, positing that fragments with similar heat exposed burning evidence both externally and internally (all surfaces of the bone) were burned, at least in a final episode, as a fragment (2005: 881). This identifies a relative archaeological signature of burned bone, based on fragmentation: bone fragments burned to a single color on all surfaces were burned as a fragment, and not as a result of fracturing in fire. Thus, a spatial cluster of bone fragments burned to a single color on all surfaces could represent the discarded remains of marrow removal or bone grease production activities that create an abundance of bone fragments.

The use of color identification of burned bone as a marker for burning intensity has been verified by thorough experimentation and review (Shipman et al. 1984; Buikstra and Swegle 1989; Stiner et al. 1995; Bennett 1999; Cain 2005; Asmussen 2009). Increased heat effects the surface color of bone in a progression from brown, to black, to grey, to blue, to white (Asmussen 2009: 529). Several studies have used Munsell color charts to map this transition, recording both the maximum heat intensity correlated color, and all other colors present differentiating between which color was predominant and which color or colors were supplementary (Shipman et al. 1984: 311; Bennett 1999: 6). Although multiple studies have focused on identifying the precise temperatures associated with burned bone color (Shipman 1984; Bennett 1999), the correlation of burned bone color to the stages of percent-carbonization and percent-calcination makes comparisons more manageable (Stiner et al. 1995: 227; Cain 2005: 875).

Identifying bone fragments with a single burned surface color versus multiple burned surface colors has also been demonstrated to correlate with the duration of burning, the presence or absence of flesh on the bone during burning, and the completeness of the element before it was burned (Buikstra and Swegle 1989: 552; Bennett 1999: 5; Cain 2005). Observations of multiple colors on burned bone fragments relate to burned bones that were partially protected from fire by flesh or other soft tissues

(Buikstra and Swegle 1989; Asmussen 2009: 529), identifying bones that were either roasted or freshly discarded into fire after processing.

Several studies of burned bone have worked to differentiate anthropogenic and natural burned bone. Bone burned by natural fire, such as a brush fire, is distinguishable by its non-uniformal burning pattern and its measurable low exposure intensity. Natural fires do not reach the temperatures and exposure times necessary to cause bone calcination; bones burned by brush fires are often only partially carbonized (Cain 2005: 875; Clark and Ligouis 2010: 2655). Experiments to differentiate incidental burning within a hearth context compare bone burned directly in a fire and bone burned as a result of fire created atop a preexisting assemblage (Stiner et al. 1995; Bennett 1999; Cain 2005). Using color variation as a means to identify heat intensity, Stiner et al. (1995) used controlled experimentation to record changes in burned bone as a function of stratigraphic depth below hearth fires. They concluded that bone directly beneath hearth fires (5 cmbs) showed signs for burning, however bone 10 cmbs were largely unaffected by the heat (Stiner et al. 1995: 230). They also concluded that no bone at any depth displayed signs of calcination, though their experimental hearth fires reached temperatures upwards of 900 degrees Celsius. Thus, it is evident that calcined bone is a result of anthropogenic burning.

Investigations of hearth fires have been used to differentiate bone burned as fuel versus bone burned as a result of cooking and food processing (Cain 2005; Clark and Ligouis 2010). Cain (2005) refers to two criteria for demonstrating the systematic use of bone for fuel: there has to be a rarity of charcoal relative to bone, and there needs to be a high representation of burned spongy bone epiphyseal ends relative to compact long bone shafts (Cain 2005: 881). Clark and Ligouis also posit that bone is not an efficient fuel type and requires a good deal of kindling fuel to start and maintain, which greatly limits its effectiveness over readily available grasses and hard woods (Clark and Ligouis 2010: 2858).

Differentiating burned bone as discarded food waste is also difficult. Asmussen relies on several ethnographic accounts to posit that bone and food waste was “not routinely incinerated in hearth fires, instead being discarded away from fires,” (Asmussen 2009: 528). However, Clark and Ligouis (2010: 2660) conclude that burning discarded food waste was a common practice of general site maintenance, probably in an attempt to keep scavengers and predators away. Ethnoarchaeological work conducted by Binford with the Nunamiut (1978: 164) and Gifford-Gonzalez with the Dassanetch (1989: 187) also identify a common discard pattern of bone debris after processing activities such as marrow removal and bone grease production in which bone fragments are treated differently between base camps and foraging camps. Base camp bone waste disposal is often discarded away from the living area in designated dump areas, while bone waste at foraging camps is treated differently, often discarded in the immediate vicinity of processing/consumption activities, such as near a hearth. Thus, because the Finch site seems to represents a short-term foraging camp (given the lack of structural features) the likelihood of bone waste being discarded in or near a hearth fire is very high.

In this study, burned bone was recorded for color variation incorporating the methodologies of Shipman et al. (1984), Stiner et al. (1995), and Cain (2005). Color variation methodology is a macroscopic analytical technique, the variation of which directly correlates to increases in heat intensity. The carbonization of bone collagen is a result of water escaping due to heating to temperatures in excess of 220 degrees Celsius, resulting in a blackened-smoky appearance. Calcination results from the complete oxidation of carbon within the bone occurring at temperatures upwards of 600 degrees Celsius and, resulting in a white chalky consistency when most of the organic matter is burned away (Lyman 1994: 385). For this study, color was recorded on an ordinal scale of 0 to 4 using the Munsell Soil Color Chart (Munsell Color Company Inc. 1954) and a 10x power hand lens to ensure consistent color categorization and dispel any surface-altering taphonomic factors (Cain 2005: 875). The first color ordinal, “0”, signifies no color change, unburned bone; “1” signifies a 5YR2/1 black; “2” signifies a 5YR 6/1 gray; “3” signifies a 5BG5/10 blue; “4” signifies a 10Y9/0 white. These ordinal distinctions were used to identify burned bone that was either unburned (0), carbonized (1), partially calcined (2, 3), or fully calcined (4). All ordinal color distinctions on each burned bone specimen were recorded. The predominant color was noted to ascertain the maximum heat intensity the specimen was exposed to.

Burned bone was then grouped in “single-burned” and “mixed-burned” groups to differentiate between bone that had been burned to a single color rank, and bone that showed evidence for multiple color ranks. Single burned bone identifies bone that had been more likely burned as a discarded fragment, while mixed burned bone identifies bone that had been more likely burned as fleshed bone. Burned bone that had evidence for rodent/carnivore gnawing and/or burned bone specimens that were complete elements were not included in the fragmented single and mixed color burned bone assemblages. It is understood that rodent and/or carnivore gnawing can take place after bone waste is discarded and that complete bone elements can be discarded after meals, however, this was done to ensure that only bone specimens burned as a likely result of food processing activities were included in the comparisons.

This differentiation was used, via spatial analysis, to identify areas of the site where potential food processing activities, such as bone marrow and grease production, and/or the locations of food waste disposal activities took place. An additional ordinal distinction, “5”, was recorded for specimens with a greenish-hue, and identifies possible mineral staining (Clark and Ligouis 2010: 2660). Specimens were recorded for counts and weights as part of the overall inventory.

Statistical Analysis

Statistical comparisons were made between the faunal assemblages of cultural temporal periods. Data was organized in contingency tables to determine differences between the distributions of taxa. Contingency tables were compared using C statistics (Gray, personal communication 2015) and singly-ordered non-symmetric correspondence analysis working with a function created by Dr. Gray using the R Statistics Software Package to test for statistical significance (R Core Team 2013).

The C statistic was used as a test for independence to analyze the categorical dispersion of the contingency cells assigned to taxa categories and temporal periods. The C statistic works to approximate the distribution of smaller samples more effectively than the Pearson’s chi-square test (Margolin and Light 1974: 755). The C statistic is also preferable when analyzing variation within categorical data, requiring the partitioning of variation into specific components, in this case, the cultural temporal periods (Light and Margolin 1971: 535). The test for significance measures the p-value: if it is greater than 0.05 it is not significant and the null hypothesis for independence is accepted, if it is less than 0.05 it is significant and the null hypothesis for independence is rejected (Sarnacchiaro and D'Ambra 2007: 1037).

Non-symmetrical correspondence analysis of the contingency tables was utilized to create a graphical summary of the asymmetric variables to visualize their association (Lombardo et al. 2011: 2125). This type of analysis assumes a symmetric relationship between the variables, and thus effectively illustrates asymmetric relationships by visualizing the proximity of statistically significant categories (Lombardo et al. 2011: 2128).

Spatial Analysis

Spatial analysis of the faunal assemblage was completed with a GIS utilizing ESRI software's ArcMap and ArcCatalog programs (ESRI 2012). The spatial analysis of artifact assemblages incorporated into a GIS allows for exploratory data analysis and the identification of trends and patterns (Connolly and Lake 2006: 46). GIS is a useful tool in managing artifact assemblages and collating data between different sites and projects. The inventory generated during the analysis of this study was compiled into ArcMap using the spatial database created by GLARC during Phase III excavation and inventory (Haas, personal communication 2013). GLARC used ArcMap to create the point, line, and polygon shapefiles and associated attribute data necessary to spatially organize all excavated provenience from the site. The database I created in Microsoft Excel was joined with the GLARC spatial data to run several queries concerned with the delineation of space and artifact assemblage variation.

In order to test for spatial patterning across the Finch site using the faunal assemblage, two types of analysis were applied, Kriging Spatial Interpolation and Kernel

Density Estimation. Spatial interpolation is a trend surface analytical method applied to quantitative data associated with spatial provenience. Interpolation predicts values of attributes in unsampled locations using positive spatial autocorrelation (O'Sullivan and Unwin 2010: 250; Conolly and Lake 2006: 90). Positive autocorrelation relies upon the assumption that neighboring data points are more similar the closer they are. The Kriging Statistical Interpolation method was used, which accounts for spatial variation and autocorrelation similar to inverse distance weighting, predicting values based on distances to unsampled locations (O'Sullivan and Unwin 2010: 294; Conolly and Lake 2006: 98).

The Kernel Density Estimation method was also utilized to identify areas of high density variables, for example, the different maximum temperature observations for burned bone or the locations of mammal resource utilization. Kernel Density Estimation is a probability density function that uses quantitative attribute data and radial distance to create "heat maps" of artifact density (O'Sullivan and Unwin 2010: 69; Conolly and Lake 2006: 175).

In this study, GIS spatial analysis was utilized to identify potential food processing activity areas using burned bone analysis data, and to identify concentrations of taxonomic abundance.   Results will first be presented using the faunal assemblage as a whole to report the horizontal distribution of all bone at the site. Additional analysis will be completed to report on the subdivided faunal assemblages associated with the various cultural components.

Chapter 5: Results

In this chapter I begin with an overview of the entire prehistoric faunal assemblage. This includes a summary of quantitative data of NISP and weight, followed by an account of the taxonomic representations of class, species, and mammal size. A description of the bone modification evidence for the combined assemblage follows including information on gnaw marks, cut marks, worked bone, bone fragmentation, and burned bone. There is also a brief section on evidence for seasonality. The remainder of the chapter is devoted to evaluation of the chronological subsets of the faunal assemblage, as defined by temporally diagnostic artifacts. These data are used to address questions about changes in diet and food processing through time. Finally, I discuss the results of the intra-site spatial analysis with regards to cooking and food processing.

Complete Faunal Assemblage Overview

The complete faunal assemblage recovered from Phase III excavations at the Finch site consists of 14544 pieces of vertebrate bone weighing a total of 2364.1 grams (see Appendix B). Fauna was recovered from 169 excavation units and 119 cultural features. Approximately 25% of the collection by count, and 70% of the collection by weight was identifiable at the level of taxonomic class. Mammals appear to have been the dominate resource, with deer as the dominant mammal, as detailed below.

NISP

Of the total 14544 pieces of bone, 3602 pieces, or approximately 25%, were identified to five vertebrate taxonomic classes; amphibian, bird, fish, mammal, and reptile. The majority of vertebrate faunal remains were not identifiable to taxonomic class due to their highly fragmented and burned state. Burned, fragmented bone is identified with multiple cultural features and makes up approximately 60% of the assemblage. The assemblage is dominated by mammal with 2826 pieces of bone, accounting for 78.46% of the identified NISP count. Fish are the next most abundant identified NISP count with 582 pieces of bone accounting for 16.16% of the identified NISP count. Next, reptiles make up 4.41% of the identified NISP count with 159 pieces of bone. Birds are represented by 34 pieces of bone, accounting for 0.94% of the identified NISP count. Reptile remains out rank bird remains in NISP and weight as a result of a dominance of turtle carapace and plastron identification. The least represented identified taxonomic class, amphibians, is represented by just one piece of bone, accounting for 0.03% of the identified NISP count (see Figure 5.1 and Table 5.1 for NISP comparisons).

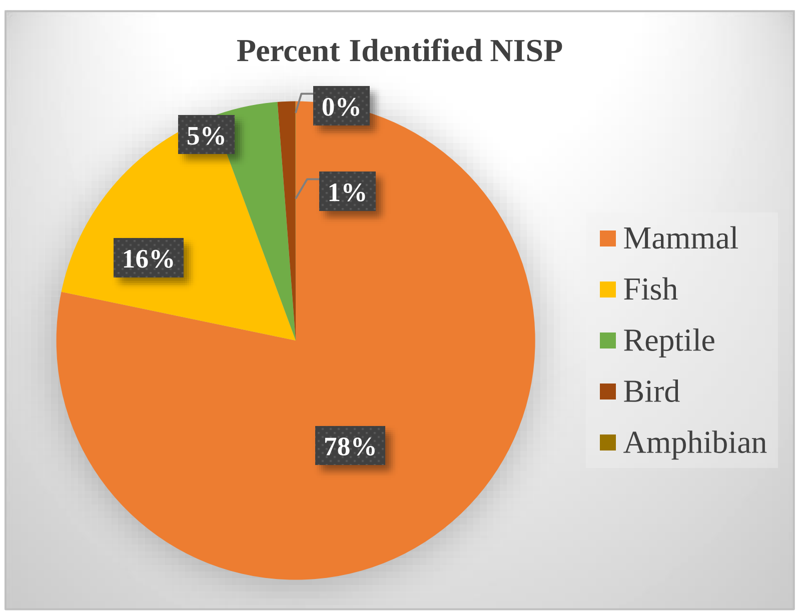


Figure 5.1: Taxonomic class represented by percent of identified NISP.

Table 5.1: Taxonomic class representation by NISP totals and percentage of total NISP.

Taxonomic Class	NISP	% NISP
Mammal	2826	78.46
Fish	582	16.16
Reptile	159	4.41
Bird	34	0.94
Amphibian	1	0.03
Total	**3602**	**100.00%**

Weight

The total weight for all pieces of bone is 2364.1 grams, of which 1657.24 grams or roughly 70% were identified to the five vertebrate taxonomic classes; amphibian, bird, fish, mammal, and reptile. The weight of the identified assemblage is dominated once again by mammal with 1611.17 grams accounting for 97.22% of the total weight (see Table 5.2). Reptiles in this case are the next most abundant with 24.85 grams accounting for 1.50% of the total identified taxa weight. Next, fish make up 0.92% with 15.22 grams. Birds are represented by 5.98 grams, accounting for 0.36% of the weight. As with NISP, the least represented identified taxonomic class, amphibians, is represented by

Table 5.2: Taxonomic class represented by weight totals and percentage of total weight.

Taxonomic Class	Weight (g)	%Weight
Mammal	1611.17	97.22
Fish	15.22	0.92
Reptile	24.85	1.50
Bird	5.98	0.36
Amphibian	0.02	0.00
Total	**1657.24**	**100.00%**

0.02 grams, accounting for less than 0.01% of the total identified taxa weight. In this case, mammals dominate the percent-weight of identified taxa as a result of mammal bone specimens generally weighing more than smaller-bodied fish, birds, reptiles, or amphibians. A pie chart would not effectively visualize this disproportional relationship.

Species Identification

In total, 17 different species were identified (see Table 5.3). Ten mammal species were identified including coyote (*Canis latrans*), elk (*Cervus canadensis*), bobcat (*Lynx rufus*), groundhog (*Marmota monax*), striped skunk (*Mephitis mephitis*), white-tailed deer (*Odocoileus virginianus*), muskrat (*Ondatra zibethicus*), deer mouse (*Peromyscus maniculatus*), raccoon (*Procyon lotor*), and eastern gray squirrel (*Sciurus carolinensis*). The most common mammal species identified was white-tailed deer, followed by elk, and then even-toed ungulate, which most likely represented more white-tailed deer. This demonstrates that the Oak Openings and Oak Forest ecological zones were utilized for large mammal procurement. The presence of raccoon and muskrat signals a Wetland zone exploitation of resources. Four species of fish were identified including freshwater drum (*Aplodinotus grunniens*), white sucker (*Catostomus commersonii*), channel catfish (*Ictalurus punctatus*), and walleye (*Sander vitreus*). These species are representative of an Aquatic ecological zone, and are present in Lake Koshkonong and the Rock River. Three species of bird were recorded including mallard (*Anas platyrhynchos*), great blue heron (*Ardea herodias*), and greater prairie chicken (*Tympanuchus cupido*). Mallard and great blue heron are associated with the Wetland/Aquatic ecological zones present around the Finch site, while the greater prairie chicken is associated with the Prairie zone. The identification of a variety of species from various ecological zones is evidence that the Finch site occupants utilized all surrounding ecological zones available.

Table 5.3: Identified taxa faunal assemblage.

Taxon	**Common Name**	**NISP**	**Weight (g)**
Bovidae	bison/cow	1	34.52
Cervus canadensis	elk	8	200.38
Odocoileus virginianus	white-tailed deer	64	204.96
Artiodactyl	even-toed ungulate	6	7.46
Canis	wolf/dog	2	2.82
Lynx rufus	bobcat	2	5.51
Canis latrans	coyote	1	1.08
Procyon lotor	raccoon	4	3.96
Marmota monax	groundhog	5	8.65
Mephitis mephitis	striped skunk	1	0.9
Ondatra zibethicus	muskrat	3	2.65
Sciurus carolinensis	eastern gray squirrel	1	0.38
Peromyscus maniculatus	deer mouse	1	0.01
Unidentified Mammal		2727	1137.89
Total Mammal		**2826**	**1611.17**
Aplodinotus grunniens	freshwater drum	2	0.1
Catostomus commersonii	white sucker	1	0.18
Ictalurus punctatus	channel catfish	2	0.7
Sander vitreus	walleye	6	0.29
Unidentified Fish		571	13.95
Total Fish		**582**	**15.22**
Testudines	turtle	148	23.84
Unidentified Reptile		11	1.01
Total Reptile		**159**	**24.85**
Anas platyrhynchos	mallard	1	0.1
Ardea herodias	great blue heron	1	2.4
Tympanuchus cupido	greater prairie chicken	1	1.49
Unidentified Bird		31	1.99
Total Bird		**34**	**0.94**
-			
Anura	frog	1	0.03
Total Amphibian		**1**	**0.03**

Mammal Size Differentiation

Mammals were further differentiated based on body size into three groups: large, medium, and small. For the purpose of this study, large-mammals are equal to or greater in size than white-tailed deer (*Odocoileus virginianus*), small-mammals are equal to or less in size than the eastern cottontail rabbit (*Sylvilagus floridanus*), and medium mammals fall in between. Mammal specimens that could not be differentiated into the three size groups, but were assuredly not part of the small-mammal size group (based on cortical thickness and general specimen dimensions) were assigned an “M/L,” or medium/large, distinction (see Table 5.4). However, M/L mammal specimens were not included in comparisons given their unspecific size classification. The size-identified mammal assemblage NISP is dominated by large-bodied mammals, followed by medium, and small bodied mammals. The weight of mammal-sized specimens follows the same trend, dominated by the more numerous large mammal specimens. Medium/Large sized mammal specimens are very numerous, with 1970 identified specimens, however, this is

Table 5.4: Mammal size differentiation by NISP, percentage of total mammal size NISP, weight, and percentage of total mammal size weight. Medium/large mammal size NISP and weight included.

Mammal Size	**NISP**	**%NISP**		**Weight (g)**	**%Weight**
Large	270	73.17		644.06	93.08
Medium	58	15.72		38.37	5.55
Small	41	11.11		9.5	1.37
Total	**369**	**100.00%**		**691.93**	**100.00%**
Medium/Large	1970	n/a		38.37	n/a

due in part to the ease of their unspecific classification, which looked solely to bone cortical thickness as an identifier for mammal size greater than eastern cottontail rabbit (*Sylvilagus floridanus*). As previously stated, their inclusion within the dataset was simply an exercise in identification thoroughness, and will not be used in any analytical comparisons, only reported.

Fish Scales and Shellfish Remains

Fish scales were not included in the total counts and weights of the reported faunal assemblage. In total, 398 fish scales were counted, weighing a total of 1.46 grams. Fish scales were recovered from feature numbers 3, 72, 128, and 135. Feature number 72 was the only feature with fish scales associated to a single temporal cultural period: the Early Woodland period. Fish scales were unmodified and unburned. Six of the 398 total fish scales recovered at the site were collected from ¼" dry screen mesh, the other 392 scales were recovered from 1/16" flotation screen mesh samples. This suggests that analyses that do rely on fish scales will maximize sample size by including flotation and fine mesh recovery. Fish scales were recorded and included in the assemblage catalog (see Appendix B) but not incorporated in the analysis or any of the results that follow.

Shell fragments were also not included in the total counts and weights, and therefore were also not included in the analysis or results. In total, 37 shell fragments recorded to the bivalve taxonomic class were recovered weighing a total of 1.96 grams. A single shell fragment was recovered from unit 384, the other 36 shell fragments were recovered from features 4, 25, 58, 111, 128, 131, 135, and 144, none of which were associated with a single temporal cultural period. Shell fragments were unmodified and unburned. Three of the 36 total shell fragments were recovered from ¼" dry screen mesh, 22 shell fragments were recovered from 1/8” water-screen mesh, and 12 shell fragments were recovered from 1/16” flotation screen mesh. Shell fragments were also recorded and included in the faunal assemblage inventory (see Appendix B) but not incorporated in the analysis or any of the following results.

Bone Modification

Several specimens were modified as evident by distinguishable surface features such as cut marks, gnaw marks, worked bone, and burned bone. Four specimens were recorded with evidence for rodent gnaw marks weighing a total of 39.32 grams.

Cut Marked Bone

Cut marks were observed on 17 specimens weighing a total of 260.78 grams (see Table 5.5). One cut-marked specimen was identified as a non-prehistoric modified bone piece by saw markings typical of metal saw historic or modern butchery techniques. The

Table 5.5: Cut marks by taxa and element.

Taxon	**Size**	**Genus-Species**	**Common Name**	**Element**	**NISP**	**Weight (g)**
Mammal	Large	Cervus canadensis	Elk	Humerus	**1**	188.96
Mammal	Large	Odocoileus virginianus	White-tailed Deer	Calcaneus	**1**	12.92
Mammal	Large	Odocoileus virginianus	White-tailed Deer	Metacarpal	**1**	12.96
Mammal	Large	Odocoileus virginianus	White-tailed Deer	Astragalus	**1**	2.45
Mammal	Large			Long bone	**2**	2.05
Mammal	Large				**3**	3.33
Mammal	M/L			Long bone	**1**	0.4
Mammal	M/L				**5**	2.94
Mammal					**1**	0.25
Total					16	226.26

specimen was identified as a lateral-border fragment of a *Bovidae* scapula, weighing 32.52 grams. The specimen was retrieved from dry-screen recovery out of level 2 (5-10 cmbs) in unit 369, and is likely historic or modern refuse, thus it was not included in the table. The 16 other cut-marked specimens were recovered from dry-screen, water-screen, and flotation recovery techniques at various depths of stratigraphy no shallower than level 5 (20-25 cmbs) and display evidence for stone tool use based on cut shape cross-section analysis and cut mark grouping location.

Worked Bone

Worked bone in the form of bone tools and bone pendants/ornaments were very rare in the Finch site faunal assemblage. Two pieces of bone were identified as worked bone: a raccoon maxillary canine, and a deer antler tine. The raccoon canine weighs 0.62 grams, and was modified into a pendant/ornament by drilling a hole in the root of the tooth. The canine tooth also shows evidence for polish and cut marks. The tooth pendant is similar to a *Canis* canine ornament excavated at the nearby Highsmith site. This tooth pendant, as described by Salzer, was being highly polished and included a small hole drilled through the tip to allow for suspension as an ornament (Salzer 1965: 160). The deer antler tine weighs 0.88 grams and has a polished surface with a worn tip and a flat-cut base. The antler resembles either an antler flaker or an antler awl similar to tools reported by Wiersum (1968) and Salzer (1965). Wiersum describes several antler flakers from the nearby Cooper Shore site as being "well smoothed and the end or tip has multiple facets. The proximal end of the implement was cut flat," (Wiersum 1968: 59). Salzer describes antler flakers as having been used to manufacture stone tools. He also describes antler awls as having a polished surface adjacent to the point of the time resulting from its use to puncture or pierce through skins (Salzer 1965: 157). Salzer also posits, however, that the identification of antler tools should be offered tentatively due to the fact that deer use their antlers for both offense and defense and that this can have the effect of polishing and damaging the tips on its own (Salzer 1965: 158). Because the antler tine has both polish and a marred tip in combination with being cut/shaped flat on the proximal surface, it is likely that it was modified as an antler tool.

Bone Fragmentation

Bone fragmentation was measured per unit and feature to discuss food processing intensity as a result of activities such as marrow extraction and/or bone grease production. Using average bone count to weight ratios, as discussed in Chapter 4, I compared the overall site assemblage ratio of fragmentation between units and features and investigated the role that recovery techniques had on this measure. On average, specimens from features appear to be more fragmented than specimens recovered from unit matrix. From the 169 units with faunal remains 5585 pieces of bone weighing a total of 1412.74 grams were recovered. The average fragment size by weight equals 0.256 grams per specimen. From 119 cultural features with faunal remains 8959 pieces of bone weighing a total of 951.36 grams were recovered. The average fragment size by weight equals 0.106 grams per specimen. Bone specimens recovered from features had an average fragment size nearly one third the size of bone specimens recovered from non-feature provenience (see Table 5.6). Fragmentation, however can be misleading due to different recovery techniques. At the Finch site, unit matrix was sifted through ¼” dry-screen mesh, with the infrequent utilization of 1/8” water-screen mesh and 1/16” flotation mesh recovery techniques. Feature matrix, by contrast, was more frequently recovered and sorted using fine-mesh 1/8” water-screen and 1/16” flotation recovery techniques to recover samples of flotation and botanical remains.

Table 5.6: Fragmentation comparing unit and feature provenience.

Provenience	**NISP**	**Weight**	**Fragmentation**
	(#)	(grams)	(grams / #)
Unit	5585	1412.74	0.256
Feature	8959	951.36	0.106

In order to address the impacts of differential recovery techniques, an examination of specimen NISP, weight, and fragmentation by recovery technique was completed (see Table 5.7). When the recovery techniques and screen size are controlled, the

Table 5.7: Fragmentation comparing unit and feature provenience by recovery technique.

Provenience	**NISP**	**Weight**	**Fragmentation**
	(#)	(grams)	(grams / #)
Dry-Screen (1/4")			
Unit	4797	1383.71	0.288
Feature	1748	707.05	0.404
Water-Screen (1/8")			
Unit	777	28.41	0.037
Feature	4186	144.39	0.034
Flotation (1/16")			
Unit	11	0.62	0.056
Feature	3025	99.92	0.033

fragmentation distinctions become more ambiguous. The average fragment weight of specimens from units and features recovered from the ¼" dry-screen mesh is greater than 1/8" and 1/16" water-screen and flotation mesh. Unit and feature specimen weights are almost identical when recovered using 1/8" water-screen mesh. Unit specimen weights recovered from 1/16" flotation mesh is greater than specimens recovered from feature specimens recovered from flotation, though the sample size of unit flotation specimens is very small in comparison to specimens recovered from feature flotation.

The greatest amount of fauna from dry-screen recovery comes from unit matrix, 4797 specimens, at a ratio of 2.75 specimens for every one feature specimen. The majority of fauna recovered using the water-screen recovery technique is from feature matrix at a ratio of 5.4 specimens for every one unit specimen. Faunal material recovered from flotation 1/16" mesh is dominated by specimens recovered from feature matrix at a ratio of 275 specimens for every one unit specimen. These ratios illustrate the ambiguous nature of comparing fragmentation between different recovery techniques as a proxy for measuring food processing intensity. This data illustrates the highly fragmented nature of the Finch faunal assemblage. To interpret processing intensity change through time, this data will be compared by separate recovery techniques and by separate provenience to alleviate concerns for biases in mesh size.

<u>Burned Bone</u>

Burning was a frequently observed bone specimen modification, accounting for 62.00% of the total number of specimens and 46.95% of the total weight with 9018 pieces of bone weighing 1109.89 grams. Burned bone was present in 130 units and 111 features (see Figure 5.2). Only 39 of the 169 units containing faunal material did not

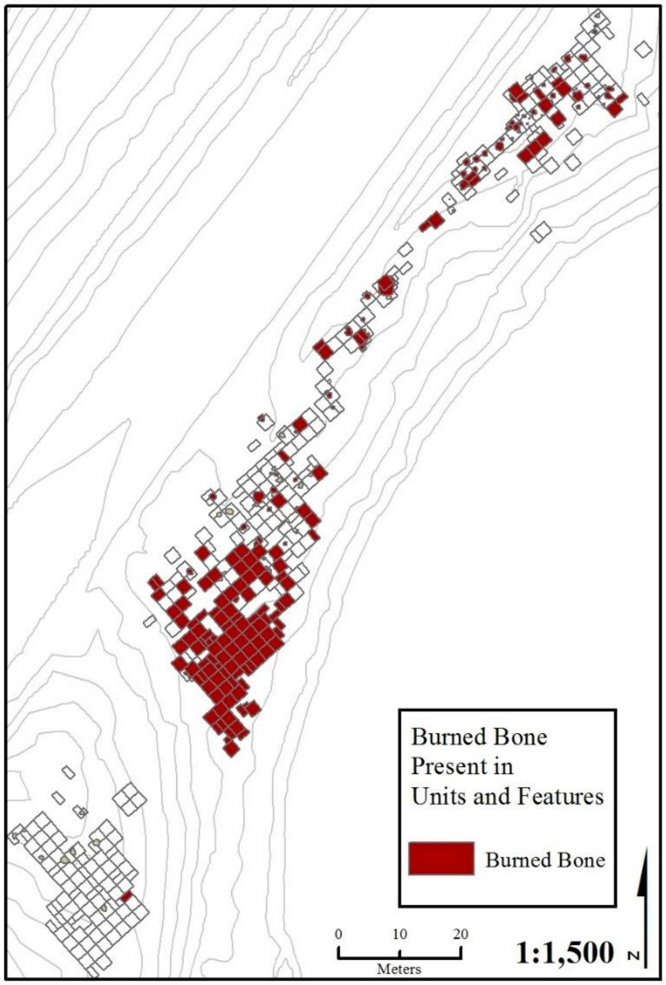


Figure 5.2: Spatial distribution of units and features containing burned bone.

have burned bone, as well as only nine of the 119 features; thus, burned bone accounts for a significant proportion of the site's faunal assemblage both spatially and by specimen counts and weights. The spatial distribution of burned bone was examined using two methods, Kriging Interpolation and Kernel Density (O'Sullivan and Unwin 2010; Conolly and Lake 2006). A Kriging Interpolation function was used to approximate the surface trend of burned bone across all excavated and unexcavated areas of the site (see Figure 5.3). This method uses statistical autocorrelation to generate a raster surface of nearest neighbor densities for predictive modeling. The Jenks Natural Break Method classification scheme was used in this analysis. Jenks Natural Breaks groups data by minimizing the within class variance and maximizing the between class variance (Dent et al. 1999: 108). This is a common data classification method allowing for the identification of homogeneous data groupings which would otherwise be indiscernible using data classes separated by Equal Interval schemes. The Jenks Natural Breaks classification scheme is used throughout this study. The Kriging Interpolation method predicts burned bone density in unexcavated areas in the southern section of the middle saddle area, just north of the southern knoll. However, the Kriging Interpolation method

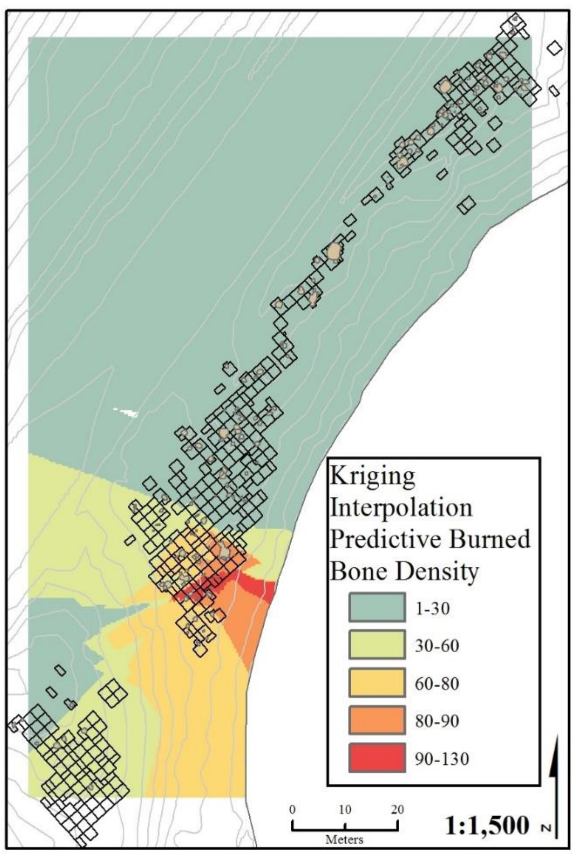


Figure 5.3: Interpolated density representation of burned bone NISP across the site using Kriging Interpolated surface trend analysis.

does not illustrate the actual density of burned bone present at the site, as it neglects the concentrations in the northern area.

The specific density of burned bone as it is distributed across the site is thus better illustrated by the Kernel Density spatial analysis function to highlight the specific locations of higher and lower densities using a five class Jenks Natural Breaks classification scheme (see Figure 5.4). Total burned bone NISP is most concentrated in the north and southern end of the saddle. Only a single piece of burned bone is present atop the southern knoll. Kernel Density analysis is more useful in this case because it illustrates clustering locally, as oppose to predicting concentrations site-wide as in the case with the Kriging Interpolated surface. This will be useful to investigate change

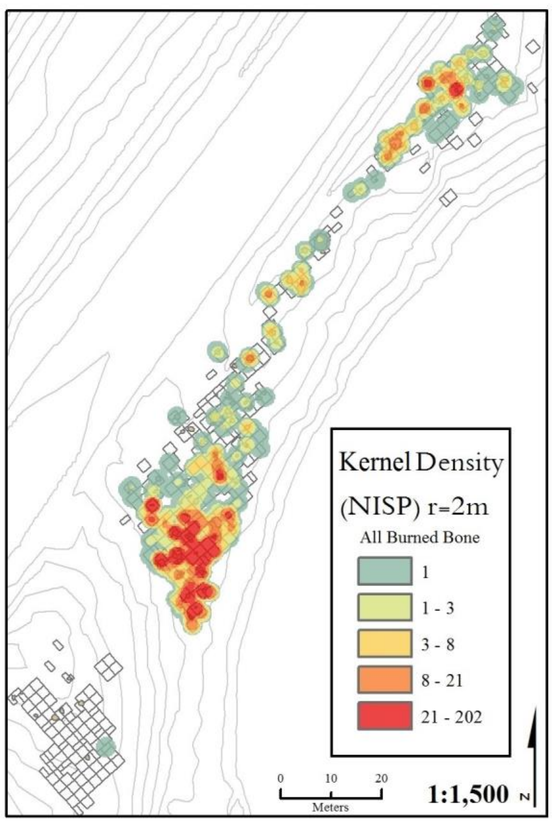


Figure 5.4: Density representation of burned bone NISP across the site using Kernel Density.

through time when comparing areas a burned bone concentration assigned to temporal provenience.

Degree of burning per fragment was quantified using an ordinal scale of maximum temperature exposure based on bone coloration. Fragments were ranked from zero thru four with zero representing specimens with no heat alteration, and four representing specimens that achieved a state of full calcification. When multiple colors were present, all were recorded. Burned bone could then be differentiated by whether or not the bone was completely burned to a single dominant color, whether the specimen was burned to multiple colors (termed mixed), and the maximum temperature the bone was exposed (see Table 5.8 and Table 5.9). Fully calcined bone dominates the burned

Table 5.8: Burned bone quantification by NISP.

Burning Description -	**Unburned**	**Carbonized**	**Part. Calcined**	**Part. Calcined**	**Calcined**
Color Description -	**no change**	**black**	**gray**	**blue**	**white**
Munsell Color -	**natural**	**5YR2/1**	**5YR6/1**	**5BG5/10**	**10Y9/0**
Ordinal Distinction -	**0**	**1**	**2**	**3**	**4**
Present	3351	587	152	2294	7978
1 Color	N/A	24	1	46	4579
> 1 Color (Mixed)	3351	563	151	2248	3399
Max. Temperature	N/A	323	35	661	7978

bone assemblage both by NISP and by weight with 4579 specimens weighing 419.94 grams. Bone that has been burned contains more carbon than unburned bone and are thus more resistant to biodegradation than more organic specimens, though burned bone has

Table 5.9: Burned bone quantification by weight (grams).

Burning Description -	Unburned	Carbonized	Part. Calcined	Mostly Calcined	Calcined
Color Description -	**no change**	**black**	**gray**	**blue**	**white**
Munsell Color -	**natural**	**5YR2/1**	**5YR6/1**	**5BG5/10**	**10Y9/0**
Ordinal Distinction -	**0**	**1**	**2**	**3**	**4**
Present	485.99	82.95	25.77	371.8	993.32
1 Color	N/A	3.31	0.01	3.58	419.94
> 1 Color (Mixed)	485.99	79.64	25.76	368.22	690.14
Max. Temperature	N/A	55.08	0.56	61.12	993.32

been demonstrated experimentally to dissolve in acidic environments more rapidly than fresh bone (Lyman 1994: 390-391). Only four burned specimens weighing a total of 0.97 grams were complete skeletal elements, the remaining 9014 specimens were all fragmented pieces of bone. Two of these complete elements were M/L sized unidentified mammal sesamoids, and the other two specimens were both unidentified fish vertebrae.

Fragments with evidence for only a single color total to 4673 specimens weighing 441.18 grams. Evidence for only a single burned exposure temperature on a specimen (one dominant color on the interior and exterior surfaces of a fragment) “indicates that they were burned, at least for the final time, as fragments” (Cain 2005: 881), a possible result of marrow extraction, bone grease production, or site maintenance. Mixed colors of burning have been demonstrated experimentally (Buikstra and Swegle 1989; Asmussen 2009) to be the result of multiple exposure temperatures. These may be a product of roasting, the multiple colors a result of bone surfaces being partially protected by soft tissue or remaining flesh, or from heat-induced fragmentation.

For this study, I have differentiation single and mixed color burned bone as a means to tease out differences in food processing activities at the site. Single color burned bone was used to identify possible activity areas where bone was fragmented and then stripped of all meat, marrow and tissue as a result of food processing for marrow and grease. Mixed burned bone was used to identify possible activity areas where food was roasted and not processed for marrow or grease, instead being discarded with partial in fire and burned with remaining marrow and tissue still attacked, resulting in mixed color burning. These two distinctions were then used to spatially identify areas of the site where food processing activities most likely occurred; marrow and bone grease processing being associated with single color burned bone fragments; roasting associated more with multiple colored burned bone fragments.

A comparison of the total burned bone density when divided into “single burned color” and “mixed burned colors” distinctions reveals that there is a difference in the spatial location of the two categories across the site (see Figure 5.5 and Figure 5.6 for comparison). Burned bone specimens with multiple ordinal color distinctions, or “mixed”, are strongly associated with the southern saddle area, concentrated in unit 266 and 267. Burned bone specimens with a single ordinal color distinction are strongly associated with the southern saddle area also, however they are not found in unit 266 and 267, but rather concentrated in feature 81 ad 114. There is also a concentration of single burned color bone in the northern area of the site, in feature 3. A spatial comparison of mixed and single burned bone can be refined by cultural temporal period. The results of this approach are addressed in the following section on temporal component variation.

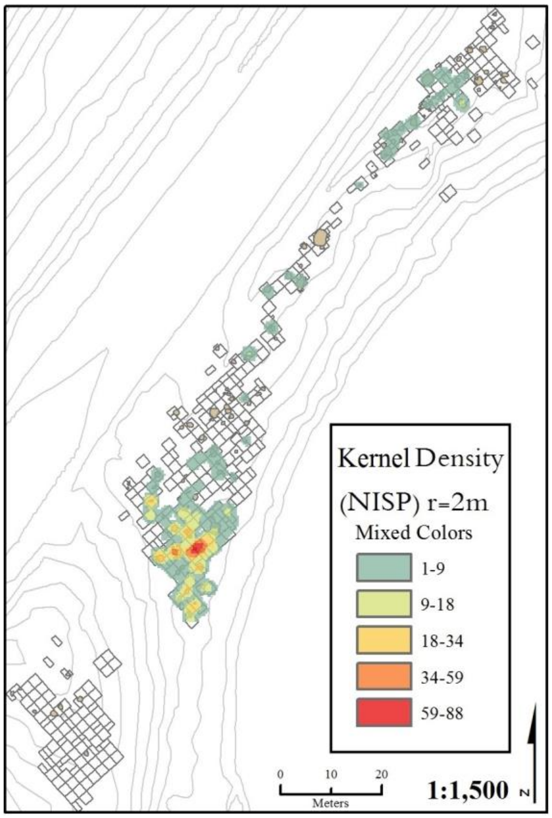


Figure 5.5: Kernel Density of mixed color burned bone spatial distribution.

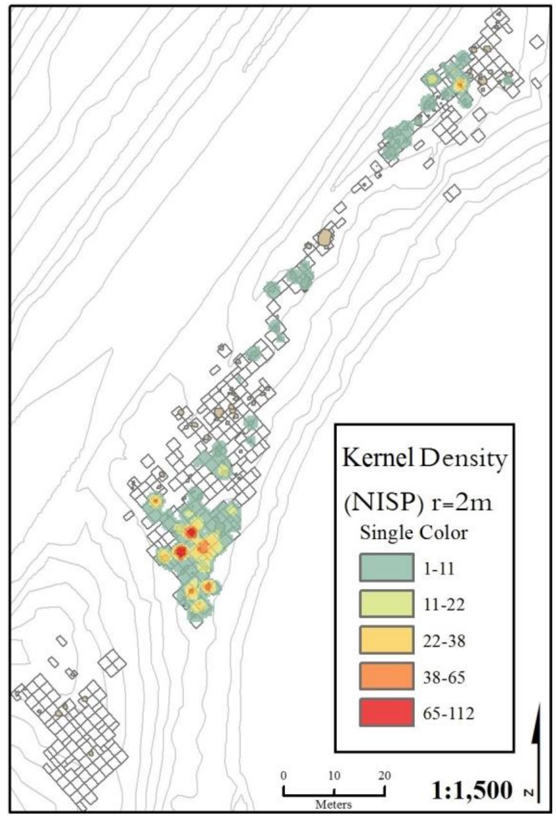


Figure 5.6: Kernel Density of single color burned bone spatial distribution.

Seasonality

Evidence for the seasonality of site occupation at the Finch site was limited to the presence of migratory bird species and the identification of fish species whose ease of procurement was identified to their biological spawning behavior and water temperature dependence in Southern Wisconsin. The resulting sample is quite small, consisting of four fish species: freshwater drum, white sucker, channel catfish, and walleye, and three bird species: mallard, great blue heron, and the greater prairie chicken.

The geographic ranges of migratory birds are closely related to the distribution of their preferred ecosystems (Temple and Cary 1987: 20). The “tension zone” separates the floristic provinces of Wisconsin into a southwest prairie-forest province half and a northeast boreal hardwoods province half (Curtis 1959: 15). The seasonal abundances of birds in these two provinces are markedly different and accounted for in Temple and Cary's <u>Wisconsin Birds: A Seasonal and Geographic Guide</u> (1987). Mallard (*Anas platyrhynchos*) are present throughout the year in southern Wisconsin, though they are most abundant during their spring and fall migrations (Temple and Cary 1987: 50) (see Table 5.10). Great blue heron are abundant across the state between March and October, however, their abundance drops in southern Wisconsin during June, July, and August as their abundance increases in northern Wisconsin during those same summer months (Temple and Cary 1987: 37). The greater prairie chicken is also discussed in Temple and Cary (1987: 88) as having a small abundance in northern Wisconsin during spring and fall months and no abundance in southern Wisconsin. However, its presence in the Finch Site faunal assemblage, and the fact that prehistoric faunal abundances may not be

Table 5.10: Seasonal availability of fauna represented by identified species at the Finch site. Species are recorded as "A" for abundantly available, referring to the months when species were most available based on migration and spawning seasons.

Taxon	**Common Name**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Anas platyrhynchos	mallard			A	A	A	A	A	A	A	A	A	
Ardea herodias	great blue heron			A	A	A				A	A		
Tympanuchus cupido	g. prairie chicken			A	A	A	A			A	A	A	
Aplodinotus grunniens	freshwater drum					A	A	A					
Catostomus commersonii	white sucker				A	A	A						
Ictalurus punctatus	channel catfish					A	A	A					
Sander vitreus	walleye				A	A	A						

accurately reflected in modern aviary studies, illustrates the tentative nature of using modern biological studies to predict prehistoric seasonality.

Fish species identified in the Finch Site faunal assemblage were analyzed for seasonality by recording their maximum availability based on recorded spawning activity based on Yerkes' (1980, 1981) investigations of fish scale incremental growth rings and season of death (1981: 535). Freshwater drum in Wisconsin spawn when water temperatures are between 18.9 – 22.2 degrees Celsius between the months of May to July (Becker 1983: 958). Yerkes (1981: 541) posits that drum would have been available most seasons of the year, however, as a bottom feeder, freshwater drum would be most available as a prehistoric food source during spawning when groups of spawning fish would amass at the surface (Becker 1983: 959). White sucker spawn soon after the ice melts off of open water when water temperatures reach 7.2 degrees Celsius. Suckers typically spawn in the night-time, and are recorded as most abundant from April to May (Becker 1987: 684) and into June (Yerkes 1981: 541). Channel catfish would have been most abundant during their spawning season from May to July, when water temperatures reach 23.9 – 26.7 degrees Celsius (Becker 1987: 713). Walleye were also identified in the site faunal assemblage and are recorded as being abundantly available during the early months of the spring thaw, when water temperatures reach 3.3 – 6.7 degrees Celsius and continuing into June, similar to the white sucker (Becker 1983: 873).

Based on the limited amount of seasonal specific species and skeletal element identifications, the complete faunal assemblage from the Finch site illustrates, at maximum, an occupation period from early spring to late fall, and at minimum an occupation period in late spring to early summer. The multiple prehistoric cultural period assemblages were also investigated separately and compared for season of occupation identification to discern temporal differences in the season of site use; as noted above, the sample sizes of seasonality data are quite limited and interpretations are best viewed as tentative. A discussion of the faunal assemblage results from the different periods follows.

Faunal Assemblage by Cultural Component

A total of 64 units and 32 features containing faunal remains were differentiated, based on the presence/absence of diagnostic artifacts, into Late Paleoindian, Middle Archaic, Late Archaic, Early Woodland, Middle Woodland, and Late Woodland period assemblages for comparison. No faunal material was associated with any Early Archaic provenience. Several Early Archaic diagnostic projectile points were recovered from the site, however all of them were located in unit assemblages with mixed diagnostics from other temporal periods, making it difficult to differentiate an Early Archaic faunal assemblage.

Paleoindian and Archaic Period Faunal Assemblages

Late Paleoindian, Middle Archaic, and Late Archaic periods were least represented in the faunal assemblage comparison, restricted in provenience at the site to the southern knoll (see Figure 5.7). Faunal assemblages from these periods were not included in any statistical comparisons of taxon distribution, spatial distribution, or burned bone spatial analysis due to sample size. However, their presence in the site faunal assemblage is important and is reported quantitatively here. It should be noted that all faunal remains from these earlier time periods come from unit contexts and ¼” dry-screen recovery, which may have biased against the recovery of smaller bodied fauna and more fragile skeletal elements.

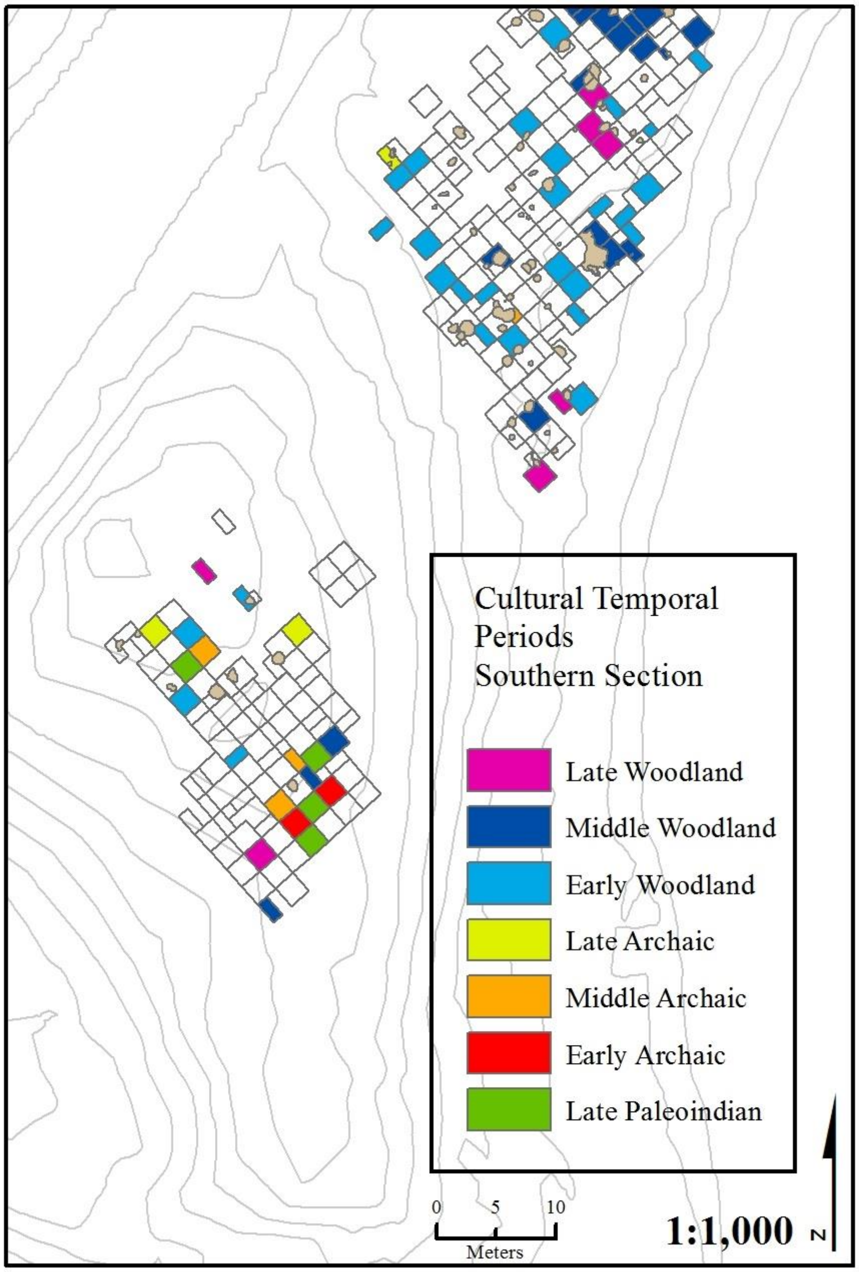


Figure 5.7: Distribution of temporally associated excavation units atop the southern knoll.

Late Paleoindian fauna is restricted to a single piece of undifferentiated bone weighing 0.81 grams, recovered from unit 79 ¼” dry-screen mesh. The specimen was recovered from level 6 (30 cmbs) associated with a Scottsbluff Eared projectile point. Middle Archaic fauna is also represented by a single undifferentiated bone specimen weighing 0.28 grams, recovered from unit 220 ¼" dry-screen mesh. The specimen is burned to color ranks 0 and 4, mixed-calcined. The specimen was discovered in level 8 (40 cmbs), associated with a Matanzas projectile point. The Late Archaic faunal assemblage consists of 10 bone specimens weighing 5.47 grams, recovered from unit 369 and 107 ¼" dry-screen mesh. A single specimen is burned to color ordinal 3 and 4 mixed-calcined, and weighs 0.11 grams. Six of the 10 specimens were identified as mammal, three of which were identified as large mammal. A single piece fragment of turtle plastron is also present. The specimens were recovered from levels three through 8 (15 – 40 cmbs) and were associated with Durst Stemmed and Preston Notched projectile points.

Woodland Period Faunal Assemblages

Faunal assemblages associated to Early, Middle, and Late Woodland periods offer larger samples and more robust comparisons between taxon, mammal size, and spatial variation in food processing evidence. Faunal remains are present from both unit and feature proveniences throughout the Woodland periods. A total of 2207 specimens weighing 217.26 grams were recovered from 18 units and three features associated with the Early Woodland period; 1856 specimens weighing 256.11 grams were recovered from 17 units and three seven features associated with the Middle Woodland period; and 765 specimens weighing 237.76 grams were recovered from 25 units and 22 features associated with the Late Woodland period (see Figure 5.8). These values include undifferentiated vertebrates as well as class-level and more specific identifications.

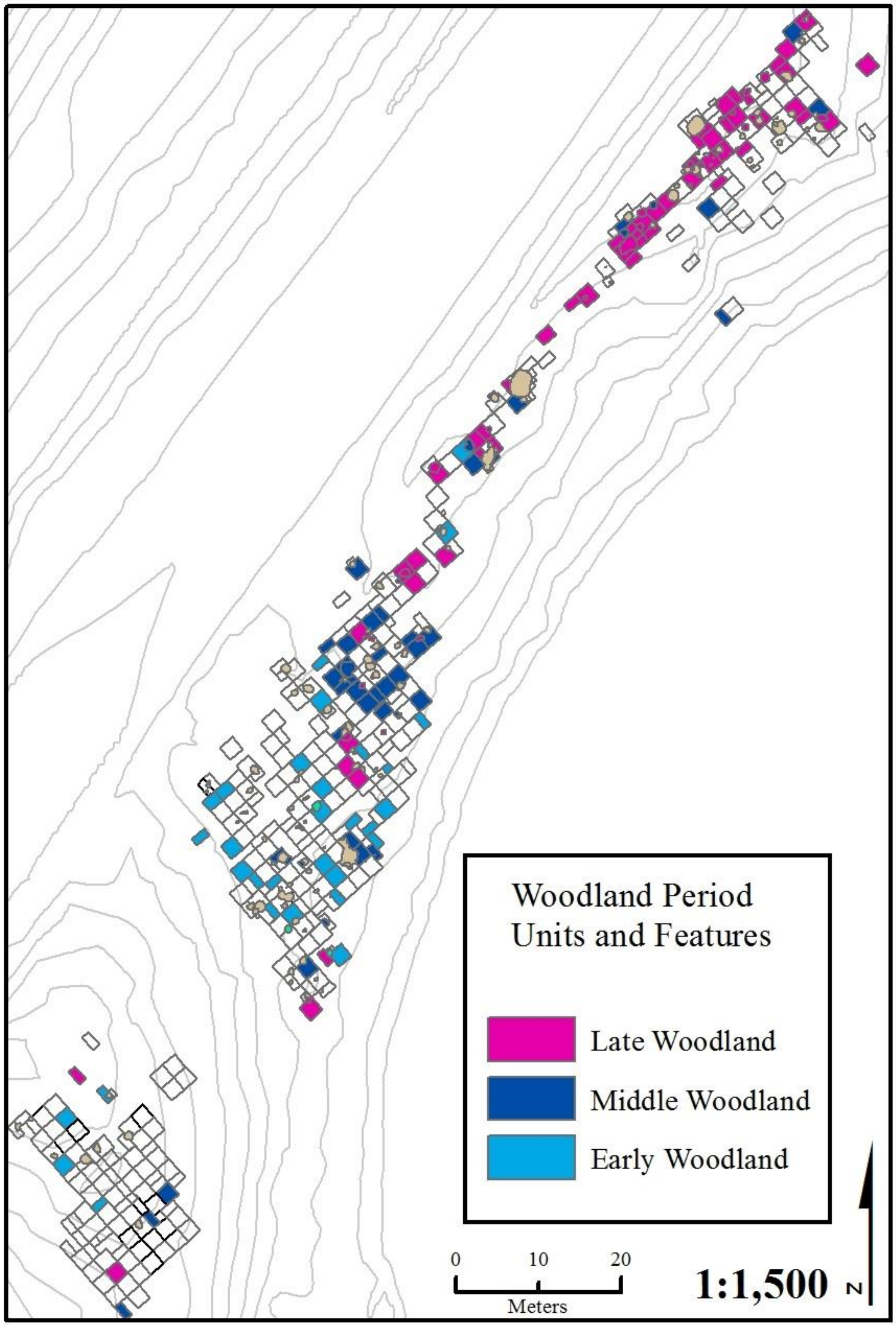


Figure 5.8: Distribution of Woodland Period associated units and features at the site.

Mammals are present in all sizes throughout the Woodland periods (see Table 5.11), recovered from both feature and unit provenience. Reptiles in general, and turtles specifically, are also present throughout the Woodland period, recovered from features and units. Bird remains were recovered from all Woodland periods, however, they were

Table 5.11: Comparison of Woodland period unit and feature provenience faunal assemblages. P = Present S = Seasonal Marker.

	Early Woodland		Middle Woodland		Late Woodland	
	Unit	Fea.	Unit	Fea.	Unit	Fea.
elk	P					P
white-tailed deer	P	P	P	P		
artiodactyl			P		P	
bobcat					P	
raccoon				P	P	
groundhog	P					
deer mouse					P	
Mammal	P	P	P	P	P	P
Large Mammal	P	P	P	P	P	P
Medium Mammal	P	P	P	P	P	P
Small Mammal	P	P	P	P	P	P
channel catfish				PS		
Fish		P		P		P
turtle	P	P	P	P	P	P
Reptile	P	P	P	P	P	P
great blue heron	PS					
g. prairie chicken	PS					
Bird	P		P		P	
Amphibian						

not recovered from feature contexts, only from unit ¼” dry-screen mesh. Fish were recovered from all Woodland periods, though just the opposite of bird remains, fish were only recovered from feature provenience. Only a single fish specimen was recovered from ¼” dry-screen mesh for all Woodland periods, while the rest were recovered using 1/8” water-screen mesh and 1/16” flotation mesh recovery techniques, illustrating the benefits of smaller screen size in recovering smaller-bodied taxon. Amphibian remains were not identified in any of the Woodland period assemblages. Eight taxa were identified to species level classification, two additional taxa, Artiodactyl and Testudines, were identified to order level classification. White-tailed deer remains were identified in both unit and feature provenience from Early and Middle Woodland periods, however, they were not identified in the Late Woodland assemblage.

Three species used here as seasonality indicators are present within the total Woodland faunal assemblage. Both the great blue heron and greater prairie chicken are associated with the Early Woodland assemblage, while the channel catfish is associated with the Middle Woodland. This offers a very limited perspective on the seasonality of site occupation for an adequate comparison of the three Woodland periods. However, it does illustrate that at minimum, the Early Woodland assemblage is represented by a possible March through November occupation by the presence of migratory avian taxa, while the Middle Woodland assemblage is represented by a possible May through July occupation based on the seasonal abundance of spawning channel catfish. These minimum season of occupation associations give some account as to the seasonally specific abundant prey species that were utilized at the Finch site.

NISP, Weight, and Taxonomic Comparisons

Comparisons of NISP and weight (grams) per taxon per Woodland period (see Table 5.12) identify several distinct differences in their distribution. These values

Table 5.12: NISP and weight comparisons of taxa per Woodland period including both unit and feature data.

	Early Woodland			
	NISP	%	Weight (g)	%
Mammal	347	83.62%	114.91	93.44%
Fish	36	8.67%	0.99	0.81%
Reptile	30	7.23%	3.19	2.59%
Bird	2	0.48%	3.89	3.16%
Total	415	100%	122.98	100%

	Middle Woodland			
	NISP	%	Weight (g)	%
Mammal	355	94.16%	207.89	99.08%
Fish	15	3.98%	0.44	0.21%
Reptile	6	1.59%	1.22	0.58%
Bird	1	0.27%	0.26	0.13%
Total	377	100%	209.81	100%

	Late Woodland			
	NISP	%	Weight (g)	%
Mammal	70	54.26%	212.43	97.27%
Fish	17	13.18%	0.25	0.11%
Reptile	40	31.01%	5.03	2.30%
Bird	2	1.55%	0.69	0.32%
Total	129	100%	218.4	100%

exclude undifferentiated vertebrate remains. When measured by weight, all three assemblages are dominated by mammal, not uncommon given the natural correlation between body size and bone weight. However, differences measured by NISP per taxon show several statistically significant trends and are visible in a bar graph, which also illustrates the variations in sample size. (see Figure 5.9). Early and Middle Woodland mammal NISP counts are very similar, while Late Woodland mammal counts remain relatively high but to a much lesser degree. An increase in reptile NISP is also identifiable in the Late Woodland period in comparison to the Early and Middle Woodland periods.

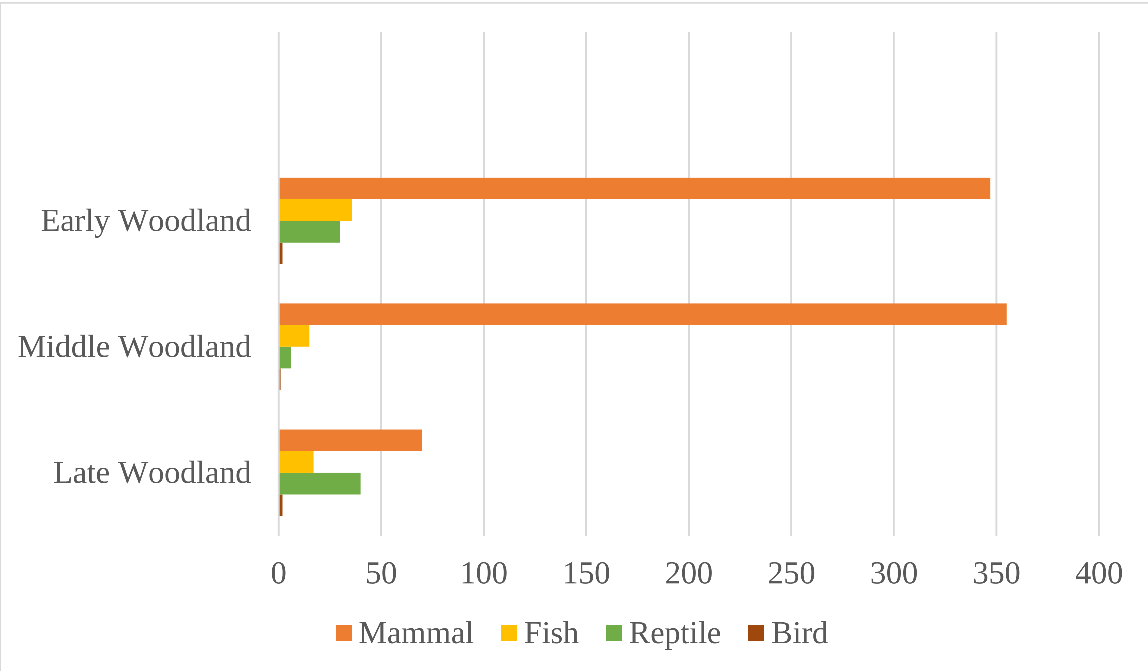


Figure 5.9: NISP comparison of unit and feature Woodland period assemblages.

Using the C statistical test for independence, Woodland period NISP counts of fauna recovered from only <u>unit</u> provenience were compared first (see Table 5.13). The overall C statistic for this comparison returned a p-value of 0.000, highly significant, meaning the assemblages are comparable and NISP can be predicted by period. The location statistical test returned a p-value of 0.000 and the dispersion statistical test returned a p-value of 1.74e -09, also both highly significant. The location statistical test looks to the mean distribution of taxa across the Woodland periods to test against the null hypothesis that the taxa have an ordered distribution. Therefore, a statistically significant change is identified by comparing the distributional order of Early, Middle, and Late Woodland taxa from most to least abundant. Early and Middle Woodland display

Table 5.13: NISP taxonomic class comparison of unit faunal assemblages.

	Early Woodland	Middle Woodland	Late Woodland
Mammal	152	46	16
Reptile	5	3	33
Bird	2	1	2
Fish	0	0	0

mammal to reptile to bird distribution, while Late Woodland taxa are distributed differently, from reptile to mammal to bird. The dispersion statistic is a test against the null hypothesis that the taxa in the three Woodland periods have an even dispersion of resource use. Therefore, a statistically significant change was identified by comparing the dispersion of taxa across the Woodland periods based on their faunal assemblage from unit provenience. The Late Woodland period represents a broadening of resource use compared with the Early and Middle Woodland's focus on mammal utilization.

The same C statistical test for independence was used to compare the distribution of faunal assemblages between Woodland period feature provenience. (see Table 5.14).

The overall C statistic for this comparison returned a p-value of 1.49e -14, highly significant, the assemblages are comparable and NISP can be predicted per period. The location statistical p-value of 0.1306 was not statistically significant, meaning that there was no evidence that the distribution between Woodland feature fauna taxa is different

Table 5.14: NISP taxonomic class comparison of feature faunal assemblages.

	Early Woodland		Middle Woodland		Late Woodland
Mammal	195		309		54
Fish	36		15		17
Reptile	25		3		7
Bird	0		0		0

between Early, Middle, and Late periods. The distribution of taxa proportions stays the same between the three periods, from most abundant to least abundant: mammal to fish to reptile. Comparing these feature results with those from the units, it is worth noting that the finer mesh recovery used with features may play a role. The dispersion statistical p-value of 1.11e -16, is highly significant, and signals a statistically significant change in the dispersion of taxa between the Woodland periods. The Middle Woodland displays evidence for a more focused utilization of mammal resources compared to the somewhat more evenly dispersed Early and Late Woodland periods dispersion between mammal, fish, and reptile.

The combined feature and unit assemblages were also analyzed using the same statistical tests (see Table 5.15). The overall C statistic for the combined comparison of

Woodland faunal assemblages returned a p-value of 0.000, highly significant, meaning once again that the assemblages are comparable and NISP can be predicted per period.

Table 5.15: NISP taxonomic class comparison of combined faunal assemblages.

	Early Woodland	Middle Woodland	Late Woodland
Mammal	347	355	70
Reptile	30	6	40
Fish	36	15	17
Bird	2	1	2

The location statistical p-value of 2.18e -13 is highly significant, meaning that there is evidence for a statistically significant difference in the distribution of taxa between the Woodland periods. Early and Middle Woodland have the same ordered distribution of taxa, from most abundant to least, as mammal to fish to reptile to bird. Late Woodland, however, has a different distribution of taxa abundance, from mammal to reptile to fish to bird. The dispersion statistical p-value of 0.000 is also highly significant, signaling a difference between the Woodland periods in the dispersion of utilized taxa. The Late Woodland period exhibits, in contrast to the Early and Middle Woodland period, a statistically broader use of taxa such as reptile and fish, while the earlier periods comparably focus on the utilization of mammals.

This relationship is effectively illustrated by the singly ordinal non-symmetric correspondence analysis biplot, which graphically displays the relationship dynamics between the taxa and Woodland periods (see Figure 5.10). The plot shows that Early and Middle Woodland period assemblages cluster closer to mammal taxa NISP counts than the Late Woodland period assemblage. The Early Woodland assemblage has a greater number of fish, reptile, and bird specimens which explains its distance from the Middle Woodland and its proximity to fish and bird. The Late Woodland assemblage has significantly fewer mammal, but also has the greatest number of reptile specimens, skewing its results away from mammal towards reptile.

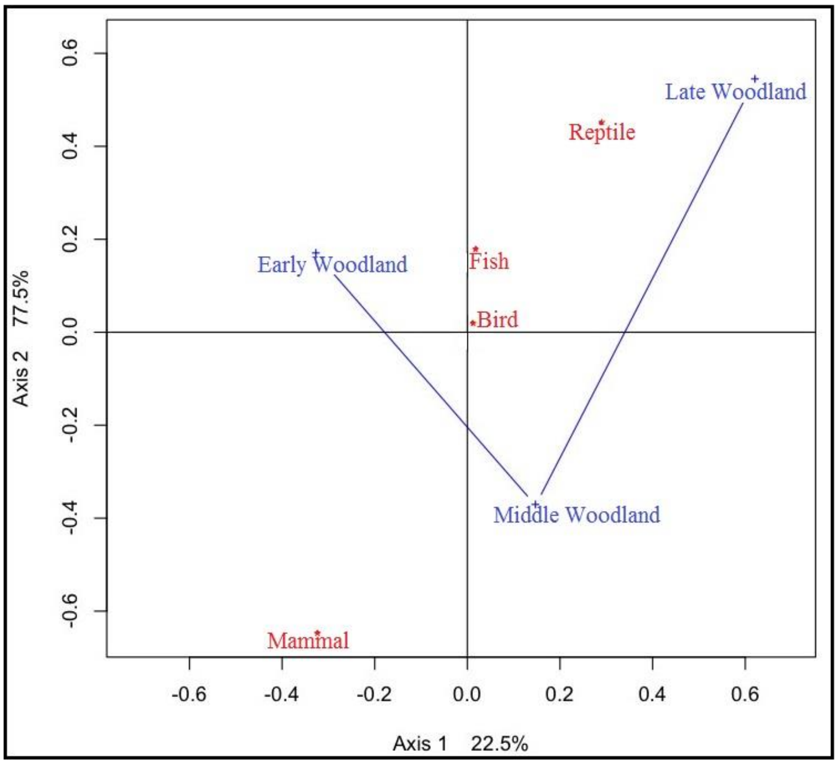


Figure 5.10: Singly ordinal non-symmetrical biplot comparing dispersion statistical distance, from Dr. Joseph P. Gray (personal communication 2015).

The spatial variation of identified vertebrate resources by taxonomic class also illustrates unique patterning across the site. The Early Woodland period fauna are grouped spatially in the southern saddle area of the site, just north of the southern knoll (see Figure 5.11). The density of mammal specimens is heavily concentrated in this area, with the majority of the 347 identified specimens grouped together in features 83 and 72.

Fish and reptile specimens are also clustered in the same area of the site. Bird remains are located in the same vicinity, and in an isolated location north of this area in the

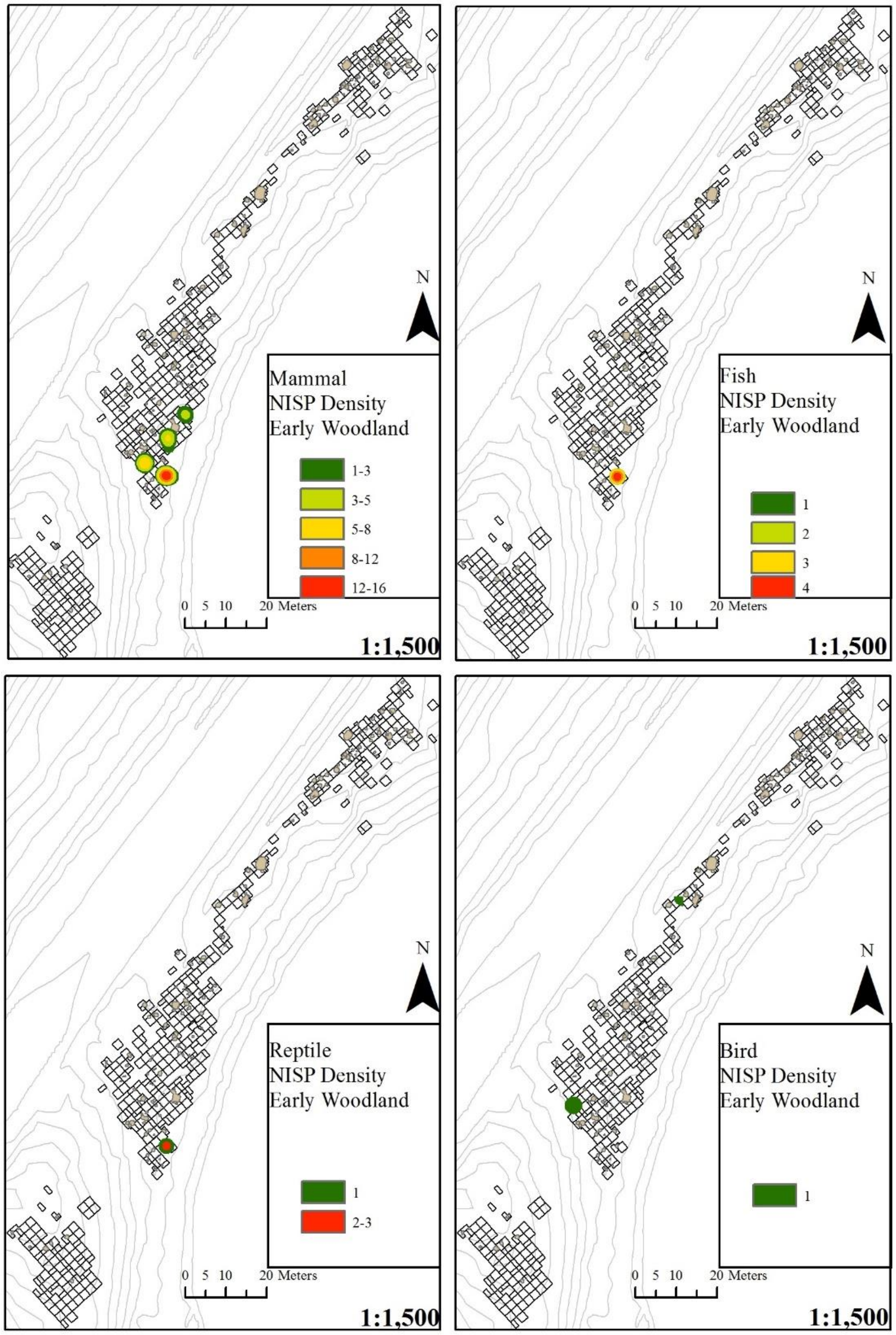


Figure 5.11: Kernel Density comparison of Early Woodland faunal distribution.

middle saddle area. Middle Woodland period fauna are also grouped in this same location just north of the southern knoll (see Figure 5.12). Mammal remains are

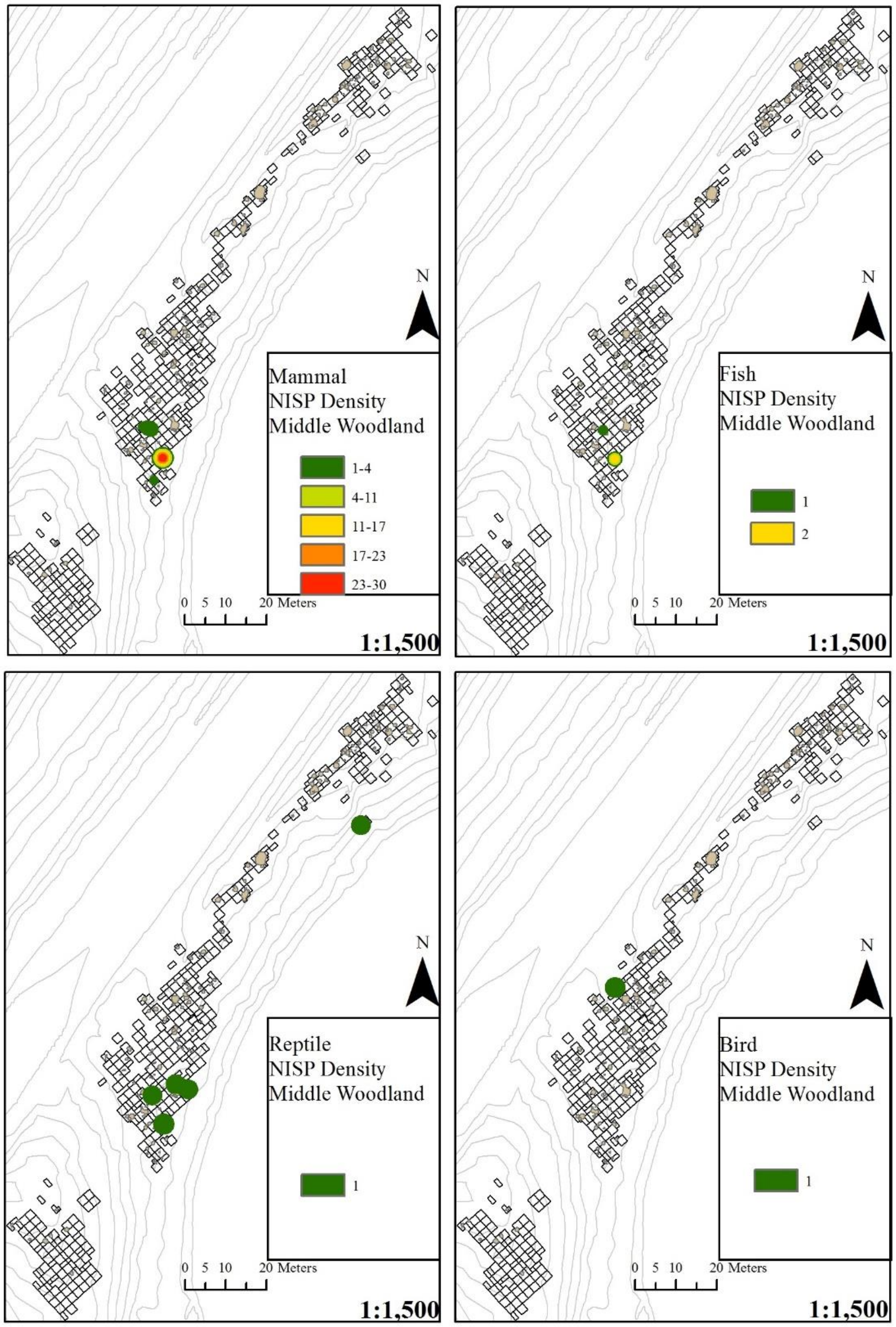


Figure 5.12: Kernel Density comparison of Middle Woodland faunal distribution.

concentrated in features 129 and 114 of the southern saddle area, while fish and reptile remains mirror mammal specimen distributions. A single isolated bird specimen is located to the north of the concentration. Late Woodland (see Figure 5.13) taxa are

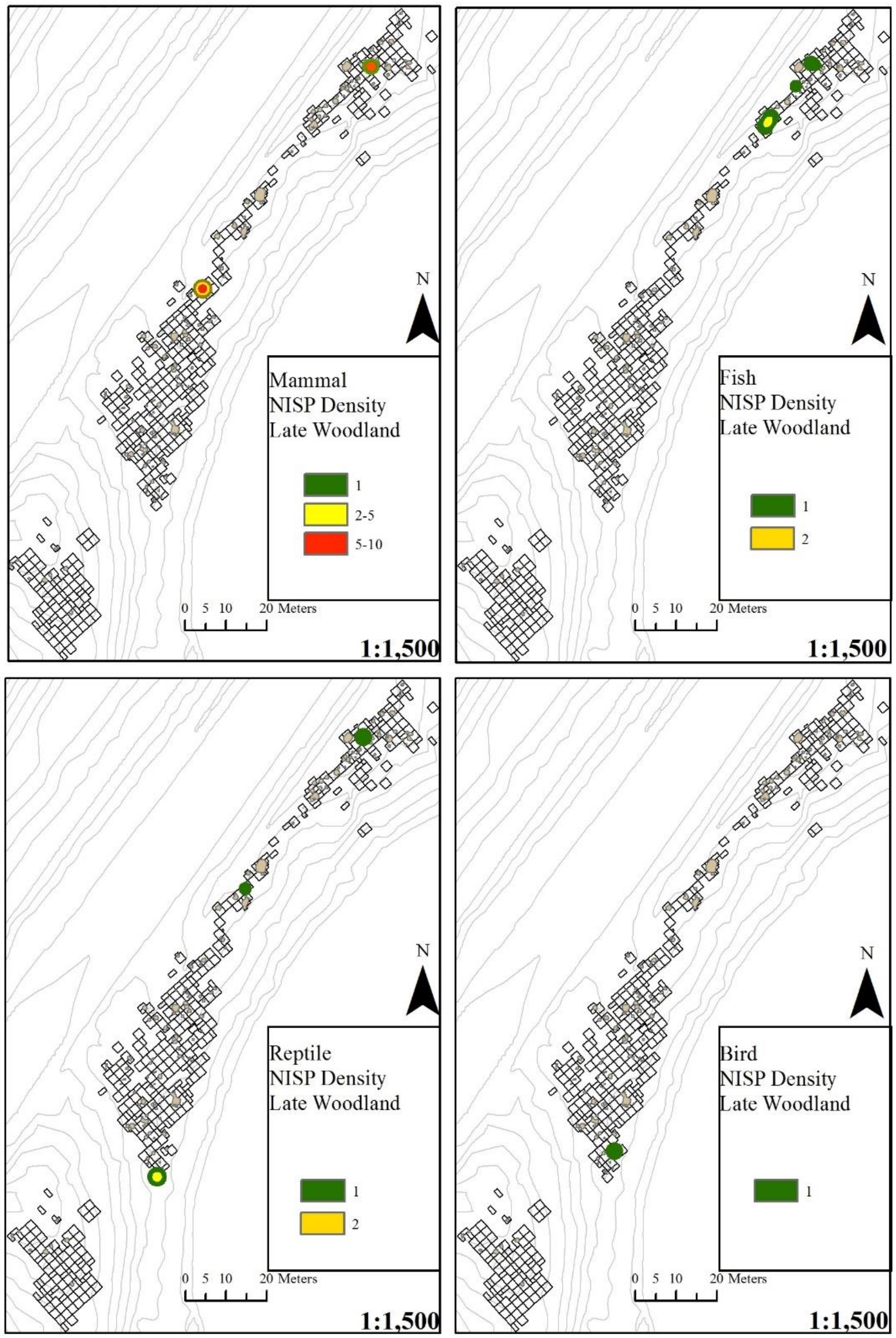


Figure 5.13: Kernel Density comparison of Late Woodland faunal distribution.

distributed across the site in multiple concentrated locations. A concentration of mammal and fish remains is present in the far northern section of the site away from the Early and Middle Woodland concentration. Reptile remains are concentrated in three locations, the largest of which mirrors the Early and Middle Woodland taxa concentrations, while the other locations are grouped with Late Woodland mammal and fish remains. Bird remains are spatially clustered north of the southern knoll with a portion of the reptile remains. The spatial density of identified fauna illustrates a continuation from Early to Middle Woodland in use of space. Late Woodland faunal distribution differs from Early and Middle spatial patterning, utilizing the northern extension of the site more intensely.

The variation in mammal resource utilization is further illustrated by comparing the amount of mammal specimens per size and Woodland period (see Table 5.16). Early and Middle Woodland period identified mammal specimens are dominated by the presence of large mammals, while the Late Woodland assemblage has a greater number

Table 5.16: Mammal size comparisons per Woodland period.

	Early Woodland		**Middle Woodland**		**Late Woodland**	
Mammal Size	NISP	%	NISP	%	NISP	%
Large	48	87.3	82	94.3	5	31.2
Medium	2	3.7	3	3.4	7	43.8
Small	5	9	2	2.3	4	2.5
Total	55	100%	87	100%	16	100%

of medium sized mammals than large. It is worth noting that all sample sizes are small and the Late Woodland sample is especially so.

Bone Modification

Of those bone modifications previously discussed in the results of the complete faunal assemblage, no specimens with gnaw marks are present in the Woodland period assemblages. The two pieces of worked bone previously discussed were also not a part of either of three Woodland period assemblages and instead were discovered in a mixed temporal provenience.

Cut Marked Bone

Of the 17 specimens discovered with cut marks three are associated to the Early Woodland, six are associated to the Middle Woodland, and one specimen is associated to a Late Woodland provenience (see Table 5.17). The location of specimens with evidence for cut marks was also mapped (see Figure 5.14).

Table 5.17: Cut marks by taxa and element per Woodland periods.

	Taxon	Size	Genus-Species	Common Name	Element	NISP	Weight (g)
Early Woodland	Mammal	M/L				**2**	1
	Mammal					**1**	0.25
Middle Woodland	Mammal	Large	O. virginianus	white-tailed deer	Calcaneus	**1**	12.92
	Mammal	Large			Long bone	**2**	2.05
	Mammal	Large				**3**	3.33
Late Woodland	Mammal	Large	C. canadensis	elk	Humerus	**1**	188.96

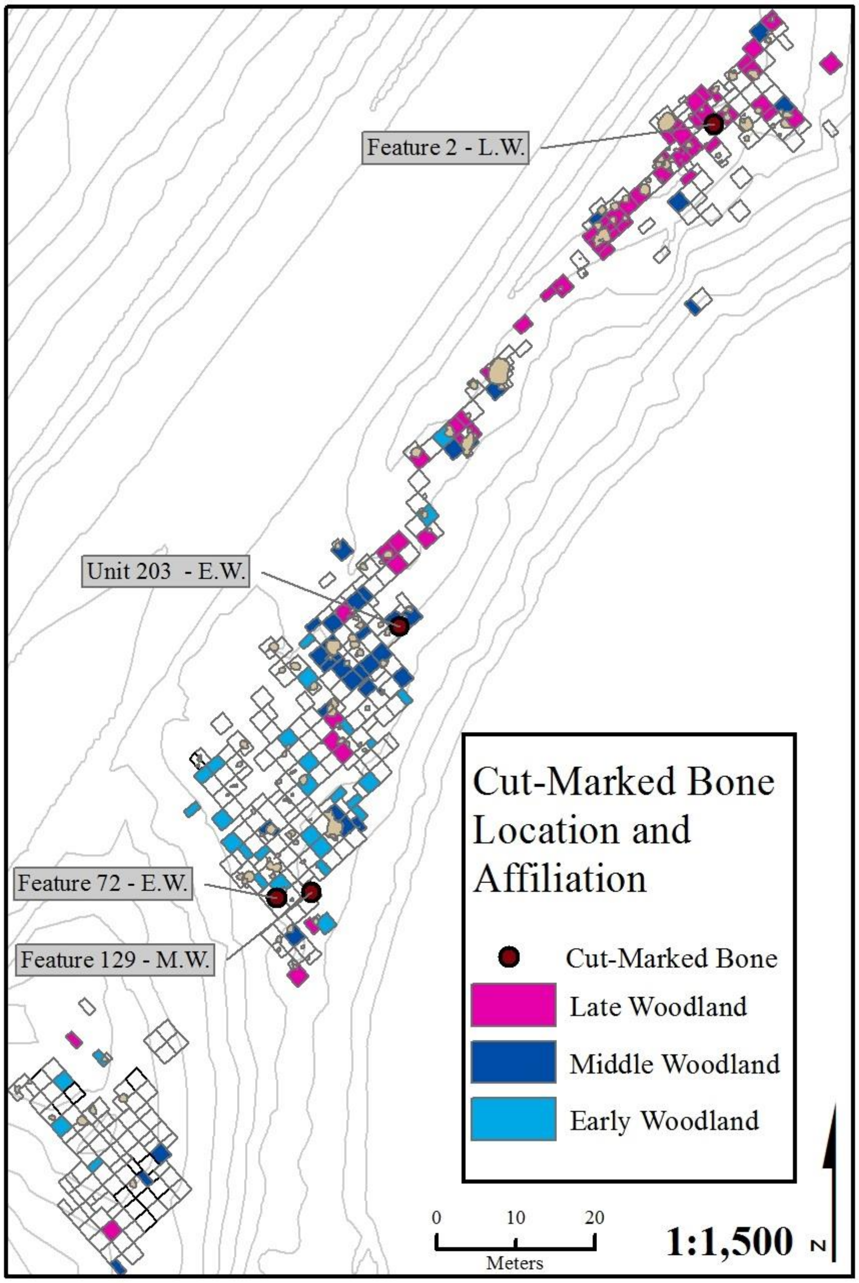


Figure 5.14: Distribution of cut marked bone and cultural associated provenience.

Bone Fragmentation

Bone fragmentation was calculated separately for unit and feature provenience using the site-wide (total) faunal assemblage. This was done to address the impacts of different recovery techniques. To compare bone fragmentation between the three

Woodland periods, a comparison of the dry-screen, water-screen, and flotation assemblages per each period was made (see Table 5.18). By looking at the fragmentation comparisons between temporal periods within each recovery technique, screen size bias is controlled. However, the presence of a single large specimen has the potential to completely change the results. For example, comparing only the dry-screen ¼" mesh recovery technique fragments from the Woodland periods it looks as if fragment size is increasing steadily through time. However, if the largest outlier is removed from each temporal period, the results change to a pattern of increase and then decrease (see Table 5.19). By removing a single elk humerus fragment weighing 188.96 grams from the Late

Table 5.18: Fragmentation comparing temporal periods and recovery technique.

	NISP	Weight	Fragmentation
	(#)	(grams)	(grams / #)
<u>Dry-Screen (1/4")</u>			
Early Woodland	576	140.54	0.244
Middle Woodland	406	202.46	0.499
Late Woodland	114	221.13	1.94
<u>Water-Screen (1/8")</u>			
Early Woodland	1243	58.4	0.047
Middle Woodland	124	8.34	0.067
Late Woodland	364	5.79	0.016
<u>Flotation (1/16")</u>			
Early Woodland	387	15.26	0.039
Middle Woodland	1325	38.95	0.029
Late Woodland	286	10.82	0.037

Woodland dry-screen assemblage, the entire fragmentation trend could be reinterpreted. This suggests that weight:NISP ratios should be reviewed for outliers when using this as a measure of fragmentation. When comparing dry-screen, water-screen, and flotation results, fragment size does not seem to follow any particular trend, making it difficult to draw any conclusions about changes in food processing intensity over time.

Table 5.19: Fragmentation comparing temporal periods of dry-screen ¼" mesh with largest outlier removed from each period.

	NISP	Weight	Fragmentation
	(#)	(grams)	(grams / #)
Dry-Screen (1/4")			
Early Woodland	575	137.43	0.239
Middle Woodland	405	189.54	0.468
Late Woodland	113	32.17	0.285

Burned Bone

Burned bone accounted for 51.37% of the total NISP and 27.92% of the total weight for the combined Early, Middle, and Late Woodland faunal assemblages with 2480 specimens weighing a total of 198.54 grams. Burned bone was present in all 32 faunal features and 39 units including 14 Early Woodland units, 15 Middle Woodland units, and 10 Late Woodland units (see Table 5.20). Burned bone was compared between the Woodland period assemblages using NISP and GIS Kernel density estimations to map out areas of density based on bone specimens that were burned to a single dominant color and to mixed colors to identify spatial differences in areas of the site where food processing activities such as marrow extraction, bone grease production, and roasting intensity was probably greater: food processing activities such as marrow and bone grease extraction being associated with single color bone fragments (Cain 2005: 881); roasting associated with multiple colored fragments (Asmussen 2009: 52) .

Table 5.20: Burned bone NISP totals by Woodland periods.

	Total Burned			Single Color Burned			Mixed Color Burned	
	NISP	Weight (g)		NISP	Weight (g)		NISP	Weight (g)
Early Woodland	990	109.51		454	49.61		317	62.44
Middle Woodland	838	58.73		536	22.3		227	49.37
Late Woodland	643	29.93		371	16.78		250	34.27

Total burned bone density for the Early Woodland period (see Figure 5.15) is focused north of the southern knoll, adjacent to the low-lying pond area of the site. A comparison between single color burned fragments and mixed color burned fragment reveals two separate concentrations of burned bone density (see Figure 5.16 and 5.17). The single color burned bone density is concentrated in feature 83, while the mixed color burned bone density is concentrated more heavily just north of feature 83, in excavation unit 49. These separate concentrations of burned bone NISP density, based on differential color rankings identify different possible locations of food processing activities.

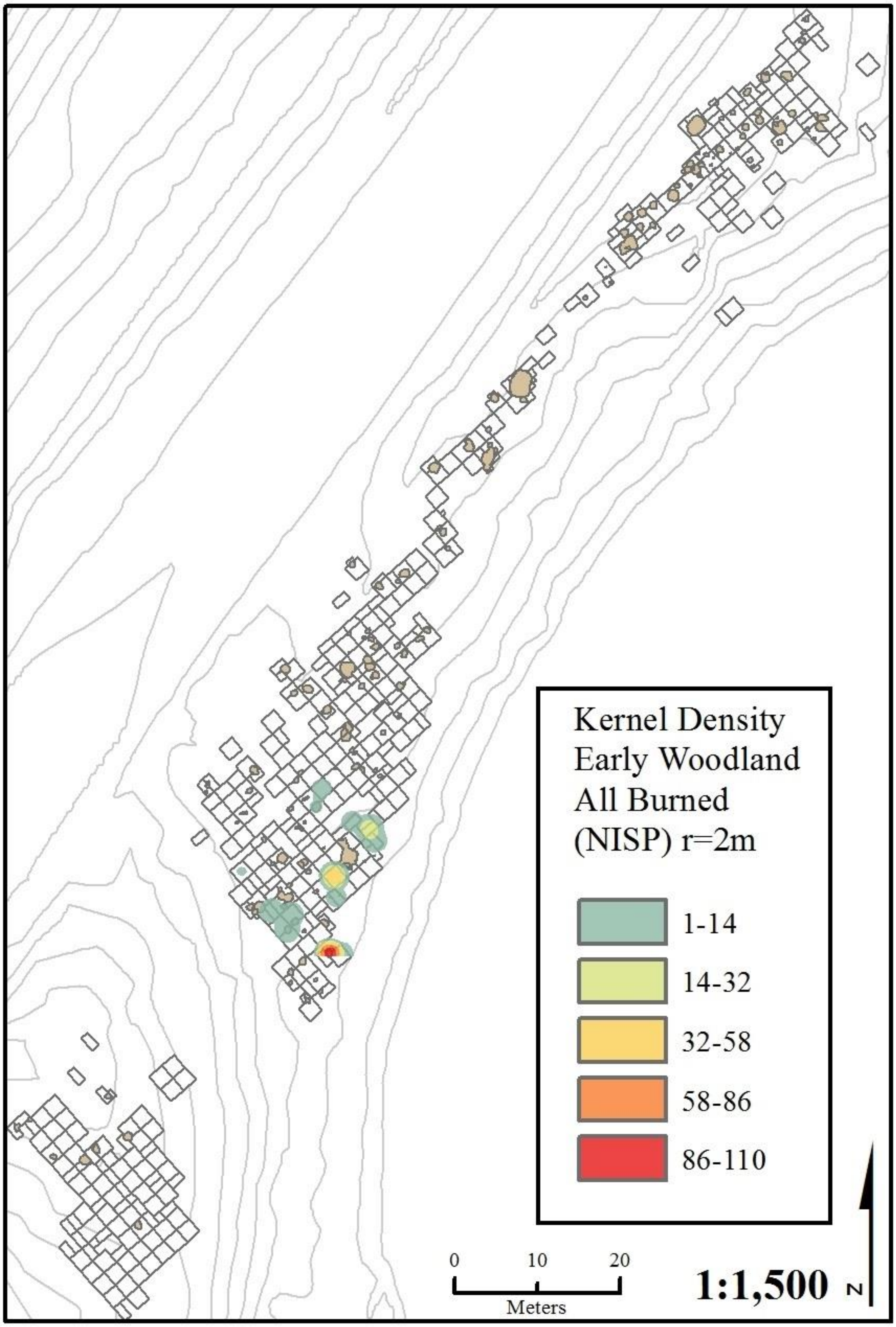


Figure 5.15: Early Woodland total burned bone Kernel Density.

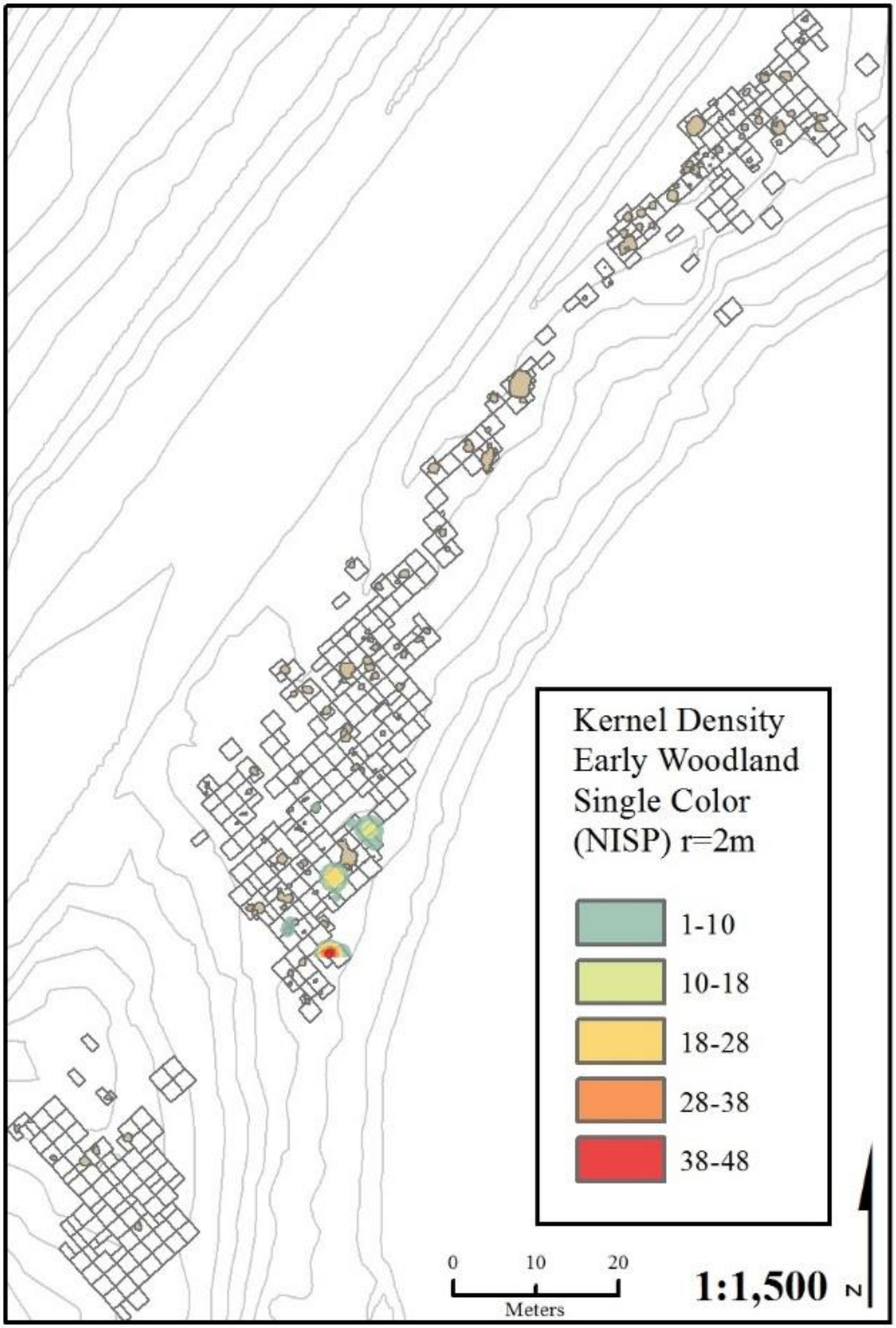


Figure 5.16: Early Woodland single color burned bone Kernel Density.

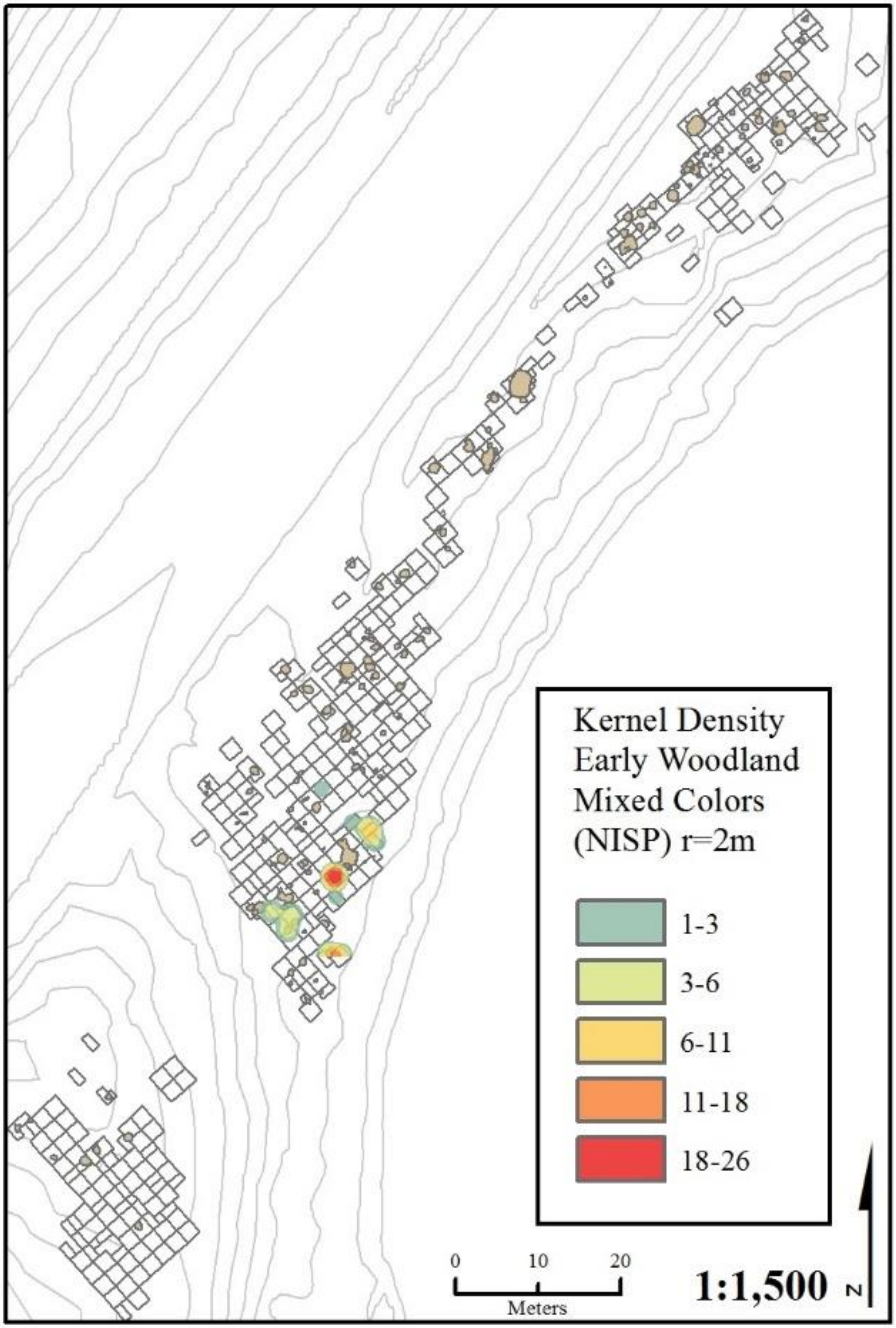


Figure 5.17: Early Woodland mixed color burned bone Kernel Density.

Middle Woodland burned bone densities are located northwest of Early Woodland burned bone densities, away from the pond shore, yet also at the northern base of the southern knoll. A few sections of burned bone density are also present in the central saddle area of the map, but they are not as densely concentrated as the area just north of the knoll (see Figure 5.18). Comparing the single color burned bone with the mixed color burned bone reveals a similar change in the concentrated spatial density (See Figure 5.19 and 5.20) The location of greatest density for single color burned bone NISP in the Middle Woodland is feature 114, located north of the southern knoll in the center of the excavation units. The location of greatest density for mixed color burned bone NISP is divided into two places: feature 114 again is a density hot-spot, and feature 29, to the southeast of feature 114 close to the shoreline of the pond. Burned bone concentrations for the Middle Woodland mirror the spatial distribution of Early Woodland concentrations in their proximity to the southern knoll and the pond shoreline. However, a few low density areas in the saddle area of the site stretching north also contained burned bone assigned to single and mixed color distinctions.

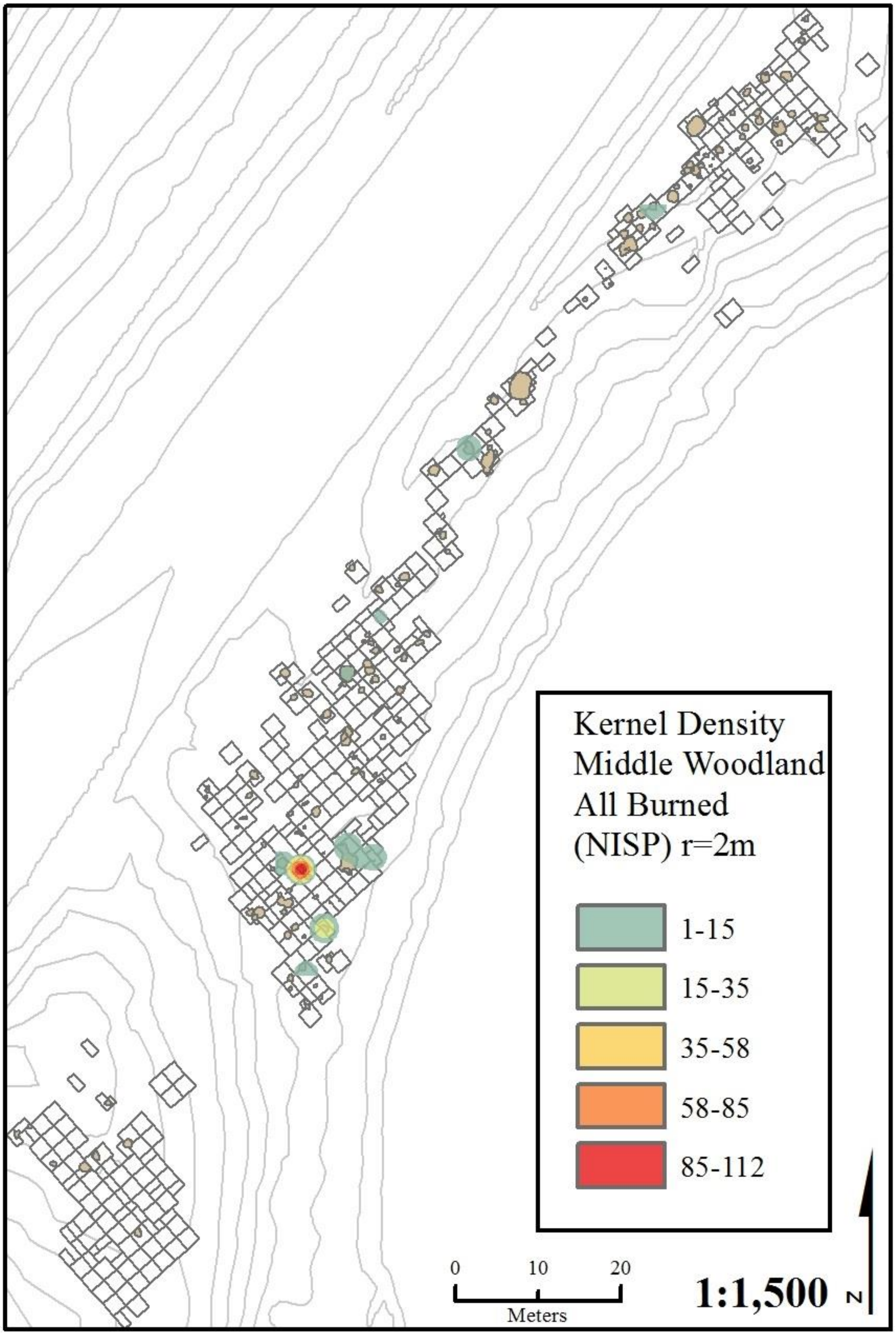


Figure 5.18: Middle Woodland total burned bone Kernel Density.

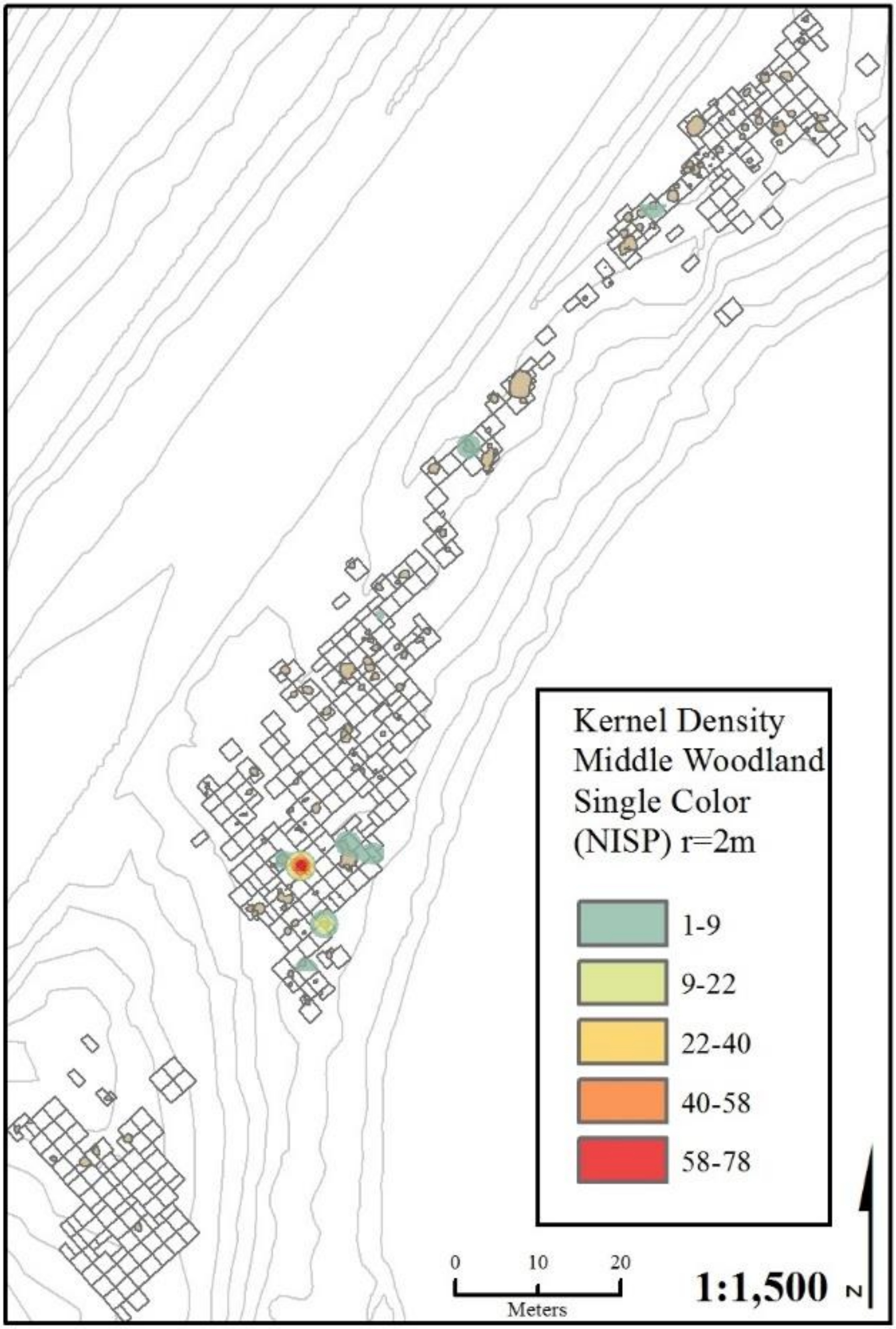


Figure 5.19: Middle Woodland single color burned bone Kernel Density.

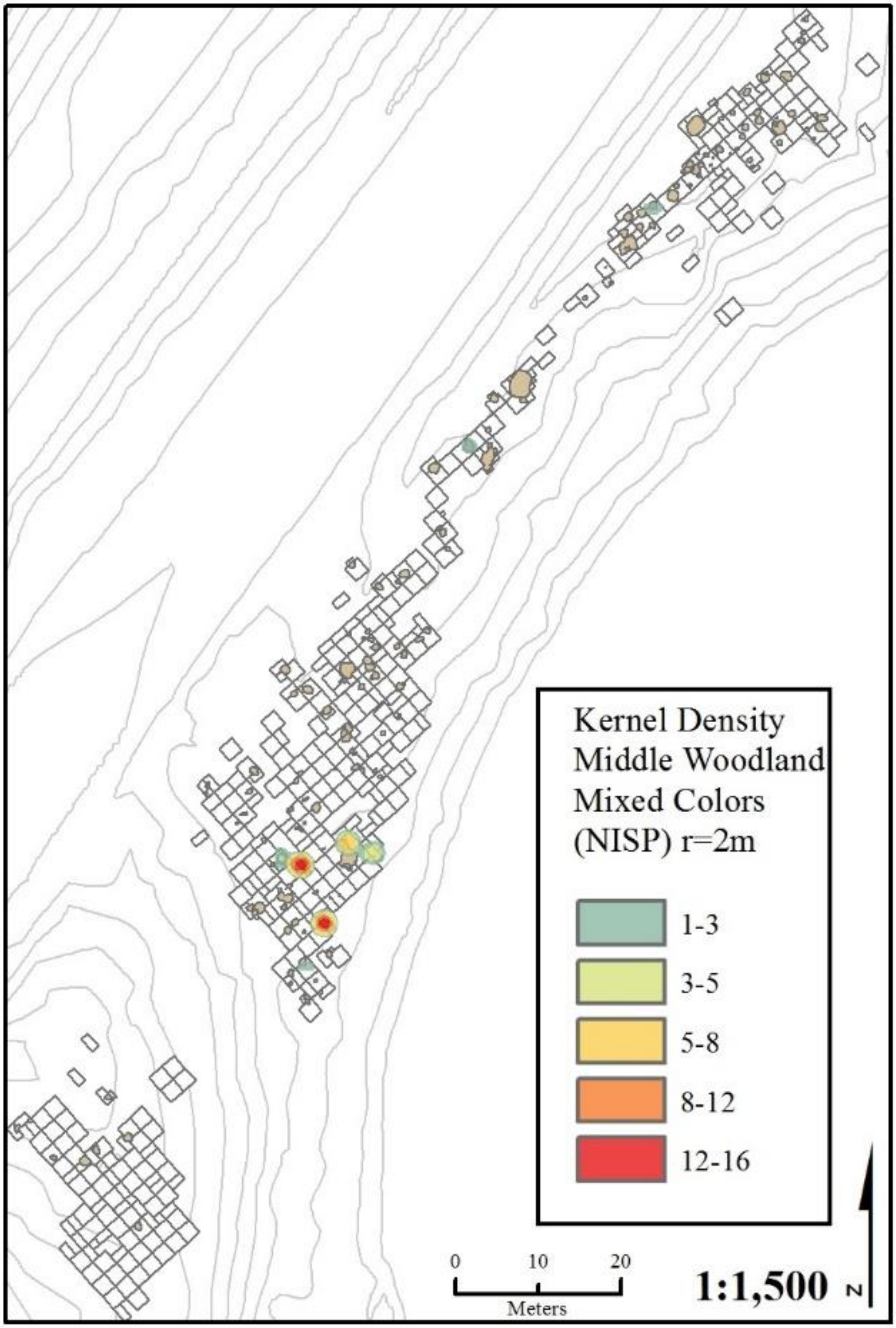


Figure 5.20: Middle Woodland mixed color burned bone Kernel Density.

Late Woodland burned bone concentrations are dramatically different from Early and Middle Woodland burned bone spatial densities (see Figure 5.21). Though there is a single concentration in the area just north of the knoll and near the pond's shoreline, the majority of burn bone concentrated density is stretched out in the saddle area and the far northern section of the site. Mixed color burned bone densities mirror the total burned bone densities for Late Woodland stretching along the saddle area of the site and concentrating most densely in the northern area of the site. The mixed color burned bone densities are less prominent and located in the same locations as the single color burned bone (see Figure 5.22 and Figure 5.23), with the exception of the single density concentration wedged between the knoll area and the pond shoreline in the far southern section of the middle saddle area.

The location of burned bone densities from Early, Middle, and Late Woodland illustrate spatial differences in the use of the topography at the Finch site. Early and Middle Woodland burned bone is heavily concentrated just north of the knoll and west of the pond shoreline in the southern section of the saddle area. Though there is a small concentration of burned bone from the Late Woodland in the same area, the largest concentration of burned bone associated to the Late Woodland stretches north away from the knoll along the saddle and into the northern section of the site, illustrating a clear distinction of site use from Early-Middle to Late Woodland periods.

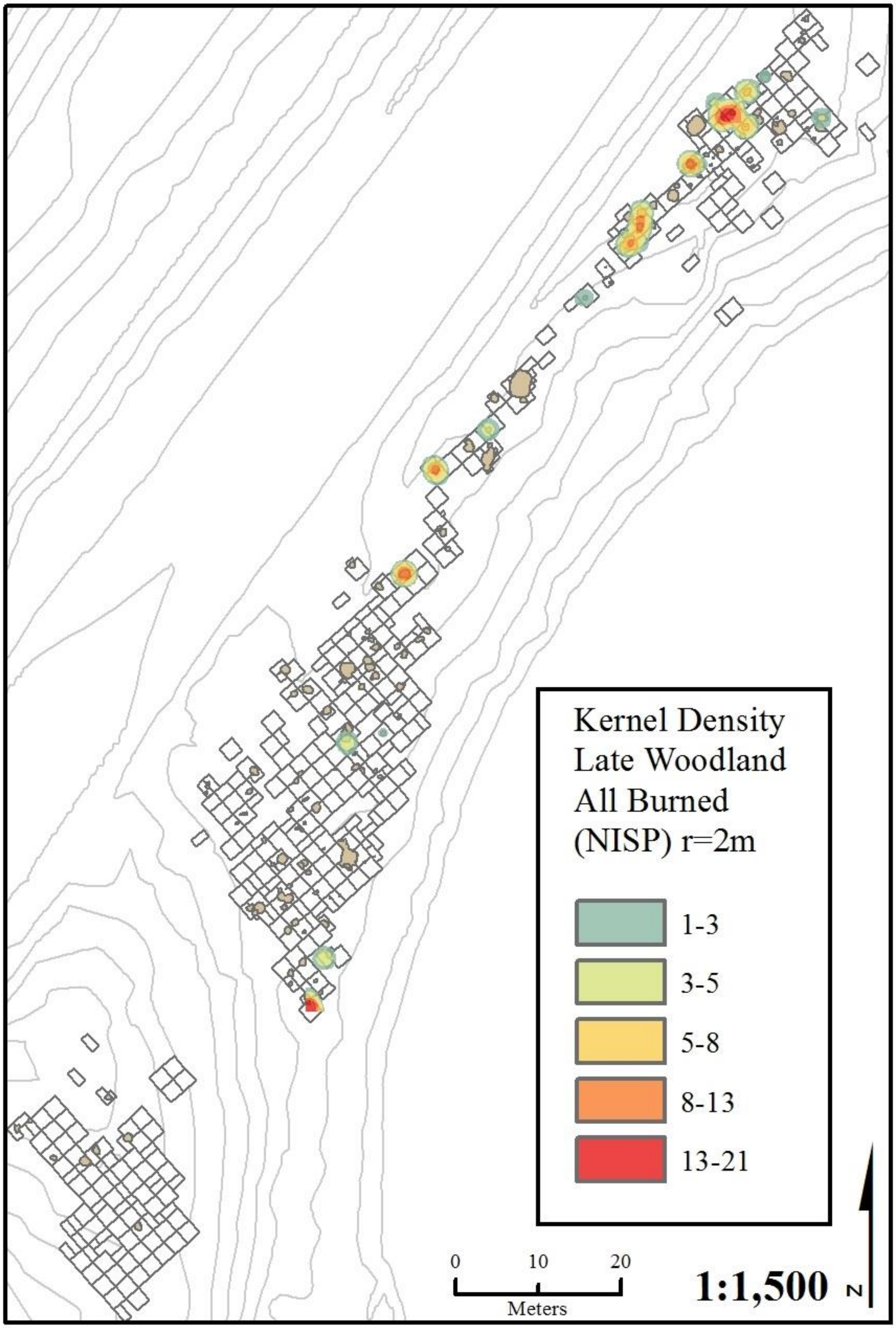


Figure 5.21: Late Woodland total burned bone Kernel Density.

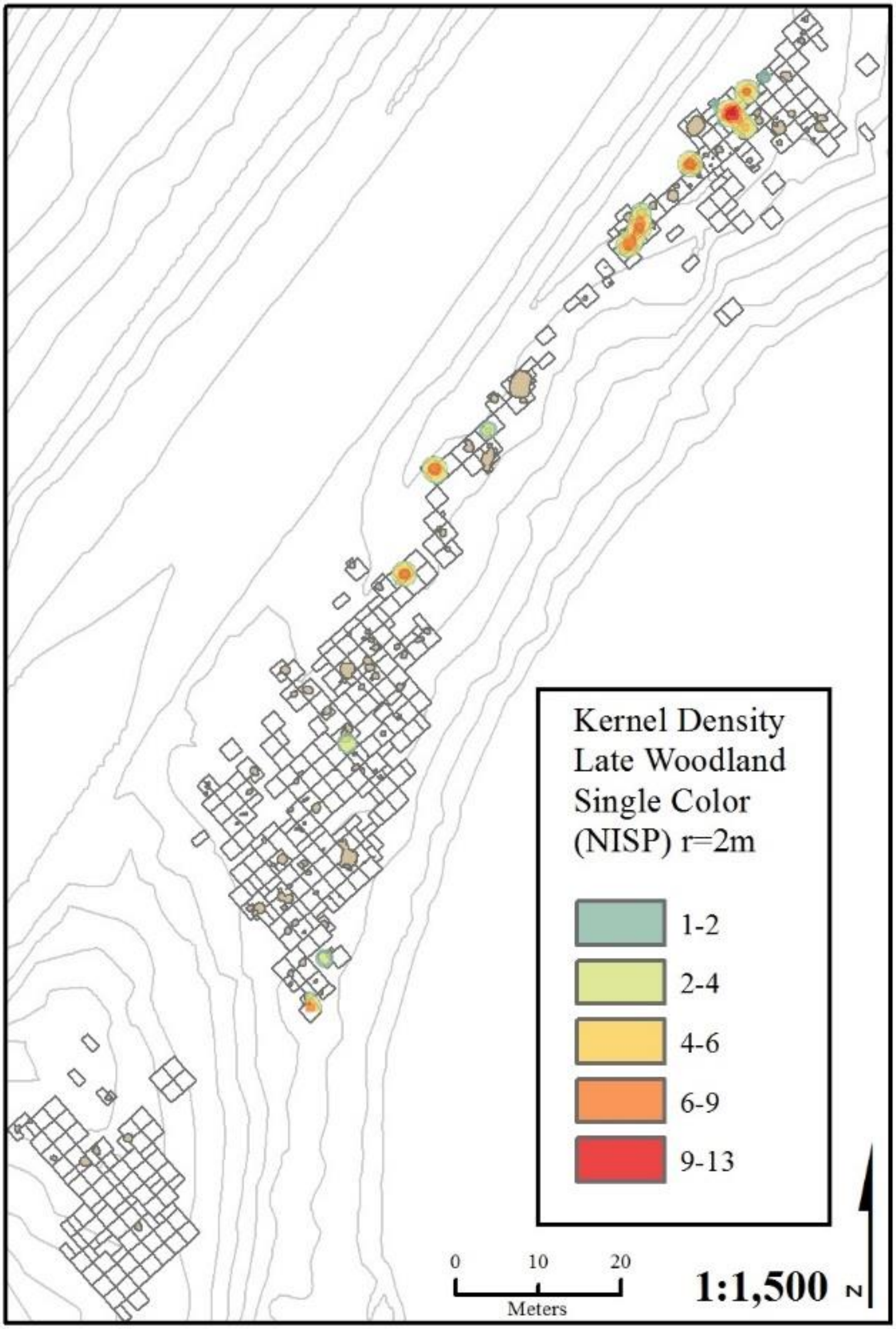


Figure 5.22: Late Woodland single color burned bone Kernel density.

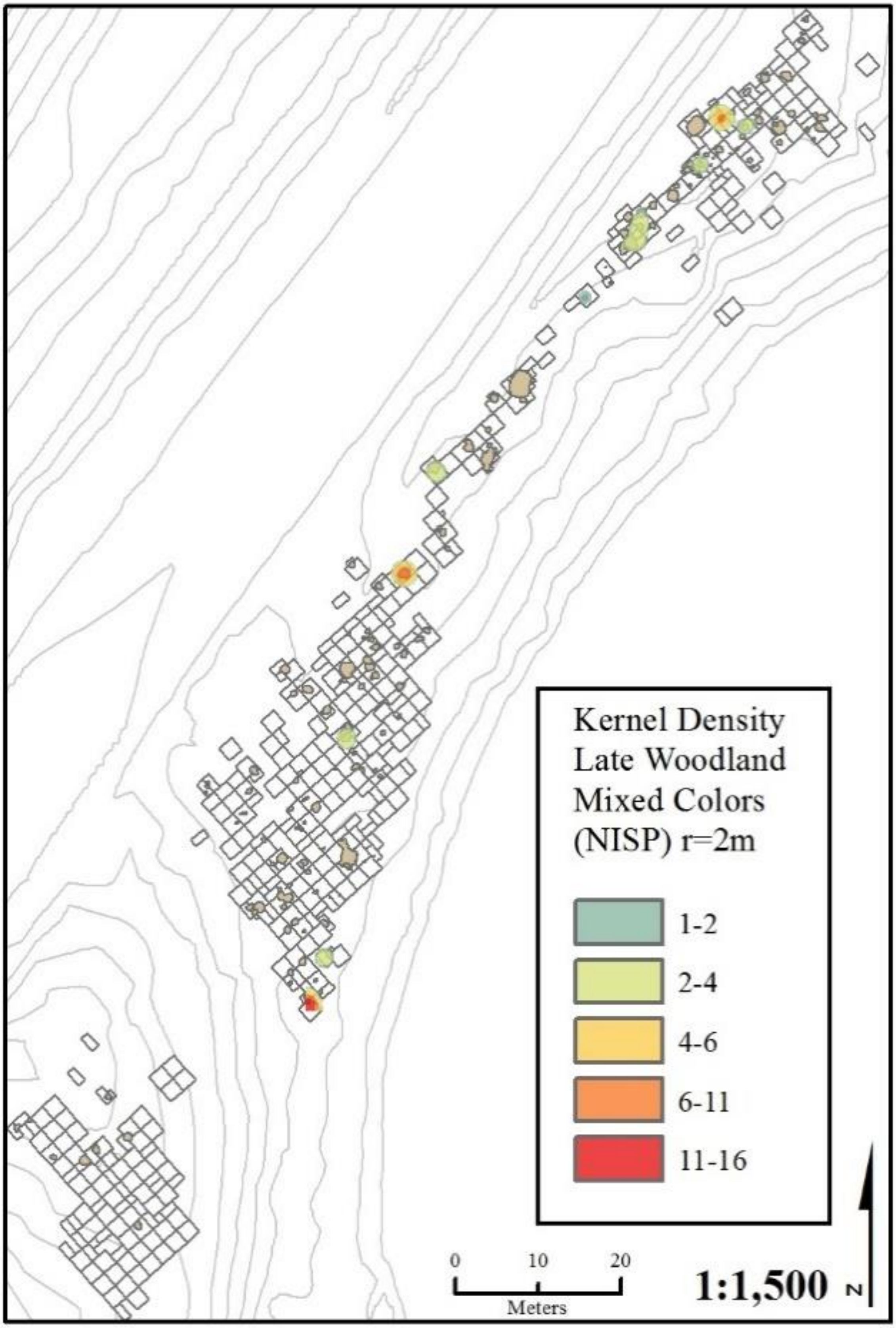


Figure 5.23: Late Woodland mixed color burned bone Kernel density.

Summary

In this chapter I have used the methodology set down in chapter 4 to detail the results of my site-wide analysis of the vertebrate faunal remains from the Finch site. Several questions were investigated using this assemblage. First, what vertebrate resources were utilized at the site and does the vertebrate resource use change through time? Second, what is the evidence for food processing at the site and does the intensity of food processing change through time? Lastly, where is vertebrate resource use identified spatially at the site and does this identification and concentration of resource use change at all through time? Within my results I have reported on the faunal assemblage in totem, and then subdivided the assemblage into cultural components to analyze chronological changes in the use of fauna and their spatial distribution associated with the identified cultural components represented at the site. Here I will summarize some of the key results.

At the site-wide level of analysis I examined the relative abundance of vertebrate taxa, bone modifications in the form of cut marked bone, worked bone, fragmentation, and burning, as well as evidence for season of occupation at the site. Mammal is the dominant taxonomic class by NISP and weight and white-tailed deer is the dominant identified species. Fish are the next dominant class by NISP, followed by reptiles, and more specifically turtles. Fish were identified predominantly in feature contexts. Birds are present in both unit and feature context but are not represented extensively in the assemblage. A single amphibian specimen was identified. Large mammals represent approximately 73% of the identified mammal NISP, while medium and small mammals represent roughly 16% and 11%.

Modified bone was represented by cut marks, worked bone, fragmentation, and burned bone. A total of 16 cut marked elements are present in the prehistoric assemblage, all identified as mammal, with 9/16 identified as large mammals including elk and white-tailed deer elements. Two pieces of worked bone were identified: a probable antler tine awl, and a probable raccoon canine pendant/ornament. Bone fragmentation was dependent upon recovery technique screen size. Larger fragments were recorded in unit provenience from 1/8” water-screen and 1/16” flotation mesh. Larger fragments were recovered from feature ¼” dry screen. Burned bone accounted for 62% of the total NISP and 47% of the total weight. Burned bone was distributed across the site, however, it was densely clustered in the southern section of the site directly north of the southern knoll along the pond shoreline. Density maps illustrated a different location for the concentration of single-colored burned bone and mixed-color burned bone, identifying different possible activity areas of food processing.

The season of occupation at the site was represented by a small assemblage of species identified for their recorded seasonal abundance. The site appears to have been inhabited between early spring and late fall, with no evidence for a winter occupation, though few seasonally-specific species are present in the assemblage.

To analyze chronological, variation I was able to sort the assemblage into several temporal components. Faunal evidence from the Late Paleoindian, Middle, and Late Archaic periods was identified, however their assemblages were too small to compare. The Early, Middle, and Late Woodland component assemblages were sizeable for comparison. Mammal is the dominant taxonomic class by NISP and weight for each component assemblage, though greatly diminished in the Late Woodland period. Fish is next abundant followed by reptile for the Early and Middle Woodland periods, which is not the case for the Late Woodland period. Differences in taxonomic abundance between the Early, Middle, and Late Woodland periods were demonstrated to be statistically significant in this chapter, and will be discussed more thoroughly in chapter 6.

Modified bone was represented by cut marks, fragmentation, and burned bone. Cut marked elements are present in all the Early, Middle, and Late Woodland assemblages on large mammal elements. Bone fragmentation did not show evidence for food processing intensity change. Fragments collected from ¼" dry-screen were smallest in the Early Woodland assemblage. Fragments collected from 1/8" water-screen were smallest in the Late Woodland assemblage. Finally, fragments collected from 1/16" flotation were smallest in the Middle Woodland assemblage. No clear trend was detected. Burned bone was identified in all three Woodland assemblages. Density mapping identified changes in the spatial utilization of the site based on the location of single-color and mixed-color burned bone fragments. Early and Middle Woodland periods mirror their locations of probable food processing activities, while the Late Woodland burned bone densities are located to the far north of the site.

The analysis of the site-wide faunal assemblage, and its use in investigating chronological change through time at the Finch site, has identified some key results to formulate conclusions about diet and food processing. The use of GIS Kernel Density mapping, combined with a statistical analysis of vertebrate taxa abundance, was used to both visualize and quantify vertebrate resource use change through time at the Finch site. The next chapter will use these results to discuss possible explanations for the identified changes in vertebrate use and spatial distribution at the Finch site.

Chapter 6: Discussion and Conclusions

The goal of this thesis was to analyze and interpret the vertebrate faunal assemblage from the Finch site (47 JE-0902). The artifact assemblage allows for the investigation of human occupation and re-occupation at a single locale in southeastern Wisconsin, from the Paleoindian period through the Late Woodland period of prehistory. Several questions were investigated: 1) diet and vertebrate resource use at the site and its variation through time; 2) evidence for food processing and variation in its intensity through space and time; 3) chronological changes in how the site was used spatially and seasonally. The results of this study are then used to discuss vertebrate resource utilization in comparison with other sites in the region.

Paleoindian and Archaic Assemblages

The Finch site was utilized from Early Paleoindian through Late Archaic, based on the presence of temporally diagnostic artifacts. However, the associated faunal evidence from these components is minimal both quantitatively and with regard to identified taxa. A single unidentified bone specimen was recovered from the Late Paleoindian component. Only 11 unidentified bone specimens were recovered from Middle and Late Archaic components, two of which are burned. Thus, these earliest of cultural components cannot be incorporated into further discussions about changes in subsistence and resource use through time at the Finch site. The use of diagnostic artifacts to differentiate the faunal assemblage into associated cultural components was a conservative exercise that omitted faunal material from mixed contexts. If future chronological analysis expands the faunal assemblage that can be dated, then a second look at these earlier time periods might be warranted.

There are several possible explanations for the limited faunal material associated with the Paleoindian and Archaic components at the site. Deterioration by both biotic and abiotic processes was likely a major contributing factor to the limited faunal remains recovered (Reitz and Wing 2008: 134). The role in which the site functioned in early prehistory also likely played a role in the limiting of faunal evidence. Evidence from Paleoindian and Archaic components at the site are clustered on the southern knoll and near the adjacent pond. The knoll likely served as a short-term camp or viewpoint to stage hunting activities (Binford 1980: 12) or to monitor the surrounding area for competitors. The spring and surrounding wetlands would also have offered a ready supply of fresh water. Further investigations as to the reasons why the knoll served as a location for Paleoindian and Archaic occupation could include a more thorough review of the surrounding elevation and topography. Is the Finch site knoll the highest elevation in the area? How far of a view does the knoll allow for? What other high-ground locations are within the immediate vicinity? Using GIS and ESRI's ArcScene software (ESRI 2012) a three dimensional elevation model could be produced to examine these question to add to future discussions about Paleoindian and Archaic subsistence strategy in southeastern Wisconsin.

Woodland Assemblages

In contrast to earlier time periods, the Woodland periods are well-represented by identifiable vertebrate remains. The combined Woodland assemblage has a total NISP of 4828 specimens weighing a total of 665.13 grams. A total of 921 specimens weighing a total of 551.19 grams were identified to taxonomic class. Only five bird specimens were associated with Woodland component assemblages, making bird resource utilization at the site difficult to interpret. A total of 2471 specimens, roughly 52% of the combined Woodland assemblage, have evidence for burning weighing a total of 198.17 grams.

Evidence for seasonality in the Woodland assemblage is small. Only two species were identified in the Early Woodland period, the greater prairie chicken and the great blue heron, and both are seasonally abundant in spring and fall months (Temple and Cary 1987: 37, 88). A single species was identified in the Middle Woodland, the channel catfish, which is seasonally abundant in the late spring to early summer months (Becker 1987: 713). No seasonally specific species were identified from the Late Woodland period. Thus a discussion about changes in the season of occupation through time at the Finch site is not adequately supported by the data. A future endeavor might include an analysis of the fish scales present in the assemblage in order to discern more evidence for season of occupation (Yerkes 1980; Yerkes 1981).

The following sections discuss the separate results from the individual Woodland period assemblages in order to answer several questions: 1) what vertebrate resources were utilized? 2) What evidence is there for food processing? 3) Where is vertebrate resource use identified spatially? Once this is completed, I will compare and discuss the identified differences between the Woodland assemblages to answer questions concerning change through time: 1) Does vertebrate resource use change? 2) Does food processing intensity change? 3) Does vertebrate use change spatially?

Early Woodland Period Assemblage

The Early Woodland period faunal assemblage is represented by a total NISP of 2207 pieces of bone with 415 specimens identified to taxonomic class. Six species were identified including elk, white-tailed deer, groundhog, great blue heron, and greater prairie chicken. Turtle plastron fragments were also identified. Mammal accounts for roughly 84% of the taxonomic class NISP and 93% of the weight. This reflects a subsistence strategy focused on the acquisition of mammals, with a subsidiary inclusion of fish and reptiles. The investigation of mammal-size demonstrates that large mammals represent the greatest contribution, roughly 87%. This evidence suggests also that Early Woodland occupants of the Finch site were practicing a more specialist subsistence strategy focused on the acquisition of large mammals such as elk and white-tailed deer.

The spatial analysis of taxa distribution identified a concentration of resource use in the southern saddle area of the site, adjacent to the pond just north of the knoll. Mammal, fish, and reptile specimens overlap spatially illustrating that mammal, fish, and reptile resources were all utilized in the same location. The spatial association of these taxa highlight the likely areas of vertebrate resource use and discard.

Food processing evidence is present in the form of cut marks, fragmented bone, and burned bone. Three cut marked specimens were recovered from this component. One specimen is located in the area of taxa concentration, the other two specimens are located further north. Cut marks identify butchery activity, however the sample size is far too small to make any definitive conclusions about the spatial identification of a butchery area. Only a single complete skeletal element is present in the assemblage, a groundhog humerus, the remaining specimens are all fragmented. All burned bone is fragmented. The spatial analysis of burned bone also correlates to the spatial concentration of identified taxa in the southern saddle area of the site, near the pond. Single color burned bone and mixed color burned bone cluster separately (see Figure 6.1). The single color burned bone area identifies a possible food processing activity area

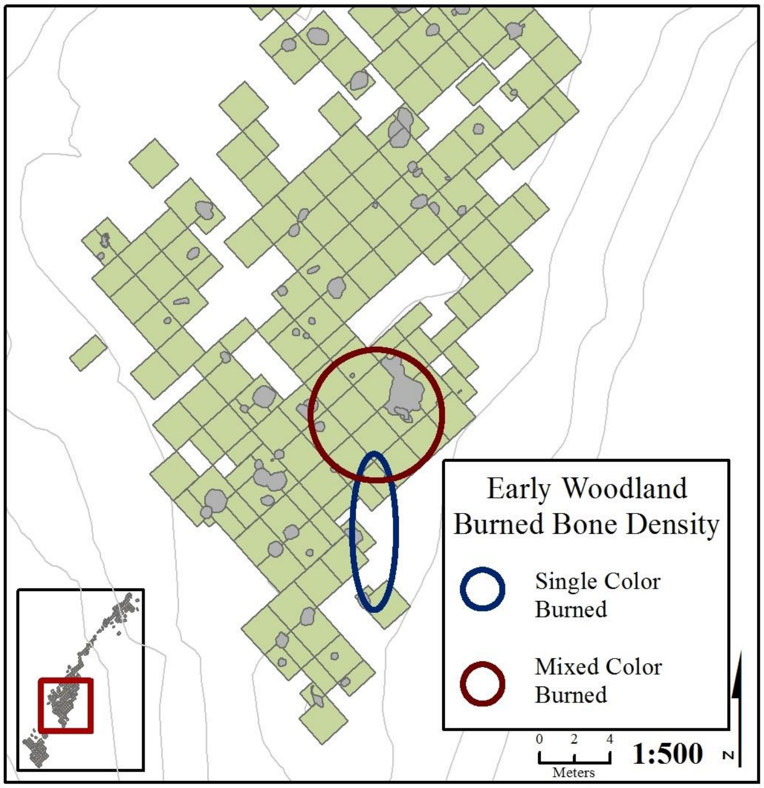


Figure 6.1: Early Woodland single color and mixed color burned bone density clusters.

where bone fragments were burned after processing, eating, and/or cooking. Thus the spatial correlation of burned bone fragments and identified taxa locate a concentration of Early Woodland bone-producing and discard activities adjacent to the pond in the southern saddle, north of the knoll.

Middle Woodland Period Assemblage

The Middle Woodland period faunal assemblage is represented by a total NISP of 1856 pieces of bone with 377 specimens identified to taxonomic class. Four species were identified including white-tailed deer, raccoon, and channel catfish. Turtle plastron and carapace fragments were also identified. Mammal accounts for 94% of the taxonomic class NISP and 99% of the weight. The Middle Woodland assemblage, like the Early Woodland assemblage, reflects a subsistence strategy focused on the acquisition of mammals, with a minimal representation of fish, reptiles, and birds. The investigation of mammal-size demonstrates that large mammals represent the greatest contribution, roughly 94%. This suggests that Middle Woodland occupants at the Finch site also practiced a specialist subsistence strategy focusing on the acquisition of large mammals, notably white-tailed deer.

The spatial distribution of identified taxa located a tightly compacted density of mammal specimens, overlapped by fish remains, in the southern saddle area of the site, adjacent to the pond and north of the knoll. Reptile remains overlap mammal and fish also, though reptiles are located in other areas as well. Mammal and fish specimen spatial densities identify a specific area of the site that likely represents a vertebrate resource use activity area for the Middle Woodland component.

Middle Woodland food processing evidence is present in the form of cut marks, fragmented bone, and burned bone. Six cut marked specimens were recovered from this component. All six cut marked specimens were recovered from the same feature, spatially overlapping the density concentration of mammal and fish remains. A single complete skeletal element is present in the assemblage, a white-tailed deer astragalus, the remaining 1855 specimens are fragmented. All burned bone specimens are fragmented. The spatial analysis of burned bone fragments identified two concentrations of burned bone density, both located in the southern saddle area see Figure 6.2). One concentration overlapped the mammal and fish concentration adjacent to the pond. The other area of burned bone density was roughly 10 meters north. This separate burned bone density location represents the concentration of single color burned bone, identifying a potential food processing activity area where bone was fragmented before being burned. The

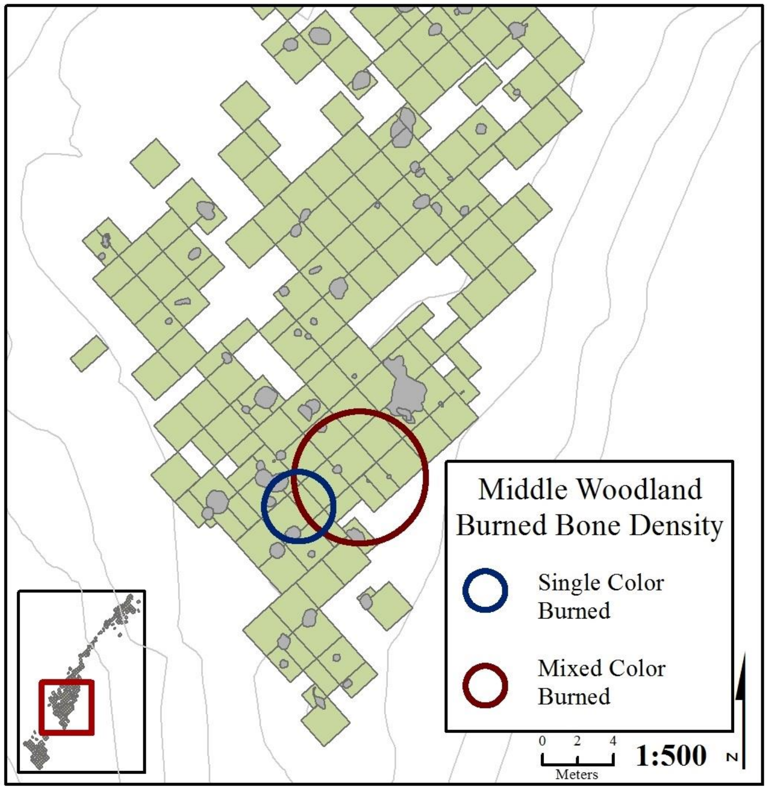


Figure 6.2: Middle Woodland single color and mixed color burned bone density clusters.

spatial correlation of burned bone fragments and identified taxa identifies a concentrated area of the site where Middle Woodland occupants utilized vertebrate resources and likely processed bone for marrow and/or bone grease or cooked meat on the bone.

Late Woodland Period Assemblage

The Late Woodland period faunal assemblage is represented by a total NISP of 765 pieces of bone with 129 specimens identified to taxonomic class. Three species were identified including bobcat, raccoon, and deer mouse. Artiodactyl remains were identified and likely represent white-tailed deer. Turtle carapace and plastron were also identified. Mammal accounts for roughly 54% of the taxonomic class NISP, reptiles represent the second most abundant taxa, accounting for 31% of the NISP, and fish represent 13% of the NISP. The Late Woodland assemblage thus reflects a different subsistence strategy from Early and Middle assemblages. Mammals represent the majority of the NISP and weight, however, reptile and fish specimens each have an abundant NISP. Though the Late Woodland identified taxa assemblage NISP low in comparison to Early and Middle periods, the abundance of fish and reptiles in comparison to mammals potentially illustrate a more generalized subsistence strategy.

The spatial analysis of taxa density concentration identifies several areas of vertebrate resource utilization across the site. Mammal is concentrated in the far northern area of the site and in the central saddle area. Fish is concentrated solely in the northern area of the site. Reptile is concentrated in two places: the northern section and the southern saddle area adjacent to the pond. Mammal, fish, and reptile specimens all overlap spatially in the northern section of the site. A separate mammal concentration is located in an area of the central saddle. A separate reptile concentration is located in the southern saddle. Thus, the Late Woodland period use of the site appears more dispersed across the site and shows more use of the northern area.

Food processing evidence is present in the form of cut marks, fragmented bone, and burned bone. One cut marked specimen, an elk humerus, is present in the Late Woodland assemblage. The specimen was located in the northern section of the site in an area of concentrated mammal remains. Only a single complete skeletal element is present in the assemblage, a fish vertebra. The remaining 764 specimens were fragmented. All burned bone was fragmented, with the exception of the complete fish vertebra. The spatial analysis of burned bone fragments identified several concentration areas. The strongest density of burned bone is located in the northern section of the site, overlapping the location of mammal and fish taxa densities. Several clusters of burned bone are located in the middle saddle area, as well as in the far south of the saddle (see Figure 6.3). Each burned bone concentration likely represents an area of food processing

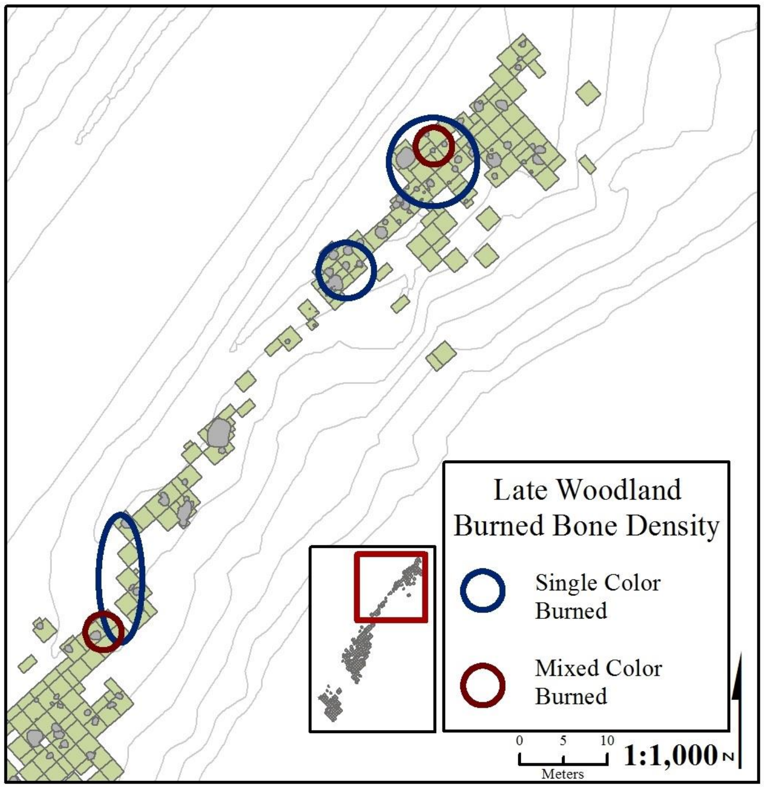


Figure 6.3: Late Woodland single color and mixed color burned bone density clusters.

and/or cooking or waste discard activity areas. The identification of several locations of identified burned bone could be interpreted as a reflection of the type of site use. One possibility is a re-visiting of the site by multiple Late Woodland groups for single use functions, such as an overnight camp, or a single cooked meal location, or both. It could also be interpreted as multiple households of the same group occupying the site at the same time with spatially separate cooking areas. This spatial patterning illustrates a possible difference in site function compared to the Early and Middle Woodland periods.

The next section of this discussion will address the changes identified between the Early, Middle, and Late Woodland assemblages.

Woodland Assemblage Comparisons

Early and Middle Woodland assemblages are very similar in their distribution of identified taxa NISP and weight, their abundance of large mammal specimens, and their identified spatial distributions of taxa and resource utilization. Each assemblage also overlaps the other in burned bone density and distribution across the site. Both components spatially utilize the southern saddle section of the site, abutting the pond and the southern knoll. By contrast the Late Woodland assemblage, though smaller in overall NISP size, is represent by a different distribution of identified taxa, a different distribution of mammal-size grouped specimens, and a different spatial distribution of taxa, resource utilization, and burned bone compared to Early and Middle Woodland assemblages.

<u>Taxonomic Abundance</u>

The statistical analysis of the Woodland faunal assemblages identified a change in both the distribution and dispersion of specimens identified to taxonomic class. First, the C Statistical Test's location component identified a statistically significant difference in the ranking of taxonomic abundance from the Early and Middle Woodland period to the Late Woodland period. Early and Middle period assemblages were identical in their taxonomic ranking (mammal-fish-reptile-bird) mammal having the largest NISP and bird having the smallest NISP. The Late Woodland ranking was slightly different, ordered from most to least abundant as mammal-reptile-fish-bird. This identifies a higher utilization of reptile taxa resources than fish resources in the Late Woodland period. This is a relatively small difference given the small Late Woodland identified taxa assemblage but could be the result of a slight change in subsistence strategy in the Late Woodland period. Perhaps the Late Woodland occupants made more use of local reptile resources from the adjacent pond, or made fewer trips to Lake Koshkonong to catch fish. Perhaps greater reliance upon horticulture led to decreased hunting and favored a smaller foraging territory size. A closer investigation of the ecology of Pritchard's pond might be useful in order to generate a higher resolution expected faunal list from the immediate vicinity. This could then be used to investigate which resources are more abundant in and around the immediate area of the site. Of the reptile specimens identified from the Late Woodland assemblage, 36/40 specimens are turtle carapace and plastron. The pond might be an ideal location to catch turtles.

The C Statistical Test's dispersion component was used to investigate the evenness, or equitability, of specimens identified to taxonomic class within each assemblage. This test component identified a statistically significant change from the Early and Middle periods to the Late Woodland period. Early and Middle assemblages are dominated by mammal specimens. The Late Woodland period assemblage, by contrast, showed greater evenness in its distribution of taxonomic specimens. Late Woodland inhabitants at the site were utilizing a greater proportion of fish and reptile resources in comparison to Early and Middle Woodland periods.

This demonstrates a likely change in the subsistence strategy utilized by occupants of the site. Early and Middle Woodland assemblages reflect a more specialized subsistence strategy, focusing on large mammals such as elk and white-tailed deer. The Late Woodland assemblage reflects a more generalized subsistence strategy, using a wider variety of vertebrate resources. The broadening of the Late Woodland subsistence strategy is further supported by an investigation of different mammal size utilization. Both Early and Middle Woodland mammal-size assemblage are dominated by large mammals, with 87.3% and 94.3%. By contrast the Late Woodland mammal-size assemblage is composed of 31.2% large mammal, with 43.8% medium sized mammals.

Food Processing Intensity

One of my original research goals was to investigate food processing intensity through comparisons of bone fragmentation. I did this by determining the average weight per fragmented specimen: weight / NISP. Each Woodland assemblage contained only a single complete skeletal element, the remaining specimens were all fragmented. Highly fragmented bone can result from a variety of taphonomic processes such as compaction, rodent or carnivore gnawing, trampling, or weathering (Lyman 1994 Gifford-Gonzalez 1989; Reitz and Wing 2008), however, highly fragmented faunal assemblages are also produced by anthropogenic activities such as butchering, food preparation, and/or marrow extraction (Leechman 1951; Vehik 1977; Binford 1978; Binford 1981; Reitz and Wing 2008).

No specimens from the Woodland period assemblages had evidence for rodent gnawing or carnivore surface modifications, and thus these taphonomic effects were not associated as a prime factor in the assemblages' degree of fragmentation. A weathering index analysis was not done. I assumed that bone specimens were exposed to some degree of weathering, but that the fragmentation of the entire assemblage could not be attributed solely to natural decay. If weathering is measured as a function of time (Lyman 1994: 359), then it would be expected that bone specimens from the Early

Woodland assemblage would have a longer period of time in which the processes of weathering would be acting upon them and thus a potentially greater degree of fragmentation in comparison to specimens from the Late Woodland assemblage. While this matches the trend seen with ¼" dry-screen recovery in Table 5.18, that apparent trend can be attributed to a single large fragment, and disappears when this outlier is removed (Table 5.19). Thus the degree of fragmentation does not appear to be predicted by weathering. At the same time, the lack of significant changes in fragmentation over time does not support an interpretation of changing intensity in food processing at the site, instead it appears to represent a constant degree of processing through time.

In order to contextualize the fragmentation evidence from the Finch site with other archaeological sites which also have used weight per specimen analysis as a proxy for the degree of fragmentation and attributed fragmentation to anthropogenic bone processing activities, several assemblages were compared. Direct temporal component comparisons were difficult to make due to a lack of comparable data, however, the comparisons represent a starting point for evaluating the potential of weight:NISP ratios for inter-site comparisons of fragmentation. These comparisons also allow me to insert Finch site fragmentation analysis data into discussions of possible marrow and grease processing evidence. For each comparison only the most relevant subassemblage of the Finch site was used. This allowed me to control for differences in screen size, animal size, and level of identification per comparison.

The Quast Site, a short-term prehistoric occupation site in La Moure county, North Dakota, and was radiocarbon dated to 1245 ± 45 AD. The site was investigated for bone fragmentation resulting from marrow extraction and bone grease production (Vehik

1977). Vehik's analysis involved the quantification of bone fragments using specimen counts and weights combined with an intrasite analysis of artifacts and features associated with bone grease production, such as grooved mauls, hammerstones, anvil stones, fire pits, "boiling-sized" stones, FCR, and pottery (Vehik 1977: 172). Because Vehik does not make explicit the recovery techniques used in excavation of unit levels and feature provenience, it will be assumed that since the feature excavations yielded carbonized floral remains, that some amount of finer-meshed recovery technique was utilized. For this comparison, assuming that the unit excavations most likely used ¼" dry-screening, only the unit provenience faunal remains will be compared with the Finch site ¼" dry-screen recovered faunal remains. Vehik used both identified and unidentified bone in her calculations, as well as all vertebrate taxonomic classes and thus, the total Finch site 1/4"" dry-screen recovered Woodland period assemblage will be used as a comparison of the degree of fragmentation (see Table 6.1). As demonstrated by the

Table 6.1: Comparison of Quast site and Finch site bone fragmentation.

	NISP	Weight (g)	Degree of Fragmentation
Quast site	4949	3516	0.710
Finch site	1096	564.13	0.515

the results, the degree of fragmentation from the Finch site assemblage is greater than that of the Quast site. This suggests that bone processing activities such as marrow extraction and bone grease production may have also been practiced at Finch (Vehik 1977).

The GiTa-19 and GiTa-23 sites, located on Kitwancool Lake, in west-central British Columbia, are both Late Prehistoric multicomponent sites. GiTa-19 is a late summer-through winter planked house village with radiocarbon dates from multiple occupations ranging from 380 BC to 1650 BC (Prince 2007: 7). GiTa-23 is a multicomponent occupation site with radiocarbon dates from multiple occupations ranging from 640 AD to historic period times. Both sites were investigated for evidence of marrow extraction and bone grease production using NISP and weights, as well as dividing fragments into size classes by maximum lengths. Excavated matrix was screened through 4mm dry-screen, which roughly equates to a 1/8" screen size (1/8" = 3.2mm). Larger fragments, such as those recoverable with ¼" mesh, necessarily be included. Faunal remains recovered from both sites consist of identified and unidentified bone specimens, as well as all vertebrate taxonomic classes, with the exception of a single river mussel shell fragment included in the GiTa-23 site assemblage (Prince 2007: 10). These site assemblages were compared to a combination of the Finch site ¼" dry-screen and 1/8" water-screen materials recovered from Woodland assemblages (see Table 6.2). The degree of fragmentation from both British Columbia sites was slightly greater than that of the Finch site. I would argue that bone fragmentation from both sites is

Table 6.2: Comparison of GiTa-19, GiTa-23, and Finch site bone fragmentation.

	NISP	Weight (g)	Degree of Fragmentation
GiTa-19	4843	653.81	0.135
GiTa-23	609	83.43	0.137
Finch site	2827	636.66	0.225

comparable and that similar food processing activities, such as marrow extraction and bone grease production, may have occurred at the Finch site.

The McCauley site (47 WN-0222) is a multicomponent site located in Winnebago county, east-central Wisconsin. The site is a year-round occupation site with evidence for a Woodland component pre-dating 1200 AD, a Lake Winnebago Phase Oneota occupation dated from 1350-1650 AD, and a Middle Historic period occupation post-dating 1650 AD (Grimm 2010: 34). Grimm used an investigation of bone fragmentation to compare the Oneota and Historic components of the site to determine if bone grease production was reduced in the Historic component due to trade and the replacement of bone grease with lard (Grimm 2010: 48). Grimm uses fragmentation data from large mammal remains only, positing that large mammals were referenced historically as being utilized for bone grease. Grimm's assemblage consists of the ¼" dry-screen faunal remains recovered in 1931-1932 by Arthur Kannenberg of the Oshkosh Public Museum. For this comparison, only the large mammal remains recovered from the ¼" dry-screen Woodland period assemblages were used (see Table 6.3). The degree of fragmentation of

Table 6.3: Comparison of McCauley and Finch site bone fragmentation.

	NISP	Weight (g)	Degree of Fragmentation
McCauley site	32	362.7	11.334
Finch site	113	328.87	2.910

large mammal remains from the Finch site is greater, more fragmented, than that of the McCauley site. The difference in fragmentation between the sites is very large, which could signal a more intensive amount of marrow extraction and/or bone grease production at the Finch site. This difference, however, is difficult to discuss without a further review of the taphonomic processes uniquely effecting each assemblage. The relatively small sample size for McCauley may also have an impact.

Next I compared fragmentation between sites where NISP and weight data were available, but where interpretations of food processing intensity had not been made using this data, choosing two Wisconsin sites, the Crescent Bay Hunt Club site and the Bell site. The Crescent Bay Hunt Club site is an Oneota habitation site located just west of Lake Koshkonong in Jefferson county, Wisconsin and has been radiocarbon dated from roughly 1200 to 1400 AD (Jeske 2003: 93). The site is located approximately eight kilometers west of the Finch site. The sample used here consists of bone specimens recovered using ¼" mesh dry-screen recovery and excludes unidentified specimens (Hudson, personal communication 2015). Another sample of bone, recovered from the Bell site (47 WN-0009) was also used for comparison. The Bell site is multicomponent site located just south of Lake Butte des Morts in Winnebago county, Wisconsin with a late prehistoric occupation dating to the 13th century AD based on AMS dating of charred corn remains (Koziarski 2012: 70). The bone sample consists of specimens recovered using ¼" mesh dry-screen recovery and excludes unidentified specimens (Koziarski 2012: 109; Hudson, personal communication 2015). This assemblage, and that from Crescent Bay Hunt Club site, were compared with the Finch site's identified ¼" dry-screen Woodland period assemblages (see Table 6.4). The comparison identifies that the Bell site assemblage has the greatest degree of bone fragmentation. This may be a result

Table 6.4: Comparison of Crescent Bay Hunt Club, Bell, and Finch site bone fragmentation.

	NISP	Weight (g)	Degree of Fragmentation
Crescent Bay Hunt Club site	3438	2081.1	0.605
Bell site	6818	865.61	0.127
Finch site	533	481.78	0.904

of the large amount of fish (5447 specimens) and bird (379 specimens) remains identified at the Bell site in comparison to the Finch site, which was dominated by mammals (504 specimens). It also could be due in part to the large amount of unidentified specimens in the Finch assemblage that were not included in this comparison due to the difficulty in identifying highly fragmented pieces of bone.

Comparing the degree of fragmentation between faunal assemblages, quantified using NISP and weight, requires the careful consideration of assemblage recovery techniques and identified versus unidentified specimen distinctions as well as the general faunal composition in terms of vertebrate classes and mammal sizes. It is also necessary to investigate each assemblage for different and multiple taphonomic processes that act to fragment bone further. The use of this method in combination with others, such as NISP:MNE ratios, length of specimen size-group comparisons, and the Fragment Freshness Index (Outram 2001), may prove useful in the future. In the present, caution is suggested when using fragmentation alone as a measure of food processing intensity.

Utilization of Space

The spatial distribution of faunal remains from the Early and Middle Woodland assemblages overlap at the site. Early and Middle Woodland assemblages are concentrated in the southern saddle area of the site, adjacent to the pond just north of the southern knoll. Burned bone spatial analysis in both the Early and Middle Woodland assemblages identifies concentrations of single and mixed color burned bone densities. This suggests that food processing activity areas were re-visited by Early and Middle Woodland occupants of the site.

By contrast, the Late Woodland assemblage suggests a different spatial distribution of taxa, resource utilization, and burned bone. Late Woodland faunal remains are concentrated across the site in areas of the southern saddle, the middle saddle, and the northern area of the site. The largest densities of taxa and burned bone are located in the northern area. This suggests that a change occurred between the Middle and Late Woodland periods in the spatial utilization of the site. Why was the same location utilized by both Early and Middle Woodland occupants, but not Late Woodland occupants? Perhaps the elevation of the southern saddle area combined with the season of site use can help to explain the spatial shift. The southern saddle area is the lowest area of elevation in the site and directly adjacent to the spring-fed marsh area known as Pritchard’s Pond. During Phase III excavations in the spring months, that area of the site was particularly waterlogged. Perhaps the Late Woodland occupations at the site coincided more with the spring months and thus the northern occupation of the site was occupied to avoid the marsh area in the southern saddle. The Early and Middle Woodland might have occupied the site more during the late summer and fall months, when the southern saddle area may have been drier. Further investigation of the site’s lithic and ceramic artifact assemblage could be used to explore comparisons of the Early, Middle, and Late Woodland component spatial distributions. This spatial analysis of vertebrate resource utilization combined with a lithic and ceramic spatial analysis would add further interpretations to the function of these specific areas of faunal density.

Intersite Comparisons

In order to further investigate the observed differences between the Woodland component faunal assemblages at the Finch site, an intersite analysis was completed. The faunal assemblage's Middle Woodland and Late Woodland components were contrasted with two other sites in Wisconsin with comparable assemblages. The Cooper's Shore site (47 RO-0002) is a Middle Woodland site located in southeastern Wisconsin, roughly 10 kilometers west of the Finch site south of Lake Koshkonong on the Rock River. The Plantz site (47 WN-0325) is a multicomponent site with a predominantly Late Woodland component roughly 100 kilometers north in east-central Wisconsin, located at the northeast edge of Rush Lake. To investigate changes in resource utilization present at the Finch site the taxonomic class NISP and identified mammal-size assemblages were compared between sites.

The Cooper's Shore Site

The Cooper's Shore site (47 RO-0002) is a Middle Woodland habitation site with a cultural assemblage suggestive of a short occupational duration (Wiersum 1968: 132). The site's artifact assemblage consists of Steuben Punctated, Weaver Cordmarked, Weaver Plain, and Havana Plain Ware ceramics. The faunal assemblage was excavated from feature and midden context using ¼" dry screen mesh. I created a 10 km radius catchment around the Cooper's Shore site in order to investigate the ecological zones that would have been available to site occupants (see Figure 6.4). The same ecological zones would have been available to both Cooper's Shore and Finch site Middle Woodland

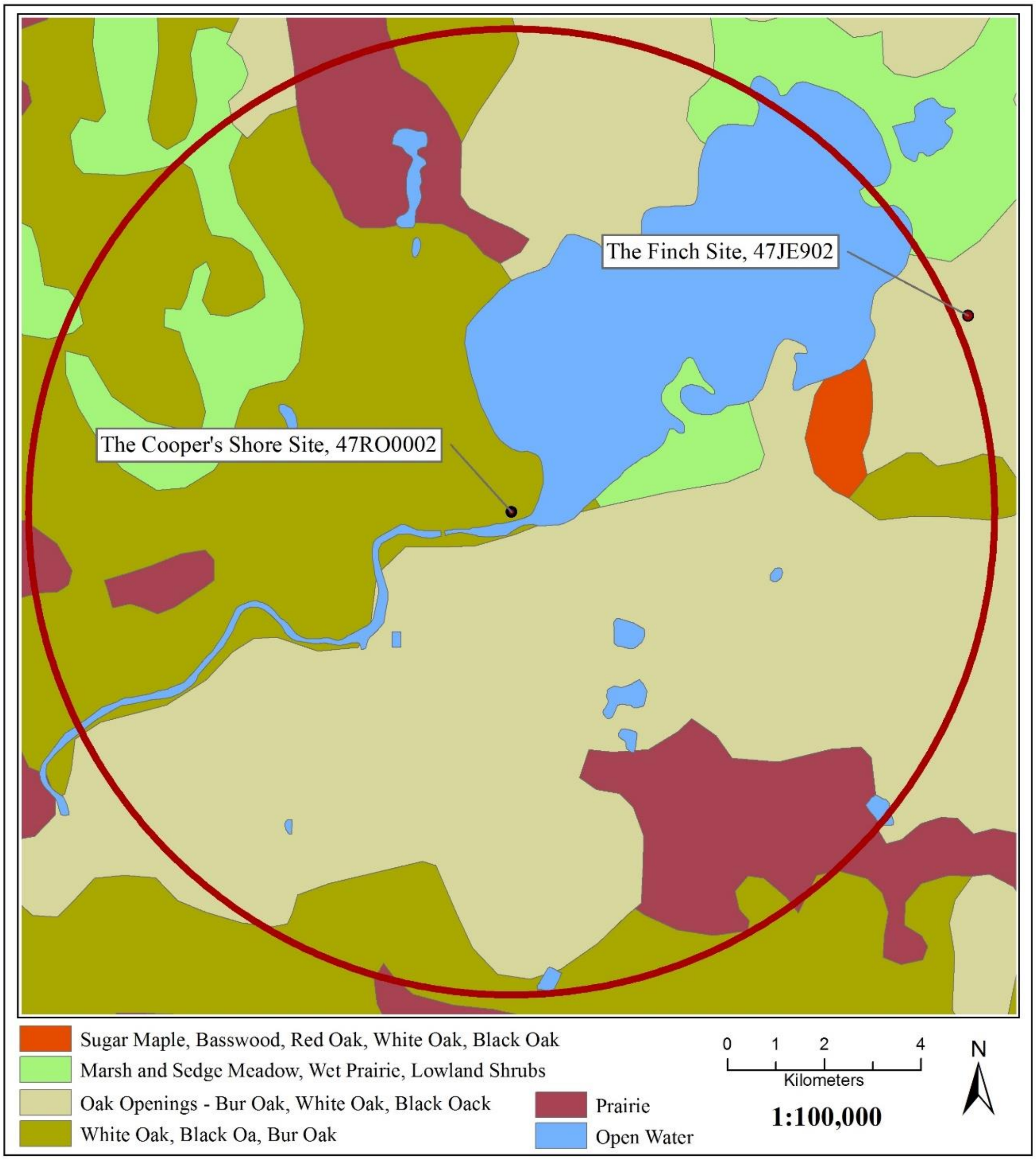


Figure 6.4: 10 km catchment of the Cooper's Shore site, modified from Finley (1976).

occupants. The only differences are that Oak Forests would have been more available to Cooper's Shore occupants, and their vicinity to the Rock River and Lake Koshkonong would have made Aquatic and Wetland resources easier to procure.

Evidence for season of occupation at the Cooper's Shore site indicates that it was occupied at least during spring and summer seasons (Lippold 1973: 57). Though the seasonality study did not show evidence for an extended period of stay at the Cooper's Shore site, the presence of a possible storage pit (Feature 7) might imply that site occupation at one point was possibly extended (Wiersum 1968: 125). Faunal remains reported from the site consist of 8159 specimens identified to vertebrate taxonomic class (see Table 6.5) (Wiersum 1968: 153-155). Mammals dominate the Cooper's Shore

Table 6.5: Middle Woodland NISP comparison, the Cooper's Shore and Finch sites.

	Cooper's Shore Site			Finch Site	
	NISP	%		NISP	%
Bird	177	2.17%		1	0.27%
Fish	1432	17.55%		15	3.98%
Mammal	6284	77.02%		355	94.16%
Reptile	266	3.26%		6	1.59%
Total	8159	100%		377	100%

Middle Woodland assemblage, as is true at the Finch site, however, there is a greater utilization of fish resources in the Cooper's Shore assemblage. This is probably a result of the site's close proximity to the Rock River and Lake Koshkonong. Large mammals dominate the Cooper's Shore assemblage with 540 of the 631 total mammal specimens (85.6%) identified to a large mammal size group. Large mammals are represented at the site by bison, elk, and white-tailed deer (Lippold 1973: 40-42). This is comparable to the Finch site's 94.3% large mammal NISP. This demonstrates that the Middle Woodland vertebrate diet at the Cooper's Shore site utilized a relatively specialized subsistence strategy primarily focused on the acquisition and utilization of large mammals, similar to the Finch site's Middle Woodland component.

The Plantz Site

The Plantz site (47 WN-0325) is a multicomponent site with evidence for Paleoindian, Middle Archaic, Early-Middle-Late Woodland, and Upper Mississippian components. The site covers approximately 7.6 acres, situated upon a terrace at the northeast edge of Rush Lake, a large shallow lake similar to Lake Koshkonong with its surrounding wetlands (Kuehn 2008: 129). The Late Woodland faunal assemblage is associated with diagnostic ceramics such as Madison wares. Effigy mounds have been identified within a mile radius of the site, though no mounds are present directly at the site (Kuehn 2008: 130). Faunal remains were also present from the Middle Woodland component of this site, though the total NISP of that assemblage is only 16 specimens. Faunal remains were recovered from ¼" mesh dry-screen, with a small portion identified from feature flotation analysis. Fragmented mammal specimens were separated into small, medium, and large based on size and cortical thickness (Kuehn 2008: 131).

A 10 km radius catchment circle was created around the Plantz site in order to investigate the ecological zones that would have been available to site occupants (see Figure 6.5). The same ecological zones available to the Finch site and the Cooper's Shore site would have been available to the Plantz site, though access to Aquatic and Wetland resources would have been more proximal, given the proximity to Rush Lake and the surrounding marsh/wetlands.

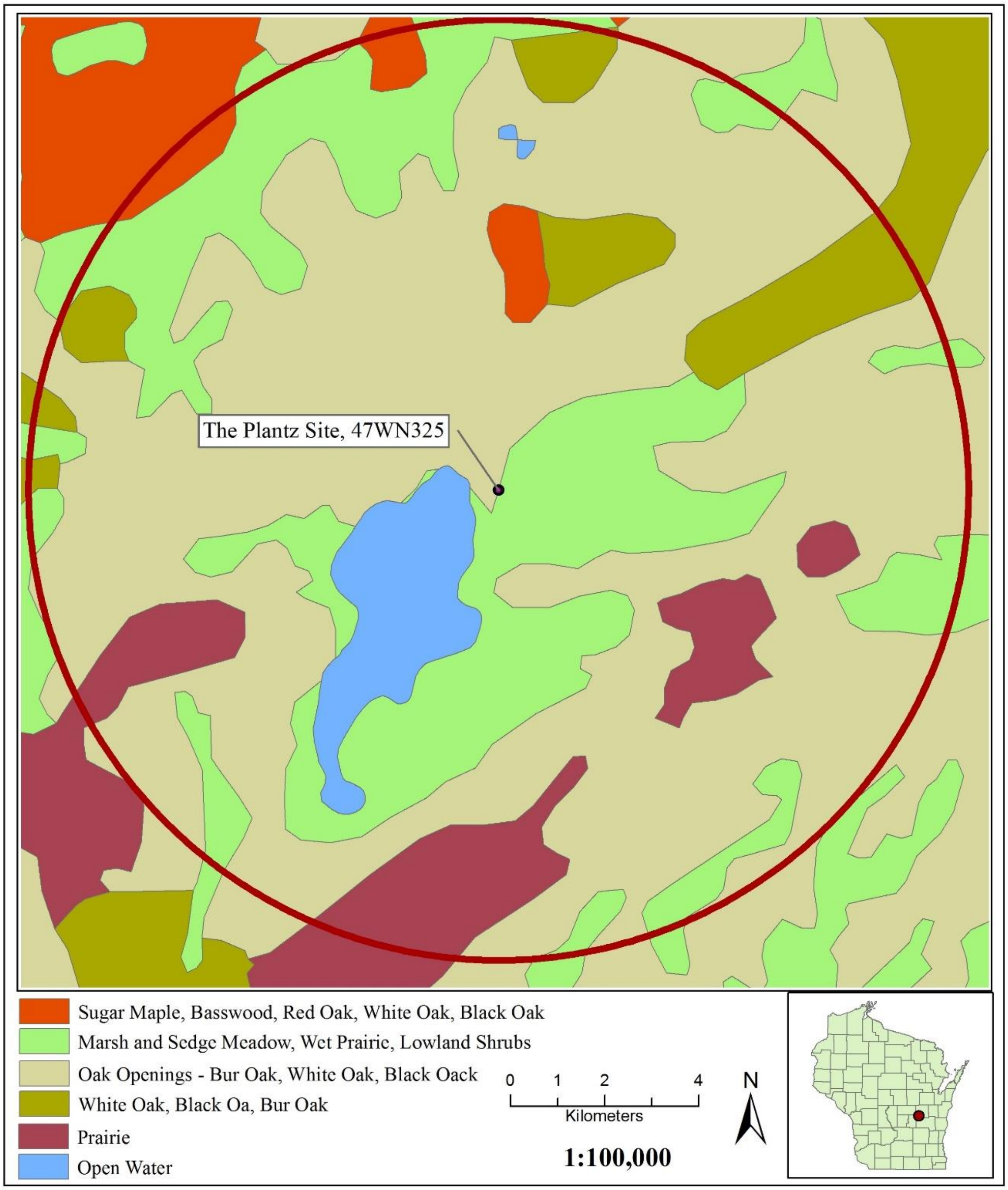


Figure 6.5: 10 km catchment of the Plantz site, modified from Finley (1976).

Evidence for season of occupation from the site indicates a broad occupation from spring to winter, when the ice cover on Rush Lake would have melted. This is based on the presence of shellfish, fish, turtles, and migratory waterfowl, though, admittedly, no specific seasonality study was completed (Kuehn 2008: 142). Faunal remains reported from the Late Woodland component consist of 1115 specimens identified to taxonomic class (see Table 6.6) (Kuehn 2008: 134-135). The Plantz site Late Woodland assemblage

Table 6.6: Late Woodland NISP comparison, the Plantz Site and the Finch site.

	Plantz Site			Finch Site	
	NISP	%		NISP	%
Bird	26	2.33%		2	1.55%
Fish	308	27.62%		17	13.18%
Mammal	530	47.53%		70	54.26%
Reptile	251	22.51%		40	31.01%
Total	1115	100%		129	100%

is remarkably similar to the Finch site's Late Woodland assemblage. Mammals are the most abundant taxa, however, there is a greater utilization of fish resources present in the Plantz site assemblage than at the Finch site. There is a reduced emphasis on large mammalian taxa utilization at the Plantz site. Only 116 of the 263 total mammal specimens (44.1%) identified to mammal size-group are represented by large mammals such as elk, white-tailed deer, and unidentified Cervidae (Kuehn 2008: 133). This is comparable to the Finch site's 31.2% large mammal representation. This evidence demonstrates that the Late Woodland vertebrate diet at the Plantz site was not focused on the acquisition and utilization of large mammals. Instead, the site displayed evidence for an adequate utilization Aquatic and Wetland species, signaling a generalized subsistence strategy, and thus a broadening of the utilized vertebrate resource base.

The intersite comparisons between the Middle Woodland Cooper's Shore site and the Late Woodland component at the Plantz site identified a difference in the utilization of faunal resources comparable to the faunal assemblage at the Finch site. The shift from a specialized subsistence strategy focused on the acquisition of large mammals in the Middle Woodland to a more even use of fish, reptiles, and mammals is not specifically unique to the Finch site, and would be interesting to pursue further through an investigation of more Middle and Late Woodland site faunal assemblages.

Conclusions

Vertebrate remains from the Finch site were used to answer several questions about resource use, food processing, spatial utilization, and changes through time. Though seasonality evidence was minimal, several species were identified suggesting that the site was utilized as a seasonal resource extraction location possibly during spring, summer, and/or fall. An absence of storage features or identified house/habitation features at the site supports this interpretation (Haas, personal communication 2015). A future research goal would be to investigate year-round occupational sites within the vicinity of the Finch site to hypothesize about larger landscape use pattern.

Statistical testing of Early, Middle, and Late Woodland taxonomic class assemblages revealed evidence for changes in identified taxa distribution and dispersion. This information was used to explore changes through time at the Finch site, and to identify a shift in subsistence strategies: from Early and Middle Woodland large-mammal specialists, to Late Woodland broad resource-base generalists. The comparison of the Finch site Woodland period faunal assemblages with additional Woodland period faunal assemblages in the region would allow further testing of this hypothesis.

Spatial analysis of faunal remains identified shifts in the locations of bone producing activities over time. Paleo and Archaic faunal remains were located atop the southern knoll, Early and Middle Woodland faunal remains were identified in the southern saddle area of the site, and the Late Woodland faunal remains were spread out from the southern saddle to more dense deposits in the northern section of the site. The spatial analysis of burned bone highlighted potential activity areas of food processing and waste discard. The inclusion of lithic and ceramic artifacts within this type of spatial analysis could further aid in delineating the function of specific site activity areas at Finch.

No radiocarbon dates have yet been processed from the Finch site, though adequate samples exist and await such pursuits. In the future, it would be interesting to compare and expand upon the results I have compiled in this study with reliably radiocarbon dated proveniences at the site.

The intersite analysis completed in this study focused on comparisons of identified vertebrate classes and mammal-size groups for Woodland period occupations in settings ecologically similar to the Finch's. The goal was to evaluate possible shifts from specialized large mammal exploitation in the Middle Woodland to more generalized use of fish, reptile, and mammal in the Late Woodland. This shift appears to be paralleled at other sites such as the Cooper's Shore site and the Plantz site. This investigation warrants future testing by more intersite comparisons of Woodland period faunal assemblages. By adding the Finch faunal assemblage to the ranks of comparable Woodland period assemblages within the region, the data compile in this thesis will be useful to future researchers interested in prehistoric vertebrate subsistence, seasonality, and food processing.

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APPENDIX A

EXPECTED FAUNA LIST

(Compiled from Cleland 1966; Becker 1983; Styles 1981; Jeske 1999; Watermolen and Murrell 2001; Haglund, personal communication 2015)

Ecological Zone	Common Name	Scientific Name
Prairies		
Mammals	bison	*Bison bison*
	elk	*Cervus canadensis*
	American badger	*Taxidea taxus*
	coyote	*Canis latrans*
	eastern spotted skunk	*Spilogale putorius*
	eastern cottontail	*Sylvilagus floridanus*
	thirteen-lined ground squirrel	*Citellus tridecemlineatus*
	ground squirrel	*Citellus franklinii*
	plains pocket gopher	*Geomys bursarius*
	prairie vole	*Micotus ochrogaster*
Birds	greater prairie chicken	*Tympanuchus cupido*
	sandhill crane	*Grus canadensis*
	short-eared owl	*Asio flammeus*
	longbilled curlew	*Numenius americanus*
	red-shouldered hawk	*Buteo lineatus*
	ferruginous hawk	*Buteo regalis*
	red-tailed hawk	*Buteo jamaicensis*
	golden Eagle	*Aquila chrysaetos*
	downy woodpecker	*Picoides pubescens*
	common raven	*Corvus corax*
Reptiles	blanding's turtle	*Emydoidea blandingii*
	ornate box turtle	*Terrapene ornata*
Oak/Deciduous Forests		
Mammals	black bear	*Ursus americanus*
	elk	*Cervus canadensis*
	white-tailed deer	*Odocoileus virginianus*
	mountain lion	*Puma concolor*
	gray wolf	*Canis lupus*
	coyote	*Canis latrans*
	bobcat	*Lynx rufus*
	lynx	*Lynx canadensis*
	common raccoon	*Procyon lotor*
	woodchuck	*Marmota monax*
	common porcupine	*Erethizon dorsatum*

	Virginia opossum	*Didelphis virginiana*
	red fox	*Vulpes vulpes*
	gray fox	*Urocyon cinereoargenteus*
	eastern cottontail	*Sylvilagus floridanus*
	striped skunk	*Mephitis mephitis*
	least weasel	*Mustela nivalis*
	eastern spotted skunk	*Spilogle putorius*
	eastern gray squirrel	*Sciurus carolinensis*
	eastern fox squirrel	*Sciurus niger*
	southern flying squirrel	*Glaucomys volans*
	red squirrel	*Tamiasciurus hudsonicus*
	plains pocket gopher	*Geomys bursarius*
	deer mouse	*Peromyscus maniculatus*
Birds	wild turkey	*Meleagris gallopavo*
	red-tailed hawk	*Buteo jamaicensis*
	common nighthawk	*Chordeiles minor*
	great horned owl	*Bubo virginianus*
	eastern screech owl	*Otus asio*
	barred owl	*Strix varia*
	ruffed grouse	*Bonasa umbellus*
	American crow	*Corvus brachyrhynchos*
	common grackle	*Quiscalus quiscula*
	red-headed woodpecker	*Melanerpes erythrocephalus*
	pileated woodpecker	*Dryocopus pileatus*
	hairy woodpecker	*Picoides villosus*
	downy woodpecker	*Picoides pubescenes*
	passenger pigeon	*Ectopistes migratorius*
	American robin	*Turdus migratorius*
	northern cardinal	*Cardinalis cardinalis*
	blue jay	*Cyanocitta cristata*
	northern bobwhite	*Colinus virginianus*
	loggerhead shrike	*Lanius ludovicianus*
	red-winged blackbird	*Agelaius phoeniceus*
	whip-poor-will	*Caprimulgus vociferus*
Reptiles	common box turtle	*Terrapene ornata*
Amphibians	eastern American toad	*Bufo americanus*

	northern spring peeper	*Pseudacris crucifer*
	wood frog	*Rana sylvatica*
	spotted salamander	*Ambystoma maculatum*
Oak Openings		
Mammals	bison	*Bison bison*
	elk	*Cervus canadensis*
	white-tailed deer	*Odocoileus virginianus*
	mountain lion	*Puma concolor*
	coyote	*Canis latrans*
	bobcat	*Lynx rufus*
	common raccoon	*Procyon lotor*
	American badger	*Taxidea taxus*
	woodchuck	*Marmota monax*
	Virginia opossum	*Didelphis virginiana*
	red fox	*Vulpes vulpes*
	gray fox	*Urocyon cinereoargenteus*
	eastern cottontail	*Sylvilagus floridanus*
	striped skunk	*Mephitis mephitis*
	eastern spotted skunk	*Spilogle putorius*
	eastern gray squirrel	*Sciurus carolinensis*
	eastern fox squirrel	*Sciurus niger*
	southern flying squirrel	*Glaucomys volans*
	plains pocket gopher	*Geomys bursarius*
	thirteen-lined ground squirrel	*Spermophilus tridecemlineatus*
	franklin's ground squirrel	*Spermophilus franklinii*
Birds	sandhill crane	*Grus canadensis*
	wild turkey	*Meleagris gallopavo*
	turkey vulture	*Cathartes aura*
	ring-necked pheasant	*Phasianus colchicus*
	sharp-tailed grouse	*Tympanuchus phasianellus*
	ruffed grouse	*Bonasa umbellus*
	eastern screech-owl	*Otus asio*
	barn owl	*Tyto alba*
	passenger pigeon	*Ectopistes migratorius*
Reptiles	common box turtle	*Terrapene ornata*

Amphibians	eastern American toad	*Bufo americanus*
	wood frog	*Rana sylvatica*
Aquatic/Wetlands		
Mammals	white-tailed deer	*Odocoileus virginianus*
	northern river otter	*Lontra canadensis*
	American beaver	*castor canadensis*
	common raccoon	*Procyon lotor*
	American mink	*Martes americana*
	muskrat	*Ondatra zibethicus*
	grey fox	*Urocyon cinereoargenteus*
	red fox	*Vulpes fulva*
	wolverine	*Gulo luscus*
	Virginia opossum	*Didelphis virginianus*
	eastern cottontail	*Sylvilagus floridanus*
	least weasel	*Mustela nivalis*
	fisher	*Martes pennanti*
	grey squirrel	*Sciurus carolinensis*
	red squirrel	*Tamiasciurus husonicus*
	water shrew	*Sorex palustris*
Birds	great blue heron	*Ardea herodias*
	American white pelican	*Pelecanus erythrorhynchos*
	sandhill crane	*Grus canadensis*
	great egret	*Ardea alba*
	whooping crane	*Grus americana*
	snow goose	*Chen caerulescens*
	trumpeter swan	*Cygnus buccinator*
	Canada goose	*Branta canadensis*
	common loon	*Gavia immer*
	double-crested cormorant	*Phalacrocorax auritus*
	mallard	*Anas platyrhynchos*
	canvasback	*Aythya valisineria*
	northern shoveler	*Anas clypeata*
	wood duck	*Aix sponsa*
	redhead	*Aythya americana*
	ring-necked duck	*Aythya collaris*
	American black duck	*Anas rubripes*
	northern pintail	*Anas acuta*

	bufflehead	*Bucephala albeola*
	common goldeneye	*Bucephala clangula*
	common merganser	*Mergus merganser*
	hooded merganser	*Lophodytes cucullatus*
	American bittern	*Botaurus lentiginsus*
	pie-billed grebe	*Podilymbus podiceps*
	American coot	*Fulcia americana*
Fish	longnose gar	*Lepisosteus osseus*
	shortnose gar	*Lepisosteus platostomus*
	paddlefish	*Polyodon spathula*
	American eel	*Anguilla rostrata*
	muskellunge	*Esox masquinongy*
	northern pike	*Esox lucius*
	walleye	*Stizostedion vitreum*
	sauger	*Stizostedion canadense*
	brown trout	*Salmo trutta*
	brook trout	*Salvelinus fontinalis*
	largemouth bass	*Micropterus salmoides*
	smallmouth bass	*Micropterus dolomieu*
	white bass	*Morone chrysops*
	yellow bass	*Morone mississippiensis*
	rock bass	*Ambloplites rupestris*
	yellow perch	*Perca flavescens*
	trout-perch	*Percopsis omiscomaycus*
	pirate perch	*Aphredoderus sayanus*
	channel catfish	*Ictalurus puctatus*
	flathead catfish	*Pylodictis olivaris*
	longnose sucker	*Catostomus catostomus*
	white sucker	*catostomus commersoni*
	northern hog sucker	*Hypentelium nigricans*
	black bullhead	*Ameiurus melas*
	yellow bullhead	*Ameiurus natalis*
	freshwater drum	*Aplodinotus grunniens*
	white crappie	*Pomoxis annularis*
	black crappie	*Pomoxis nigromaculatus*
	green sunfish	*Lepomis cyanellus*
	pumpkinseed	*Lepomis gibbosus*
	orange spotted sunfish	*Lepomis humilis*

	bluegill	*Lepomis macrochirus*
Reptiles	eastern snapping turtle	*Chelydra serpentina serpentina*
	painted turtle	*Chrysemys picta*
	northern map turtle	*Graptemys geographica*
	smooth softshell turtle	*Apalone mutica*
	spiny softshell turtle	*Apalone spinifera*
	stinkpot	*Sternotherus odoratus*
Amphibians	American bullfrog	*Rana catesbeiana*
	northern leopard frog	*Rana pipiens*
	northern green frog	*Rana clamitans melanota*

Appendix B: Finch Site Faunal Assemblage

(see supplemental file: *Stencil_Thesis _May2015-Finch_Faunal_Data.xlsx)*

Assemblage Key

Lot Number	#
A#	artifact number
Unit	#
Feature	#
Temporal	LP, MA, LA, EW, MW, LW
Level	# below surface
Count	#
Weight (g)	#
Burned	yes/no
0	burned color rank - unburned
1	burned color rank - carbonized
2	burned color rank – partially calcined
3	burned color rank – partially calcined
4	burned color rank - calcined
5	burned color rank – mineral stained
Recovery	D-dry-screen; W-water-screen; F-flotation
Taxon	taxonomic class
Size	mammal size: small, medium, M/L, large
Species	most specific taxonomic classification
Common Name	name
Element	identified skeletal element name
Part	fragment, complete, or partial complete, description
Side	side of body element is from
Butchery	cut marks

Worked	type of modification
Gnawed	yes/no
Season	yes/no
Age	Adult, Sub-adult, Juvenile