May 2020

Prehistoric Humans and Elk (cervus Canadensis) in the Western Great Lakes: A Zooarchaeological Perspective

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PREHISTORIC HUMANS AND ELK (*CERVUS CANADENSIS*) IN THE WESTERN GREAT LAKES: A ZOOARCHAEOLGOCIAL PERSPECTIVE

by

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A Thesis Submitted in

Partial Fulfillment of the

Requirements for the Degree of

Master of Science

in Anthropology

at

The University of Wisconsin-Milwaukee

May 2020

ABSTRACT

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Rebekah Ann Ernat

The University of Wisconsin-Milwaukee, 2020
Under the Supervision of Professor Jean Hudson

This thesis examines the relationship between humans and elk (*Cervus canadensis*) in the western Great Lakes region from prehistoric through early historic times, with a focus on Wisconsin archaeological sites. It takes a social zooarchaeological perspective, drawing from archaeological, ecological, biological, historical, and ethnographic sources. I also use optimal foraging theory to examine subsistence-related decisions. Based on my review of 34 Wisconsin archaeological sites or site components, elk diminished in relative dietary importance in prehistoric times as subsistence strategies shifted. The use of their bones, especially scapulae and antlers, in tool production increased. Other roles, as markers of group and personal identity, holders of spiritual power, images to invoke magic or provide instruction, and figures in stories, are less straightforward to track over time but no less relevant. Modern human-elk relationships can be enriched by a greater understanding of the past, especially through museums and other forms of public education.

To my family, especially my parents, in gratitude

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LIST OF ABBREVIATIONS

AMS	accelerator mass spectrometry
ARL	Archaeological Research Laboratory
BAHA	Barnes Area Historical Association
BRSF	Black River State Forest
CRM	Cultural Resource Management
DNR	Department of Natural Resources
GLARC	Great Lakes Archaeological Research Center
HSI	habitat suitability index
IUCN	International Union for Conservation of Nature and Natural Resources
MGUI	modified general utility index
MNI	minimum number of individuals
MUI	meat utility index
NISP	number of identified specimens
OFT	optimal foraging theory
RMEF	Rocky Mountain Elk Foundation
UWM	University of Wisconsin-Milwaukee

ACKNOWLEDGEMENTS

My profound gratitude goes to Dr. Jean Hudson for all of her support, guidance, patience, and perpetual optimism throughout the process of writing this thesis. I am so thankful for the many opportunities she has presented to me. To my other committee members, Dawn Scher Thomae and Dr. Pat Richards, I am grateful for their guidance and insight. I am indebted to Dr. John Richards for offering his knowledge and assistance with my table of repositories. Thank you to the Barnes Area Historical Association who, along with Dr. Hudson, launched me on this journey of elk discovery. I am especially grateful for their hospitality during my visit in September 2019. I am also honored to have been invited to share my research with the Kettle Moraine Natural History Association.

For all the teachers, professors, and role models who have guided me over the years, my gratitude surpasses words. To my fellow Anthropology and Museum Studies students, it has been a joy to share this journey with you, even in the occasionally unjoyful circumstances of graduate school. Finally, to my parents, Chris and Don, and to Matthew, Andrew, Sarah, and Jacob, thank you all for your immeasurable support, unconditional love, and constant encouragement. It is no exaggeration to say that I could not have done this without you.

CHAPTER 1: INTRODUCTION

Interactions between humans and animals are ubiquitous, and these interactions typically take the form of hunting or domestication for food and other raw materials. However, animals can also be significant in other ways, including symbolically, socially, and spiritually (Rajnovich 1994; Russell 2010). This thesis uses archaeological, ethnographic, biological, and historical lines of evidence to examine the relationship between humans and elk (*Cervus canadensis*) in the western Great Lakes, with a focus on Wisconsin.

Figure 1.1: North American elk, *Cervus canadensis* (National Park Service 2018)

I became interested in elk in the spring of 2018, when I volunteered for an internship with Dr. Hudson at the University of Wisconsin-Milwaukee (UWM). I was tasked with helping prepare for the long-term loan of an elk skeleton from the UWM Archaeological Research Laboratory (ARL) to a small museum in Barnes, Wisconsin. More information about this project and my

involvement in it can be found in Section 4.4. Over the course of my internship, I learned a lot about elk, prehistoric peoples of Wisconsin, and zooarchaeology. After it ended, I was excited to expand the work I had already done into this thesis.

Among the remains of other large mammals found at archaeological sites, elk can be overlooked. Bison are more frequently hunted by peoples of the Plains, while deer are a much more common Woodland game animal (Callender 1978b; Clifton 1978; DeMallie and Miller 2001; Leigl 2014; Lippold 1971; Parmalee 1959, 1960a, 1960b; Sasso 2014; Shay 1978; Theler et al. 2016). Compared to deer, which are numerous and practically ubiquitous at Wisconsin archaeological sites, elk may seem of little importance. They appear in the archaeological record less regularly and may remain unidentified when they do so. Even the most rigorous faunal analyses frequently have a category of "unidentified large mammal" or something similar (e.g. Anderson et al. 1995; Grimm 2010; Koziarski 2004; Leigl 2014; Parmalee 1960b; Savage 1978; Stevenson 1982; Warwick 2002), which may include the remains of deer, bison, elk, and/or black bear. In northern Wisconsin, moose and caribou also fall into this category (Kuehn 1997, 1998). Shay (1978) examined 14 archaeological sites in Wisconsin's western prairie peninsula, and calculated the mean percentage of identified remains of different species. Deer (10.1%) and bison (9.7%) were identified much more frequently than elk (3.2%) (Shay 1978: 202).

Despite this relative scarcity, the fact that elk were not only hunted, but also present in stories, rock art, and other written records attests to their significance in people's lives. In this thesis, I attempt to reconstruct not only a more complete map of where and when interactions between humans and elk took place, but also what they might have meant to the people who experienced them. My research concerns two primary perspectives: a biological perspective,

examining elk ecology, and an archaeological perspective, examining human subsistence, material culture, and art. By examining these perspectives, I hope to contribute to an overall greater understanding of life and human-animal relationships in the western Great Lakes in prehistoric and early historic times. I also briefly examine, in Chapter 4, how elk continue to have meaning to people in the region today.

Figure 1.2: Map of the western Great Lakes region (Michigan State University 2020)

I use "prehistoric" throughout this thesis as roughly synonymous with "pre-contact," i.e. before the arrival of Europeans in the region circa the mid-17th century. The term prehistoric has traditionally been used to refer to the time before local written records; however, people in the western Great Lakes kept visual records in the form of rock art and bark scrolls for hundreds if

not thousands of years before European contact (Dewdney and Kidd 1962; Rajnovich 1994; Schrab and Boszhardt 2016).

I use the term "western Great Lakes" to refer to the geographic area surrounding Lakes Superior and Michigan, and to the west of Lake Huron, encompassed by the modern-day borders of southern Ontario, eastern Minnesota, northeastern Iowa, Wisconsin, Michigan, and the northern portions of Illinois, Indiana, and Ohio. This region is shown in Figure 1.2 above. I consider the term "upper Great Lakes" interchangeable but do not use it here. Due to considerations of time and the scope of this thesis, my analysis of archaeological sites is limited to Wisconsin. However, other illustrations of human-elk relationships, including rock art, ethnographic examples, and data about the local extinction and reintroduction of elk, are drawn from across the region.

1.1 Research Questions

I address two primary research questions in this thesis. The first is, where in Wisconsin is there evidence for prehistoric human-elk interactions? The second is, how did people interact with elk in the western Great Lakes in prehistoric times? In relation to the latter question, I will also explore: What evidence for human-elk interactions is present in the archaeological record? How can the ethnographic/historical record enhance our understanding of zooarchaeological remains? What significance did elk have beyond their role as a physical resource (as sources of meat, antler, hide, and other raw materials)? In other words, how might elk have been, as Russell (2010) says, both food and "food for thought?"

1.2 Theoretical Background

I use a behavioral ecology model, specifically optimal foraging theory (OFT), to examine the diet-related choices made by both humans and elk. As a sub-discipline of evolutionary ecology, behavioral ecology analyzes behavior, whether of humans or other animals, in the context of the environment (Schutkowski 2006; Smith and Winterhalder 1992). In general, behavioral ecology operates under the assumptions that organisms are shaped by natural selection and that they live in ecosystems in which resources, especially time and energy, are limited (Schutkowski 2006). OFT employs further assumptions, namely: 1) that the diet is varied, and different foods provide different energetic yields, 2) that food sources are not evenly distributed across an environment but typically exist in dispersed patches, and 3) that there is an optimal group size for cooperative foraging (Schutkowski 2006: 64-65).

Ultimately, OFT predicts that food procurement choices maximize caloric (energetic) intake and minimize time and energetic output (Broughton 1999). For elk, this model would predict grazing from the most nutrient-rich plants and/or in the most nutrient-rich patches. Herd size would potentially be limited by the "optimal group size" discussed by Schutkowski (2006: 64). Section 2.2.3 provides greater detail about elk diet and habitat choices.

For humans, OFT may or may not predict the hunting of elk. While elk provide a lot of meat and thus a large caloric return, they also typically require more energy to pursue, bring down, bring home, and prepare for consumption (Kelly 1995; Koziarski 2004; Lippold 1971). Prey choice modeling and patch choice modeling, two models within OFT, could be used to explain why human hunters chose to pursue or not pursue elk as prey. Both are discussed in greater detail in Section 3.3. There are also other factors at play in human foraging decisions aside from

the optimization of caloric returns; social and cultural factors can influence choices that might seem inefficient from a purely biological standpoint (Gifford-Gonzales 2018; Jochim 1983; Keene 1983).

Another theoretical perspective from which to consider human-animal relationships is social zooarchaeology, as defined by Nerissa Russell (2010) and to some extent Diane Gifford-Gonzales (2007, 2018). This contextual, post-processual approach seeks to understand how quotidian social practices and dynamics (Gifford-Gonzales (2007: 11-12) also invokes Bourdieu's concept of habitus) are manifested in the zooarchaeological record. Ideology, age, gender, the timing and organization of labor, notions of power and prestige, and economic practices variably shape the ways in which humans interact with animals (Gifford-Gonzales 2007; Russell 2010). For example, in keeping with Jochim's (1983) and Keene's (1983) point above, even if the hunting of elk does not maximize biological efficiency, it may still be practiced because of the prestige typically associated with bringing down large game (Russell 2010: 155-156). Conversely, societies that focus on agriculture as their primary subsistence strategy may be less interested in pursuing elk, even if it is energetically cost-effective.

Russell (2010) incorporates animal art and symbolism into this model as well, noting that they can be used to inform zooarchaeological interpretations and vice versa. Mithen (1990) takes a similar view of rock art, emphasizing individual decision making, although his focus is specifically on the Upper Paleolithic and the function of art as a teaching tool for hunting. Nevertheless, elements of these theoretical perspectives are useful to my own analysis of art depicting elk. It is the artist's personal experiences, choices, beliefs, and habitus that influence his or her creation of imagery, regardless of the meaning that is ultimately conveyed to the viewers of said imagery

(Mithen 1990: 197-198). Rajnovich's (1994) review of Canadian rock art also falls within this contextual theoretical framework and informs much of my own interpretation, which is presented in Sections 3.2 and 5.2.

Although it is impossible to truly understand the minds of the prehistoric and early historic peoples here studied, both Mithen (1990) and Rajnovich (1994) propose a series of tests to assess the robustness of potential interpretations. Does it explain all of the given phenomena? Is it compatible with other interpretations and overarching themes? Are there any alternative solutions? Can it be used to make predictions that act as future tests? Mithen (1990: 244) emphasizes that arriving at a single "correct" interpretation is not feasible in this model. However, by considering the social and cultural contexts for which Russell (2010), Gifford-Gonzales (2007), and Rajnovich (1994) advocate, we can approach a fuller understanding of people of the past and their relationships to the animals with which they interacted.

1.3 Methods and Sources

Archaeology—the study of past human cultures through the material remains they leave behind—provides part of the broad framework for my study of prehistoric human-elk interactions. In the western Great Lakes, archaeology usually entails the systematic excavation of sites where humans lived, worked, created, or were buried and the processing of materials (e.g. soil, lithics, ceramics, floral and faunal remains) from such excavations. It is the last category, faunal remains, with which this thesis is primarily concerned. Animal bones may be uncovered, whether whole or in fragments, during the initial excavation, or they may be found later in screening soil samples. Zooarchaeology developed as a subdiscipline of archaeology; it provides

a way for archaeologists to identify and more rigorously study animal remains connected to human cultures. More specific information about how faunal remains from the sites I examined were categorized and analyzed is provided in Section 3.3.

As an initial step toward identifying and analyzing Wisconsin sites at which elk remains have been found, I consulted FAUNMAP. FAUNMAP is an open-access electronic database that uses published primary data to show the late Quaternary distribution of mammals across the United States. It was created by the Illinois State Museum and currently resides on the University of California Museum of Paleontology website. FAUNMAP was developed using funds from the National Science Foundation, first launched in 1994, and last updated in 2003 by Russell Graham and Ernest Lundelius, Jr. It is primarily intended for paleontologists but, since it includes results from up to 500 years ago, has utility for archaeologists as well (FAUNMAP Working Group 1994).

I discuss the specifics of my FAUNMAP search in greater detail in Section 3.3. While I did not expect the results of this search to be comprehensive or provide all the archaeological details in which I was interested, it did provide a list of sites and associated time periods that could be researched further in archaeological publications. Unfortunately, FAUNMAP does not provide direct access to a bibliography for the sites it references, so I was not able to find literature for all of the FAUNMAP sites. I searched articles in *The Wisconsin Archeologist* and other journals, theses and dissertations, and reports of cultural resource management investigations to provide more detailed faunal analysis for a number of the sites on the FAUNMAP list. The majority of this search was conducted through the UWM library database, although I also relied on bibliographies, Google Scholar, and the personal recommendations of my committee members.

As an additional means of finding zooarchaeological elk remains, I started to look through Great Lakes Archaeological Research Center (GLARC) and UWM Cultural Resource Management (CRM) site reports. These reports are bound, boxed, and shelved chronologically in the UWM CRM office. They provide information about location, excavation methods, cultural materials found, and recommendations for the site. Regrettably, their level of faunal identification was insufficient for my analytic goals. Large faunal remains, in the rare instance that they were found at a site, were seldom identified to species. In one or two instances that I encountered, "possible elk" was noted for a piece of bone, but I didn't come across any positive identifications. The amount of time needed to peruse each report and confirm each possible elk identification was judged to be beyond the scope of this thesis. However, it does provide a potential avenue for future research, as a more rigorous analysis of faunal remains from cultural resource management reports could further expand our knowledge of Wisconsin's prehistoric inhabitants, their lifeways, and the animals on which they may have relied.

The GLARC/UWM CRM reports fall into a category conventionally known as archaeological "gray literature," that is, reports of compliance projects that are filed with the state rather than published in the public domain. Such literature can be difficult to access because it is not available in traditional academic avenues such as journals and/or because it lacks a searchable database for specific findings, such as elk remains. I was able to access the GLARC/UWM CRM gray literature through contacting Dr. Pat Richards, the assistant director of the UWM CRM Services, and Megan Thornton, who is the ARL Collections Manager.

The journal articles, books, and other academic publications from which I derived much of my archaeological data are available to the public and can be more easily searched. The major

journal on which I relied, *The Wisconsin Archeologist*, is "the longest continuously published archaeological journal in North America," published biannually by the Wisconsin Archeological Society (Wisconsin Archeological Society 2019). Other journals from which I obtained articles include *American Antiquity*, *American Anthropologist*, *Ohio Archaeologist*, *Ontario Archaeology*, and *Plains Anthropologist*. I also referenced the graduate work of several of my predecessors in the UWM Department of Anthropology, including Edwards (2017), Foley-Winkler (2011), Grimm (2010), Koziarski (2004), Kuehn (1997), McTavish (2019), Saleh (2019), Stencil (2015), and Warwick (2002).

My search for evidence for elk in rock art comprised a review of literature, including but not limited to Dewdney and Kidd's (1962) *Indian Rock Paintings of the Great Lakes*, several articles on Wisconsin rock art by Salzer (1987a, 1987b, 1997), Dudzik's (1995) article on the rock art of Minnesota, and Schrab and Boszhardt's (2016) *Hidden Thunder: Rock Art of the Upper Midwest*. Schrab and Boszhardt, who examine rock art from artistic and archaeological perspectives, respectively, also include the voices of several Native Americans in their book to "provide a stream of continuity from the creators of the art to their living descendants" (2016: 2). Among these is Mike Hoffman (Cīhkwānahkwat), whom I reference regarding the meaning and interpretation of rock art in Section 3.2. With respect to interpretation, I am also indebted to Rajnovich's (1994) *Reading Rock Art*, which incorporates her own archaeological expertise, ethnographic and historical records, and personal communication with people of Native American descent.

Regarding ethnographic and historic sources, which contribute to parts of Chapters 2 and 3 of this thesis, I started by searching several databases: eHRAF World Cultures; Early Encounters

in North America: People, Cultures, and the Environment; and European Views of the Americas: 1493-1750. I also searched the Annual Reports to the Bureau of American Ethnology for references to elk. The authors of these reports—Denig (1930), Densmore (1918, 1929), Dorsey (1894), Fletcher and La Flesche (1911), Hoffman (1896), Jones (1939), La Flesche (1921), and Radin (1923)—largely based their reports on personal experience, ethnographic research, and interviews with Native Americans. La Flesche was himself Native American, a member of the Omaha tribe. Schorger (1982) additionally provided a number of historic sources, presented in Section 3.4.

My overview of early historic tribes in Chapter 3 is drawn from historic sources, e.g. Assikinack (1858), Blackbird (1887), Forsyth (1912), Lahontan (1703), and Marston (1912), and the authors in Trigger's (1978) Volume 15 of *Handbook of North American Indians*. This volume is one of the first of 16 volumes published between 1978 and 2008 by the Smithsonian Institution "to give an encyclopedic summary of what is known about the prehistory, history, and cultures of the aboriginal peoples of North America" (Trigger 1978: xiii). Its authors are anthropologists and academics, nearly all associated with universities or museums in Canada or the northeastern United States (Trigger 1978: 805-806). Because the time period I aim to elucidate here is several hundred years in the past, I have endeavored to choose sources that provide as direct a link to that period as possible. The authors in Trigger's (1978) volume cite and synthesize such early historic sources and ethnographies, which is why this book remains a valuable and valid reference even decades after its publication.

Christian and Johanna Feest, are Austrian ethnologists. Christian studied Native American art and culture starting in the 1960s, with much of his research focusing on the early contact

period. He was associated with the *Museum für Völkerkunde* (Museum of Ethnology) in Vienna in 1978, but he has also taught anthropology and ethnology at several European universities and served as a post-doctoral fellow at the Smithsonian Institution. The Feests' chapter on the Ottawa cites myriad historic sources from contact through the 1960s, including volumes 33, 41, 50-52, 54-57, 59, 61, and 67 of the *Jesuit Relations* (Thwaites 1896-1901), Radisson (1885), Perrot (1864), Bacqueville de la Potherie (1753), and Lahontan (1703).

Charles Callender, who wrote or contributed to a number of the chapters I have cited, was affiliated with the Department of Anthropology at Case Western Reserve University in Ohio starting in 1963. He had previously earned both his M.S. and Ph.D. in anthropology from the University of Chicago and conducted ethnographic research in Egypt. Callender studied Native American culture, especially gender expression and berdache (Two-Spirit) customs. The material I have referenced from his chapter on the Meskwaki comes from Bacqueville de la Potherie (Blair 1911, 1912), Forsyth (1912), and Marston (1912). Forsyth and Marston also provided much of the ethnographic data for Callender's chapter on the Sauk. His chapter on the Illinois draws mainly from Deliette's (1934) observations of the Peoria and Kaskaskia made in the late 17th century and from Marquette's report in volume 59 of the *Jesuit Relations* (Thwaites 1896-1901). For his chapter on the Miami, Callender cited Bacqueveille de la Potherie (Blair 1911, 1912), Gist (1893), and Trowbridge's (1938) account from the 1820s. Callender died in 1986.

James Clifton was affiliated with what was then the Department of Humanism and Cultural Change at the University of Wisconsin-Green Bay. A psychological anthropologist and ethnohistorian, he concentrated much of his studies on Native Americans, writing several books about different tribes and serving as a forensic ethnohistorian in treaty rights cases. He worked

with the Potawatomi in both Canada and Kansas. His chapter on the Potawatomi cites Perrot and Bacqueveille de la Potherie, found in Blair (1911), and volumes 54 and 55 of the *Jesuit Relations* (Thwaites 1896-1901).

Ives Goddard worked in the Department of Anthropology at the Smithsonian Institution. He is primarily a linguist, although his research on Algonquian linguistics also led him to study ethnohistory, and he served as a coeditor of volume 14 of the *Handbook of North American Indians*, Southeast. He has published numerous articles, books, and book chapters on eastern Native Americans and their language from the late 1970s through the present. For his chapter on the Mascouten, he relied heavily on unspecified volumes of the *Jesuit Relations* (Thwaites 1896-1901) and ethnographic accounts in Blair (1911, 1912).

The Milwaukee Public Museum's (MPM) Anthropology Department provided a couple of authors, Nancy Oestreich Lurie and Robert Ritzenthaler. Lurie began her career in the late 1940s and retired from the MPM in 1992. During that time, she taught anthropology at several universities, served as an expert witness on behalf of tribal petitioners in many land claims and related cases, and published extensively on Native American ethnohistory. The material I have cited from her chapter on the Winnebago [Ho-Chunk] comes mainly from Radin (1923) and Bacqueveille de la Potherie (Blair 1911, 1912).

Ritzenthaler preceded Lurie as Curator of Anthropology, having served from 1945 until 1972. He contributed to Midwest archaeology, conducted ethnographic field studies in Wisconsin and elsewhere, and published several books as well as articles in *The American Anthropologist*, *Wisconsin Archeologist*, *American Antiquity*, and the MPM Bulletin. In his

chapter on the southwestern Chippewa (Ojibwe), he cites the *Jesuit Relations* (Thwaites 1896-1901), Warren (1885), and Armstrong (1892).

Richard and Susan Pope both were affiliated with the Department of Anthropology at the University of Saskatchewan. Richard researched and taught about the First Nations of Canada and their experiences post-European contact. He was also an ethnographer who spent time among the Kickapoo in the 1950s. Their chapter on the Kickapoo, co-written with Charles Callender, relied heavily on Dillingham's (1963) thesis, based on fieldwork also conducted during the 1950s. They also relied on fieldwork by Ritzenthaler and Peterson (1956).

Edward Rogers served as the head of the Royal Ontario Museum in the Department of Ethnology. He studied and wrote about the First Nations of Ontario. Bacqueville de la Potherie (Blair 1911, 1912), Lahontan (1905), Perrot (Blair 1911), and Kinietz (1940) provide much of the early ethnographic material reported in his chapter on the southeastern Ojibwe.

Louise Spindler was associated with Stanford University's Department of Anthropology, where she was a lecturer for more than 40 years. Her research was largely concerned with women and cultural change; she published *Menominee Women and Cultural Change* in 1962. She also worked closely with her husband, George Spindler, and the couple served as editors of *The American Anthropologist*. Her chapter on the Menominee draws on a detailed synthesis by Keesing (1939), the *Jesuit Relations* (Thwaites 1896-1901), Perrot's memoirs (Blair 1911), and Hoffman (1896), among other sources.

Regarding elk biology, I referred primarily to Nowak (1999), Thomas and Toweill (1982), and Toweill and Thomas (2002) (a later edition of the previous book). Journal articles from *Acta*

Theriologica, *The American Midland Naturalist*, *Animal Conservation*, *Journal of Wildlife Management*, and *Molecular Phylogenetics and Evolution* are referenced as well.

The database in Appendix A represents the results of my searches for zooarchaeological, biological, and rock art sites in Wisconsin. By "biological," I mean any elk remains that were not associated with an archaeological site and/or that did not have evidence of human modification. I used Microsoft Excel to create the database, with data drawn from numerous journal articles, news articles (for the biological discoveries), theses, dissertations, and books. Appendix B lists the repositories where material from these sites are stored. FAUNMAP provided repository information from some sites, others were noted in the sources I have referenced, and others were provided by Dr. John Richards of UWM. Some needed to be updated to reflect changes in location, as FAUNMAP's data are from 2003. Appendix C provides an additional list of sources for the sites and associated repositories listed in Appendix B, also created with the assistance of Dr. Richards.

A number of the maps presented in this thesis (Figures 3.4, 3.5, 3.10, 3.12, 3.13, 3.14 and 5.1) were created using a template showing Wisconsin counties and major waterways from the State Cartographer's Office at the University of Wisconsin-Madison (2020). The Driftless Area map (Figure 3.4) was adapted from a report created by the United States Department of Agriculture (2012). For mapping rock art sites (Figure 3.5), I relied on Schrab and Boszhardt's (2016: 2) map showing their distribution in Wisconsin. Archaeological sites (Figures 3.10 and 3.12-3.14) were mapped using either images or specific descriptions of locations in their source documents (Anderson et al. 1995; Arzigian et al. 1993; Dietz 1956; Gibbon 1969, 1970; Grimm 2010; Jones 2014; Kreisa 1986; Kuehn 1997, 1998; Leigl 2014; Lippold 1971; Parmalee 1959,

1960a, 1960b; Pillaert 1969; Savage 1978; Stencil 2015; Stevenson 1985; Theler 1989; Theler et al. 2016; Wittry 1959). For some of these, I consulted Google Maps in order to pinpoint exact geographical locations. Figure 5.1 represents a compilation of these archaeological sites, other sites, and historical literature references to elk noted by Schorger (1982).

1.4 Organization of the Thesis

In Chapter 2, I present background information on both elk and humans in the western Great Lakes. The taxonomic classification, behavior, growth, interactions with other species, diet and habitat preferences, historic range, historic abundance, and local extinction of elk are discussed. I also provide a brief background about humans in the region, from Paleoindian through later prehistoric/early historic times. Geographic range and movement, subsistence strategies, belief systems, and cultural connections are among the topics covered.

Chapter 3 is presented in three parts. The first is a review of rock art sites in Minnesota, Wisconsin, and Ontario. I provide background information on the creation and interpretation of rock art as well as offering a few of my own possible interpretations for depictions of elk in petroglyphs and pictographs. The second part is a review of archaeological sites in Wisconsin at which elk remains, including bone, teeth, and antler, have been found. I group sites culturally and temporally—Paleoindian, Archaic, Woodland, Mississippian, Oneota—in order to trace general trends and changes in interactions with elk over time. The third section is a brief review of historic references to elk in Wisconsin between the late 17th and mid-19th centuries.

Chapter 4 brings the focus into the present day, examining the ways in which humans and elk in the western Great Lakes continue to influence one another. First, I discuss recent

reintroduction efforts, which work to return elk to a region from which they had been locally extirpated. Next, I examine several instances in which the discoveries of elk remains have become popular news stories, influenced local communities, and connected people to the past. Finally, I highlight one such discovery, the Silver Beach Elk from Barnes, as an illustration of an elk—more specifically, its skeleton—that generated local pride and provided the impetus for a community to create their own regional history museum.

In Chapter 5, I synthesize my results from two perspectives, one examining ecology and optimal foraging theory, and the other pertaining to social zooarchaeology and culture. I attempt to answer my two primary research questions, concerning where and how humans and elk interacted in the western Great Lakes region in prehistoric and early historic times. A composite map, Figure 5.1, shows archaeological, biological, rock art, and historic records of elk in Wisconsin. I draw conclusions about human and elk ecology including distribution, density, and preferred habitat. I also note changes over time and functional roles filled by elk (or their remains) in daily life, summarizing previous chapters, offering my own interpretations for the patterns observed, and suggesting avenues for future research.

CHAPTER 2: BACKGROUND ON ELK AND HUMANS OF THE WESTERN GREAT LAKES

2.1 Introduction

Before considering the numerous ways in which humans and elk have interacted and influenced each other throughout the history of the Great Lakes region, it is first important to examine the two species individually. The first section of this chapter will attempt to answer the question "what is an elk?" by addressing taxonomy, behavior, growth, diet, interactions with other species, subspecies, historic range, historic abundance, and local extirpations. The second section will present an overview of Native peoples of the western Great Lakes, including their cultural connections, subsistence strategies, movement, diet, and belief systems.

Since my primary focus is on the interactions between humans and elk, which had been nearly exterminated from the western Great Lakes region by the 1850s (Bryant and Maser 1982; O'Gara and Dundas 2002), my examination of human cultures will concentrate on the years prior to the mid-19th century. I refer to these Native American groups in the past tense not because they are limited to the historic or prehistoric record, but because my own concentration is on the past rather than the present. Another aspect of this focus will be a concentration on the relationships between humans and animals/nature, rather than among different human groups. While no culture exists in a vacuum, I recognize that I cannot here do justice to the many complex issues—which have been well-discussed elsewhere (for example, Dion 1991, Hickerson 1970, McNickel 1957, Preston 2009, Washburn 1988, and White 1991, among many others)—relating to human interactions during this time period.

While I had hoped in this thesis to give preference to a more emic perspective by citing Native American authors, I had difficulty in finding sources by indigenous authors that provided

the kind of overview I was seeking. Emic sources that reference elk and their roles in peoples' lives certainly exist, but such references are often embedded in complex cultural contexts and require more time to find and bring together than I was able to devote to research. This, however, suggests another direction for future research; a more thorough review of emic literature and its representation of oral traditions would undoubtedly provide more detailed, personal accounts of human-elk interactions. It would also expand the temporal range of my research further into the Historic period.

Because I still wish to acknowledge the voices of Native peoples and allow them to speak for themselves, I have included links below to current tribal websites I was able to find for the groups mentioned in this thesis:

Assiniboine & Sioux: http://www.fortpecktribes.org/
Ho-Chunk: https://ho-chunknation.com/
Iowa: https://www.bahkhoje.com/
Kickapoo: https://kickapootexas.org/
http://www.kickapootribeofoklahoma.com/
https://www.ktik-nsn.gov/
Menominee: https://www.menominee-nsn.gov/
Meskwaki: https://meskwaki.org/
Miami: https://www.miamination.com/
Ojibwe/Chippewa: http://www.badriver-nsn.gov/
http://www.boisforte.com/
http://www.llojibwe.org/
http://www.redcliff-nsn.gov/
http://www.sagchip.org/
http://www.stcciw.com/
http://www.lvdtribal.com/
http://sokaogonchippewa.com/
https://www.lcotribe.com/
https://millelacsband.com/
https://tmchippewa.com/
https://whiteearth.com/home
https://www.ldftribe.com/
https://www.mnchippewatribe.org/
https://www.redlakenation.org/
https://www.saulttribe.com/membership-services/education/14-membership-services/culture/2318-the-ojibwe-learning-center-and-library
Ottawa & Chippewa: http://www.gtbindians.org/
Ottawa: http://www.ottawatribe.org/

Potawatomi: https://www.potawatomi.org/
https://www.fcpotawatomi.com/
https://www.pbpindiantribe.com/
http://www.pokagon.com/
https://www.nhbpi.org/
Santee Dakota: https://santeesioux.com/
http://www.santeedakota.org/santee_sioux_tribe_of_nebraska.htm
Sauk/Sac & Meskwaki/Fox: http://sacandfoxnation-nsn.gov/

My overview of early historic tribes in this chapter is drawn from the authors in Trigger's (1978) Volume 15 of Handbook of North American Indians. Background information for this volume and its contributing authors is provided in Section 1.3. I also rely on various historic sources, including Assikinack (1858), Blackbird (1887), Forsyth (1912), Lahontan (1703), and Marston (1912).

2.2 Elk

2.2.1 Taxonomy

Carl Linnaeus, the father of modern taxonomy, designated the European red deer as *Cervus elaphus* in 1758. In 1777, German naturalist Erxleben described the Eastern elk of North America, based on a specimen from Quebec, Canada. He called it *C. e. canadensis* (Bryant and Maser 1982; O'Gara 2002; Wilson and Reeder 2005). Three years later, North American elk were elevated from subspecies to species (*C. canadensis*) by Borowski. Caton contested this classification in 1877, claiming that American elk did not warrant species status distinct from their European counterparts. It wasn't until nearly a century later, however, that Ellerman and Morrison-Scott (1951), Jones et al. (1973), and others changed the species name for elk from *C. canadensis* back to *C. elaphus*. The current species name of *C. elaphus* encompasses European

red deer, Asian elk (commonly known as maral, izubr, or wapiti), and North American elk, also called wapiti (Bryant and Maser 1982; ITIS 2020; O'Gara 2002).

KINGDOM: Animalia
PHYLUM: Chordata
SUBPHYLUM: Vertebrata
CLASS: Mammalia
ORDER: Artiodactyla
SUBORDER: Ruminatia
FAMILY: Cervidae
SUBFAMILY: Cervinae
GENUS: *Cervus*
SPECIES: *Cervus canadensis*

Figure 2.1: Nested classification (Bryant and Maser 1982; O'Gara 2002)

More recent genetic analysis has again called this classification into question. Ludt *et al.* (2003), Pitra *et al.* (2004), Polziehn and Strobeck (2002), and Randi *et al.* (2001) all support a phylogenetic distinction between *C. elaphus* and *C. canadensis* based on mitochondrial (maternally inherited) DNA. Lorenzini and Garofalo (2015: 1) also confirm that red deer and elk are "highly differentiated taxa, with genetic distances, divergence times and phylogenetic positions compatible with the rank of species."

Furthermore, North American elk exhibit substantial morphological variation from red deer. While red deer have uniform reddish brown coloration, elk have darker heads, necks, legs, and underbellies in contrast to lighter bodies. Red deer have radially branching antlers; elk antlers exhibit linear branching. Elk also have larger rump patches, smaller tails, and more substantial neck manes than red deer (see Figure 2.2). Both male and female elk have these

manes, which are present to a lesser degree in red deer males alone. Their vocalizations differ as well: bull elk have a distinctive bugle, while the call of red deer bulls could better be described as a roar (O'Gara 2002; Schonewald 1994). Elk also exhibit less sexual dimorphism, with cows approximately three-quarters the size of bulls, whereas red deer cows are only a little over half the size of bulls (Dzieciolowski 1970; Flook 1970). Schonewald's (1994) morphometric analysis supports the conclusion that Eurasian *C. elaphus* are not conspecific with American *Cervus*.

Figure 2.2: North American elk, left (Parker 2007)**, and European red deer, right** (Viatour 2011)

O'Gara (2002: 16) defines species as "groups of actually or potentially interbreeding natural populations that are reproductively isolated from other such groups." Modern European and North American populations are geographically isolated, making reproduction impossible in the wild (Nowak 1999). While they have been known to interbreed in captivity (notably, in an introduced herd in New Zealand), F_1 hybridization is semi-lethal between individuals from clinal extremes, i.e. western Europe and North America (Caughley 1971; Dratch 1986; Schonewald 1994). Finally, the International Union for Conservation of Nature and Natural Resources (IUCN)

also recognizes *C. canadensis* as a distinct species (IUCN Red List 2020). For the above reasons, as well as the increasing popularity of *C. canadensis* to refer to the North American taxon (Cole 2019), I refer to elk as *C. canadensis* in this thesis.

A final note about the nomenclature of elk: it is not only their scientific name that has been debated across many years and multiple continents; their common name has also been a source of some confusion and contention. Early European explorers who encountered the animal now commonly called elk in North America fell into two camps. Some recognized its close relation to European red deer and referred to it as such, or as "stag" or "hind." Others differentiated between the two and used "la Boche/la Cerf," "Cerf de Canada," "Cerfz," "Loshes," "American red-deer," "American stag," "Canada stag," "round-horned elk," or "grey moose" (Bryant and Maser 1982). The ultimate adoption of elk as the common name led to subsequent confusion, as the animal known to Americans as "moose" (*Alces alces*) is called "elk" in Europe. Some effort has been made to promote wapiti, a Native American word possibly meaning "white rump," as a more appropriate common name for *C. canadensis*, but elk has proven to be the more widespread and enduring term (O'Gara 2002). I utilize the common name, elk, throughout this thesis but consider wapiti interchangeable.

2.2.2 Life History

The data in this and the following section are drawn primarily from Nowak (1999), Thomas and Toweill (1982), and Toweill and Thomas (2002) (a later edition of the previous book). The latter two sources draw most of their generalizations from studies and observations of herds in North America. These include the chapters written by Bubenik (1982); Geist (1982, 2002); Cook

(2002); Hudson and Haigh (2002); Miller (2002); Raedeke, Millspaugh, and Clark (2002); and Skovlin, Zager, and Johnson (2002). Notably, Raedeke, Millspaugh, and Clark (2002) draw from numerous studies of elk predation—e.g. Gese and Grothe (1995); Kunkel et al. (1999); Myers et al. (1996); and Singer et al. (1997)—in the western United States, especially in Yellowstone National Park. Singer and Norland's (1994) and Kittam's (1953) observations are also drawn specifically from elk in Yellowstone. Andrews (2013) provides information about elk in Wisconsin from Department of Natural Resources (DNR) elk biologist Laine Stowell, who has been involved in the state's elk restoration program from its inception. In Section 2.2.4, Figure 2.3 shows a map of the current and historic range of elk in North America, with Yellowstone National Park labelled.

While elk are highly gregarious, males and females live in separate herds for most of the year. Females and their calves of both sexes congregate on winter ranges of up to 40 hectares, where they are occasionally also joined by males. More frequently, smaller groups of up to six males make use of a roughly 25-hectare range during the winter months. Summer ranges are more extensive: female groups occupy ranges of 60 hectares on average, and male groups expand to roughly 40 hectares. In each group, a ranked hierarchy is maintained by kicking, chasing, and threatening posturing (Nowak 1999).

Between late January and mid-March, mature males start growing their antlers. The growing period lasts until late summer, during which time the developing antlers are protected by a soft layer of tissue called velvet. Two-year-old bulls, though nearly mature, don't start growing antlers until late April or early May. Their antlers may still be brittle in autumn due to incomplete mineralization. Bulls shed their velvet by September; the antlers underneath are

hardened bone, weighing up to 40 pounds. The shedding of velvet marks the start of the mating season or rut (Hudson and Haigh 2002; Nowak 1999).

Competition among males to amass and maintain a harem of cows during the rut is fierce. Displaying, bugling, and spraying urine are among the courting techniques employed to attract cows. Research shows that cows are more attracted to bulls with larger antlers, which tend to be indicative of sparring success as well as overall health. Harem size varies depending on the charm and prowess of the bull in question, but successful males may defend up to 20 females (Hudson and Haigh 2002; Nowak 1999). Success comes at a cost, however: males frequently sustain serious injuries from each other's antlers, with an estimated five percent dying annually from fighting during the rut. Surviving losers are driven away, but may linger at the margins of the herd in hopes of mating with cows who stray too far (Geist 1982; Nowak 1999).

By mid-October, the rut is over. Males and females again go their separate ways. Throughout the fall, elk will shed their lighter summer coats in favor of a thicker undercoat for the upcoming winter months. This dense undercoat provides insulation; individuals with poor or thin undercoats lose their fat reserves more rapidly. As mentioned above, both sexes sometimes come together in midwinter, but they disperse again in the spring. The thick winter coat is then shed, and a new summer coat grows in (Bubenik 1982; Nowak 1999).

Throughout late May and early June, cows give birth after a gestation of 247 to 265 days, or approximately eight and a half months (Nowak 1999). Seldom is more than one calf born at once; twins are produced only 0.3% of the time (Andrews 2013; Kittams 1953). At birth, calves weigh an average of 30 to 40 pounds. They are able to stand shortly thereafter and can follow their mothers around after three days. By four weeks of age, they can start grazing, but full

weaning does not occur until at least four to seven months after birth. Cows and their calves are fairly solitary in the weeks following parturition (Nowak 1999).

During the first two weeks of its life, a calf will gain approximately two pounds (900 grams) per day (Bubenik 1982). During the day, calves hide while their mothers graze. Although cows return periodically to check on and feed their calves, newborn elk are particularly susceptible to predators such as bears during this time (Geist 1982; Raedeke, Millspaugh, and Clark 2002). By mid-July, cows and calves congregate with other adult females and juveniles of both sexes in large herds (Nowak 1999).

In the wild, a bull elk will live for an average of 14-16 years, a cow for 15-17 years (Bubenik 1982). Elk reach sexual maturity by their third autumn: cows at that age are ready to be bred, but bulls younger than four are seldom permitted to mate. Seven to ten years of age represents the peak of fighting and mating ability for bulls, with success tapering off as they approach old age (Geist 1982; Nowak 1999).

2.2.3 Ecology

Elk employ a cursorial (running) strategy to escape predators (Geist 2002). Coyotes, wolves, black and grizzly bears, and mountain lions have all been known to prey on elk calves (Raedeke, Millspaugh, and Clark 2002). Unlike musk oxen or bison, elk seldom defend their young against predators, with the exception of coyotes (Geist 2002). Wolves and, in the west, cougars represent the most significant predators of adult elk (Raedeke, Millspaugh, and Clark 2002). Both of these predators take out more older and younger elk than human hunters, according to a study in Glacier National Park (Kunkel et al. 1999). Evidence for the hunting of elk by prehistoric

humans is well-documented, and presented in greater detail in Chapter 3. Historically, Caton (1877) reports that mounted hunters in western North America had difficulty keeping up with elk, especially on rocky terrain, but that they were easier to run down on the open plains.

As flexible ruminants, elk are capable of metabolizing grasses, sedges, forbs, browse, and bark (United States Department of Agriculture 1999). In terms of foraging strategies, elk are classified as intermediate feeders. They are able to digest cell walls—the rougher, microscopic parts of a plant—more easily than white-tailed deer, but not as efficiently as bison or cattle (Cook 2002). While they apparently prefer to eat grass, elk are opportunistic feeders and also take advantage of various shrubs and woody browse (Bubenik 1982). They eat grasses and sedges to a greater extent than other cervids, although the exact composition of their diet changes seasonally (Cook 2002; Schorger 1982). "Cervids" refers to members of the family Cervidae, which in North America includes white-tailed deer, mule deer, moose, caribou, and elk.

In the winter, a mixture of grasses, forbs, and shrubs ensures the proper intake of nitrogen (United States Department of Agriculture 1999). Shrubs are important during this time because their protein content is higher than that of grasses. Regardless of nutritional content, the most important factor in winter foraging is accessibility. Snow conditions, especially snow depth, determine what plants are available for elk to eat. Between December and February, elk move to ranges where snow depth is reduced so they have access to the widest possible range of dietary options. Scarcity of food across a landscape is what sometimes causes male and female herds, usually separate, to congregate in midwinter. Accessible forage might be reduced to a few small pockets. During particularly harsh winters, greater snow depths may force elk to take advantage of tall shrubs, conifers, and arboreal lichens (Cook 2002). Yet, as Cook (2002: 302)

states, “the nutritive value of forage on winter range typically is marginal at best, even during relatively mild winters.”

Fortunately, nutrient intake during the rest of the year more than equips most elk to deal with the bleakness of the winter months. Early during the growing season, grasses and forbs have a higher nutritional value compared to other shrubs. Later in the growing season and during the dormant season, they are comparatively lower in quality. Foraging during March through May is likely to be dominated by early-growth plants such as grasses, while June through August may see an increase in the selection of forbs and shrubs. These seasonal shifts in foraging strategies lead to different habitats being more or less suitable to elk at different times of the year. This is especially true during the winter and early spring, when plant resources are at their most scarce (Cook 2002). Table 2.1 below indicates the habitat types most suitable for elk during these lean times.

As the year cycles back into fall, dried grasses and grass regrowth may become more prominent sources of food, but elk still take advantage of other types of plants available to them (Cook 2002). This time of year, which coincides with the rut, represents a dangerous time for bulls for reasons beyond sparring over cows: a male defending his harem devotes little time to eating and may lose up to 20% of his body weight in a few weeks. In order to survive the upcoming winter, he must regain some of this lost bulk. Bull feeding strategies, therefore, are geared toward accumulating a greater surfeit of weight during the summer months, so there will be less of a deficit to make up after the rut. Those that did well over the summer can afford to browse on coarse forage with cows during the fall. Bulls that were not as industrious over the

summer must disperse in order to search for pockets of more nutritious forage (Geist 1982; Hudson and Haigh 2002).

Both elk and moose select shrubs while foraging during the late summer, but there doesn't seem to be significant evidence for competition between the two species (Cook 2002). In fact, elk are seldom in competition for food resources, even with other large ungulates whose diets are similar. Moose eat a much higher percentage of browse and tend to occupy riparian habitats. Deer generally favor browse over grasses as well, while elk do the opposite. Differences in habitat choice also preclude these species from competing: deer prefer foraging in riparian and scrubland environments; elk prefer grassland habitats near the forest edge (Miller 2002).

Elk have the highest chance of competing for food with bison, based on similarities in size, physiology, and habitat selection. Since modern populations of these species are small, with ranges that seldom overlap, studying interactions between them is difficult (Miller 2002). Nevertheless, it seems that bison have a much less varied diet than elk, consuming 99% grasses and 1% forbs in a 1994 study. At the same location (Yellowstone National Park), elk consumed 86% grasses and sedges, 11% forbs, and 3% shrubs (Singer and Norland 1994). A more recent and local study at Nachusa Grassland in northern Illinois found that bison consumed a seasonally-variable mixture of primarily grasses, with some sedges and browse (Blackburn 2018; Saleh 2019).

The ability of elk to utilize a variety of food resources also enables them to adapt to a range of environments. Six subspecies of elk, discussed in greater detail under "Historic Range and Abundance" below, occupied habitats ranging from the dense rainforests of the Pacific Northwest, to the dry chaparral of the Southwest, northern conifer/hardwood and shrub forests,

Rocky Mountains, and Great Plains. As with any animal, elk choose their habitats based on several crucial features: access to food and water, cover (e.g. from predators or adverse weather), and availability. Other factors, such as topography, meteorology, and the avoidance of pests or predators also play a role in habitat choice (Skovlin, Zager, and Johnson 2002). Gilbert and coauthors (2010) used Wisconsin land cover data to analyze different habitat types for suitability in three areas: winter cover, winter foods, and spring foods. Their findings suggest that while some habitat types (e.g. forested wetland, deciduous forest) are more suitable than others (e.g. barren, lowland shrub), a mixture of habitat types would allow elk to optimize resources at different times of the year. Their results, used to identify areas of suitable elk habitat in Wisconsin, are partially summarized in Table 2.1 below. Higher Habitat Suitability Index (HSI) values indicate greater suitability.

Table 2.1: Habitat Suitability Index (HSI) values for Wisconsin (from Gilbert et al. 2010)

WISCLAND Habitat Classes	Winter Cover	Winter Foods	Spring Foods	Average HSI
Grassland	0	0.3	0.7	0.33
Deciduous Forest	0.3	0.9	0.7	0.63
Coniferous Forest	0.5	0.7	0.5	0.56
Mixed Forest	0.3	0.5	0.3	0.36
Emergent Wetland	0	0	0.7	0.23
Lowland Shrub	0.3	0	0.2	0.16
Forested Wetland	1.0	0.6	0.6	0.73
Barren	0	0	0	0
Shrub	0.3	0.2	0.5	0.33

Schorger (1982: 8) writes, “On the Great Plains [the elk] was formerly found intermingled with buffalo. In Wisconsin the elk was most numerous in the open woodlands, oak openings, and at the border of grassland and forest.” The open temperate forests, oak savannas, and

prairies of the upper Midwest were highly suitable elk habitat. For millennia, the region surrounding the western Great Lakes provided suitable habitat, abundant forage, and adequate cover for avoiding predators when necessary. Relationships between human and elk populations were apparently sustainable. The arrival of Europeans on the landscape dramatically altered these factors, as discussed below.

2.2.4 Historic Range and Abundance

Data about elk range and abundance are drawn primarily from Bryant and Maser (1982) and O'Gara and Dundas (2002), both of which synthesize historic documents and first-person reports to reconstruct where elk were found in the past. I also rely on historical accounts including Allen (1871), Brayton (1882), Caton (1877), Hoy (1882), Kirtland (1838), Roosevelt (1905), and Strong (1883).

Elk in North America are traditionally divided into six subspecies: *C. c. roosevelti*, *C. c. nannodes*, *C. c. manitobensis*, *C. c. nelsoni*, and the now-extinct *C. c. merriamimi* and *C. c. canadensis.* Respectively, these subspecies are commonly known as Roosevelt elk, Tule elk, Manitoban elk, Rocky Mountain elk, Merriam elk, and Eastern elk (Bryant and Maser 1982; O'Gara 2002). It is the Eastern elk, which formerly occupied eastern North America including the Great Lakes region, with which this thesis is primarily concerned.

The map on the following page shows both the current and historic distribution of elk in North America. The dark red patches show where elk still live or have been reintroduced. Other patches show the historic extent of the six subspecies of elk in North America. Yellowstone

National Park is marked as a location where many studies of elk (e.g. Gese and Grothe 1995, Kittam 1953, Singer et al. 1997, and Singer and Norland 1994) have taken place.

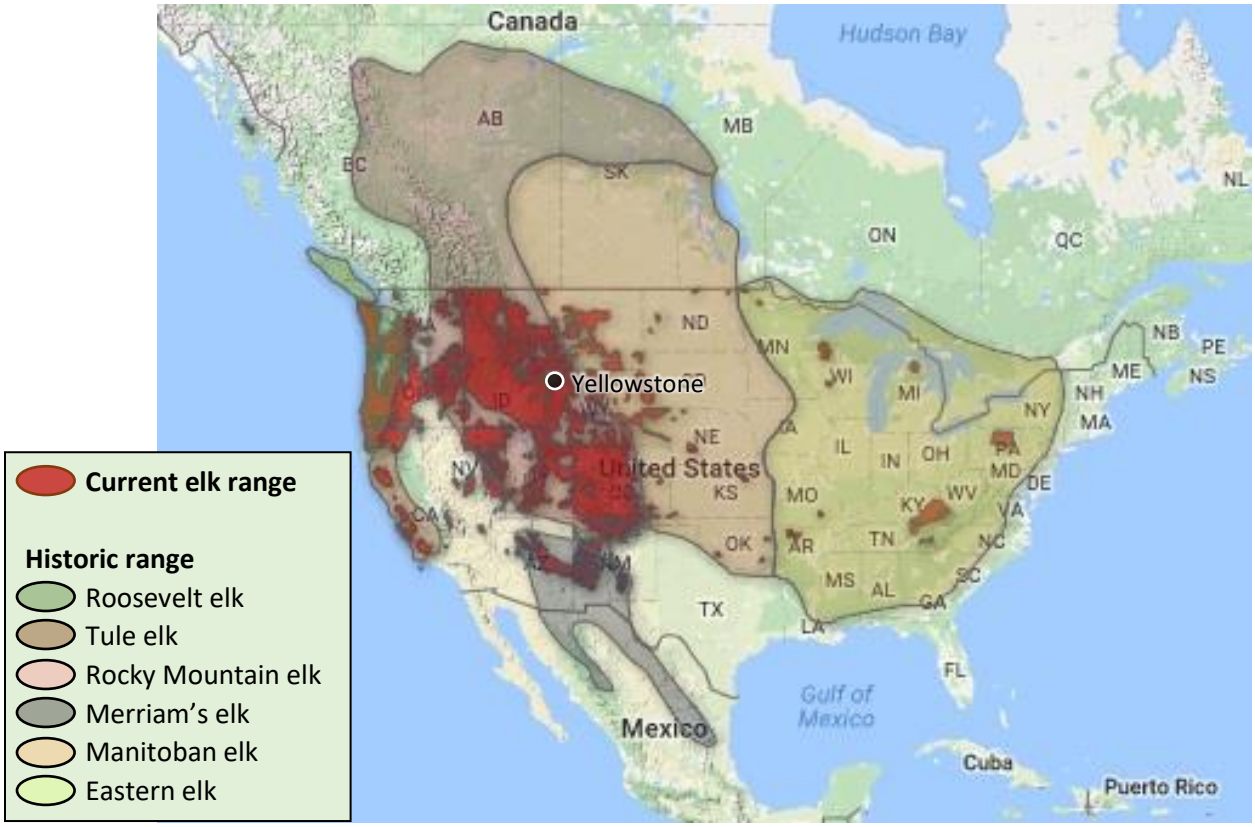


Figure 2.3: Historic and present distribution of elk in North America (Rocky Mountain Elk Foundation 2019)

The Eastern elk type specimen, named by Erxleben in 1777, comes from Quebec (Miller and Kellogg 1955); I was unable to discover where this holotype currently resides. Its historic range encompassed not only southern Quebec and Ontario, but also the eastern United States as far south as North Carolina and as far west as Minnesota, Iowa, and Missouri (Bryant and Maser 1982). While modern state and national boundaries are largely arbitrary compared to the movements of animal populations, they provide a useful framework within which to conduct

research. My focus on the western Great Lakes region encompasses the states of Minnesota, Iowa, Wisconsin, Illinois, Indiana, Michigan, and Ohio, and the province of Ontario.

The North American elk population is frequently cited as being at around ten million individuals prior to the arrival of Europeans (United States Department of Agriculture 1999; McCabe 2002; Seton 1927). Whether or not this estimate is accurate, it is impossible to say what percentage of the prehistoric population was Eastern elk. However, it is possible to examine the extent of their historic range, and the decline of their population. The Eastern elk occupied both mountainous and lowland habitats, ranging from the Alleghenies (Pennsylvania) and upper Appalachians (West Virginia); to the forests surrounding the Great Lakes; the plains and savannas of Indiana, Illinois, and Iowa; and even the canebrakes of the Mississippi bottom in Tennessee (Murie 1951).

Historic references to elk are sometimes difficult to distinguish from accounts of similar animals (e.g. deer or moose) because terminology was not standard among the earliest accounts. Similarities between American elk and European red deer were noted by Europeans, who commonly referred to the former as stag, hind, or cerf (Bryant and Maser 1982). I mention other names given to elk at the end of Section 2.2.1. In many cases, the translators of the original source material, much of which was written in French, are the arbiters of identification. Later accounts, written in English by Euroamericans, make it easier to pinpoint references to *Cervus canadensis*.

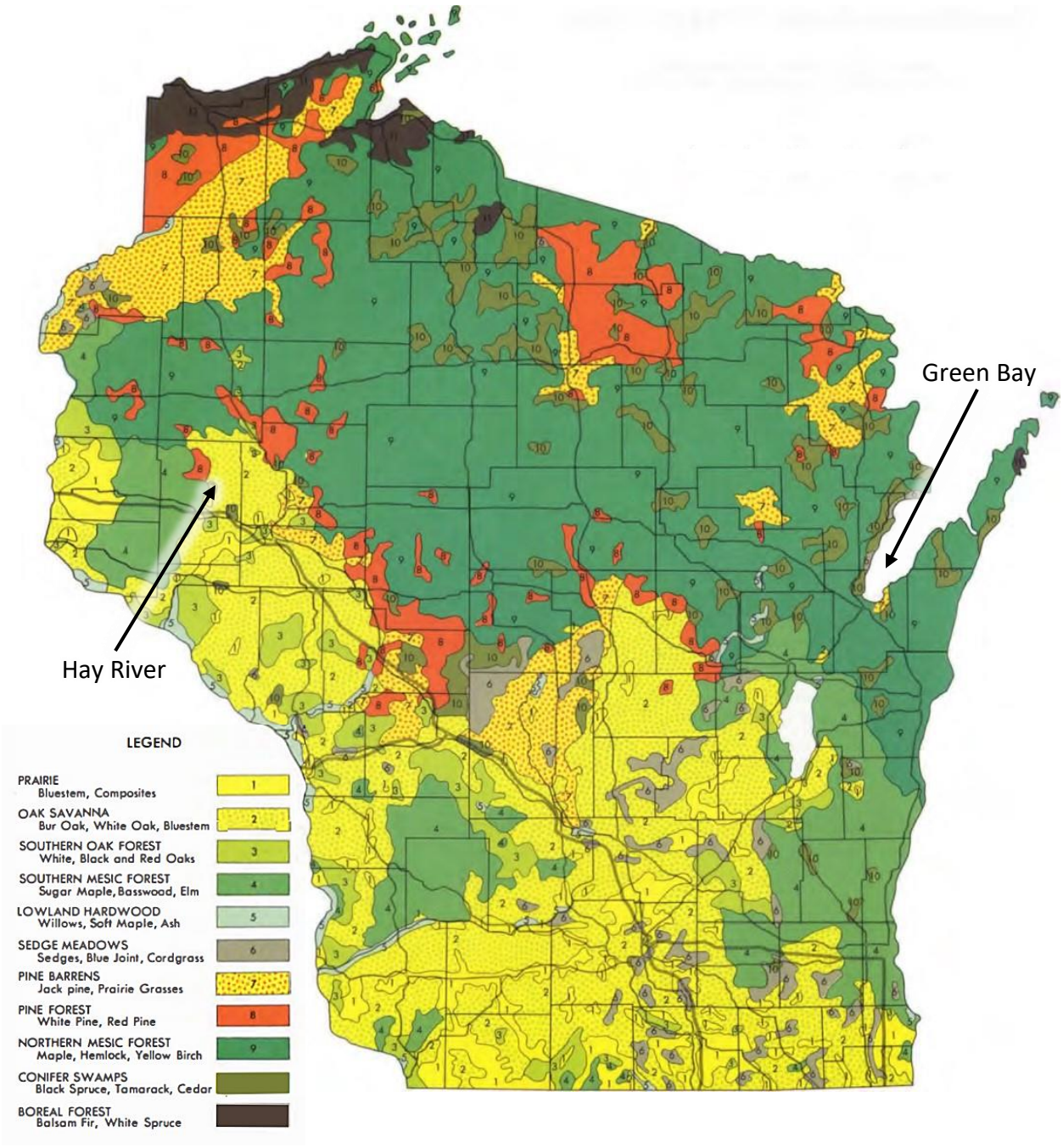


Figure 2.4: Map of Wisconsin vegetation, circa the mid-nineteenth century (Wisconsin Geological and Natural History Survey 1965)

Wisconsin. Historical records indicate the presence of elk in at least 50 of Wisconsin's 72 counties (Bryant and Maser 1982). Schorger (1982) provides an extensive review of written

references to elk in Wisconsin, some of which appear in Section 3.4 of this thesis. A map of these references can be found in Figure 5.1 on page 140. Saleh (2019) discusses the extension of the Prairie Peninsula westward into Wisconsin and its potential effects on bison, which are a primarily grassland-dwelling species. The growth and contraction of the Prairie Peninsula due to climatic shifts during the prehistoric period (Sasso 1993) may also have influenced the distribution of elk populations. Figure 2.4 shows a map of the distribution of different types of vegetation in Wisconsin around the middle of the 19th century, shortly before elk went extinct in the state. Possible interpretations of the correlation between elk distribution and habitat type in Wisconsin are offered in Chapter 5.

Elk were observed near the Hay River in 1863 (Hoy 1882: 256) and in the vicinity of Green Bay as late as 1878 (Brayton 1882: 80). These locations are indicated on the map in Figure 2.4. During the geological survey of 1873-1879, they were reportedly "very rare in northern and central Wisconsin" (Strong 1883: 347). Early in the 20th century, Jackson (1908: 15) noted: "The elk is without doubt now extinct in Wisconsin, but cast-off antlers scattered throughout the lakes, marshes, and woods of northern Wisconsin attest of its former occurrence there."

Minnesota. Elk were once abundant in both the western prairies (Manitoban elk) and hardwood forests (Eastern elk) of the state (Bryant and Maser 1982). Fashingbauer (1965: 105) postulates that they "originally compromised a significant part of the continental elk population." In 1805, Zebulon Pike encountered herds of 150 or more on the west bank of the Mississippi River. Nonetheless, their numbers were declining; a missionary to the Sioux reported that elk had become rare along the Minnesota River in 1834. Six years later, about 2,000 elk were spotted in southern Minnesota, but within the next decade they seem to have disappeared from the

eastern part of the state. Several records from the 1870s and one from the 1890s confirm the continued presence of elk in the far northwest corner. The last native Minnesotan elk is thought to have been killed in 1908 (O'Gara and Dundas 2002). In 1932, a herd of elk were spotted in the northwest corner of the state. These were presumably Manitoban elk that had migrated down from Canada (Bryant and Maser 1982).

Iowa. With the westward expansion of Euroamerican settlers, elk in the Great Plains faced a similar tragic fate as bison. Early settlers reported that elk were plentiful in Iowa, roaming in herds of up to 500 individuals. Elk were an important source of meat to these pioneers, although deer later became a more valuable food resource. In the mid-19th century, elk were killed in numbers far greater than what was needed for food. Allen (1871: 185) reported, "In the severer weather of winter [elk] were often driven to seek shelter and food in the vicinity of settlements. At such times the people, not satisfied with killing enough for their present need, mercilessly engaged in exterminating butchery. Rendered bold by their extremity, the elk were easily dispatched with such implements as axes and corn knives." This apparent slaughter, combined with several harsh winters, rapidly drove the elk population below sustainable numbers (O'Gara and Dundas 2002). The last elk in the state was reportedly killed in 1885 (Bryant and Maser 1982).

Illinois. Elk remains dating from throughout the Holocene have been found in Illinois. Reports of missionaries and European explorers such as Jacques Marquette and Father Gabriel Marest indicate that elk were not uncommon during the early Historic period. The 1820s and 30s continued to provide accounts of elk hunting, particularly in the western and southern parts

of the state (O'Gara and Dundas 2002). Following increased settlement and habitat disturbance in the first half of the 19th century, elk disappeared from Illinois (Bryant and Maser 1982).

Indiana. Elk remains from the late Pleistocene have been found in at least eight counties, and elk are known to have lived throughout the state historically (O'Gara and Dundas 2002). Similar to Illinois, Indiana experienced increased settlement and disturbance, pushing elk out in the early 19th century (Bryant and Maser 1982). The last recorded sighting of elk was in Knox County in southwest Indiana in 1830 (O'Gara and Dundas 2002).

Michigan. Eastern elk formerly occupied the southern peninsula of Michigan, but no recorded sightings in the northern peninsula are known. They were particularly abundant in the heavy pine forests of Tuscola County between 1856 and 1863, where they were said to be as common as deer. Within a few decades, they had become very rare (Bryant and Maser 1982). However, Roosevelt (1905) and Caton (1877) attest to their survival in the northern lower peninsula until the 1870s.

Ohio. Early records give a clear indication of the presence, but not the overall abundance, of Eastern elk in Ohio. They were reportedly common on the Cuyahoga River in 1792 (O'Gara and Dundas 2002). According to Kirtland (1838: 177), "The elk was frequently to be met with in Astabula County, until within the last 6 years, I learn from Col. Harper of that County, that one was killed there as recently as October of the present season." Eastern elk were likely fully extirpated from the state around 1840 (Bryant and Maser 1982).

Ontario. Eastern elk were once present in southern Ontario; the exact date of their extirpation from the province is unknown (Bryant and Maser 1982). No known sightings of elk were recorded by the earliest European settlers in 1832. Much earlier records of elk exist in the

form of verbal accounts and subfossils. Elk were present in southern Ontario during the 18th century according to Native American oral tradition; ancient elk remains have been recovered from at least 16 sites throughout Ontario, some dating to as recently as around 1730 (O'Gara and Dundas 2002).

In short, within the span of 300 years, North American elk went from having a population in the millions to numbering less than 100,000 individuals by the start of the 20th century. While prehistoric Native American populations made their own impacts on the landscape, hunted, and grew crops, the continual presence of elk in the archaeological record as well as in early historic documents attests to the apparent sustainability of the prehistoric human-elk relationship (McCabe 2002). In contrast to the prehistoric period, growing populations of Euroamericans increased the density of humans in the region; they also altered the landscape more dramatically by extensive clearing of forests and native vegetation for farmland. Unregulated hunting, urbanization and habitat destruction, competition with domestic livestock for grazing territory, and westward expansion of increasing densities of human populations all contributed to the eventual decline of elk (United States Department of Agriculture 1999; Murie 1951). The last Eastern elk was allegedly killed by an indigenous hunter in Pennsylvania in November 1867 (O'Gara 2002).

2.3 Native Peoples of the Western Great Lakes

2.3.1 Prehistoric Period

The prehistoric era—defined as the time prior to local written records—is broken into shorter periods or traditions that encompass the rise and fall of different cultural elements.

These traditions can be identified by stylistic changes in material culture preserved in the archeological record, most notably stone tools and ceramics. Changes in subsistence strategies, group size and dynamics, and settlement patterns can also be indicative of different prehistoric traditions, as elaborated below. The data here presented are based on both the archaeological record and the oral traditions of Native peoples pertaining to more recent prehistory. Defining prehistoric periods strictly by calendar years is difficult, as cultural changes do not occur uniformly and simultaneously throughout a region. However, the prehistoric era as a whole can be said to have lasted from over 13,000 years ago, when humans first arrived in the Great Lakes region following the retreat of the glaciers, to the 17th century, when Europeans journeyed into the continent and recorded their observations of the people, animals, and landscapes they encountered (Cleland 1966; Mason 2002).

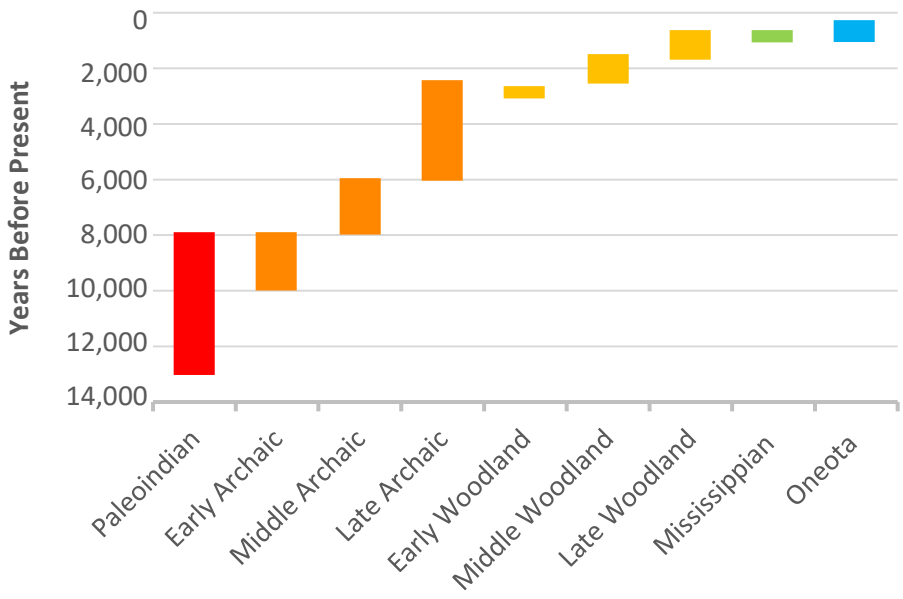


Figure 2.5: Chronological table of prehistoric traditions in the Western Great Lakes
References: Cleland 1966; Gibbon 1998; Koziarski 2004; Schrab and Bozshardt 2016

Paleoindian

The first humans on the landscape were Paleoindians, who traveled in small nomadic groups circa 13,000-8,000 years ago. As the glaciers receded north, they left behind a tundra landscape well suited to mammoth, mastodon, and other large herbivores that the Paleoindians hunted. Climatic shifts approximately 10,000 years ago marked the end of the Ice Age, the extinction of most megafauna in the region, and thus the necessary transition to a new way of life (McCabe 2002; Schrab and Boszhardt 2016). Kuehn (1997) and Mason (2002) note that by about 10,000 years ago, the western Great Lakes landscape already contained many of the same plant and animal communities that were present at the time of European contact, albeit distributed in patchier microhabitat "mosaics."

Evidence for Paleoindians in the archaeological record comes primarily from stone tools and weapons; Clovis style points are among the most distinctive and common fluted points found around the Great Lakes (Mason 2002; McCabe 2002; Schrab and Boszhardt 2016). Some stone points were made from locally or regionally exotic materials. For example, Hixton silicified sandstone was quarried in western Wisconsin but found in projectile points throughout northern and eastern Wisconsin. End scrapers, which were likely hafted in bone, wood, or antler handles, are another commonly-found Paleoindian tool (Mason 2002). Little cultural variation is seen in this time period, which Cleland (1966: 47) partially explains through low population density and "a very specific adaptive pattern."

No sites with clear evidence of elk hunting in the western Great Lakes are yet known, although a broken fluted point embedded in an elk rib was found in northeastern Ohio (Mason

2002: 99), and caribou (*Rangifer* sp.) bones have been found in a fire pit associated with Paleoindian stone tools in Michigan (Cleland 1966: 46). Another site with caribou and other faunal remains was found in southcentral Ontario and dated to 10,000-10,500 years ago (Storck and Spiess 1994).

In general, Paleoindian sites with faunal remains in the western Great Lakes are scarce, but Late Paleoindian sites—those approaching the transition between Paleoindian and Archaic—are the most common. Late Paleoindian/Early Archaic sites represent a cultural interregnum (Kuehn 1997, 1998; Mason 2002). This transitional period is generally placed between 10,000 and 8,000 years ago, or 8000-6000 B.C. (Cleland 1966; Kuehn 1997, 1998; Mason 2002). These sites provide a glimpse into subsistence behavior during a time of cultural change.

Archaic

The Archaic Period followed the Paleoindian Period, lasting from roughly 10,000 to 2,500 years ago. As mentioned above, cultural change is not instantaneous, and the Late Paleoindian Period was something of a cultural interregnum between the Paleoindian and Archaic Periods, hence there is some temporal overlap between them. Although Archaic peoples still relied on hunting and gathering, they transitioned to a slightly less nomadic lifestyle, congregating near resource-rich rivers and streams during the summer. During the cooler months, they dispersed to more sheltered hunting camps (Mason 2002; McCabe 2002; Schrab and Boszhardt 2016). Human population densities remained low during the Early Archaic but increased during the Late Archaic (Mason 2002).

Early during the Archaic Period, a prolonged drought drove herds of *Bison occidentalis* eastward into central Wisconsin. During the Middle Archaic period, elk and deer became the primary large game species due in part to the resurgence of oak savanna after the drought (Schrab and Boszhardt 2016). Archaic peoples also adapted their subsistence strategies to take advantage of generally smaller and more forest-dwelling fauna (Cleland 1966). Spear points from this period reflect these changes, transitioning from notched or stemmed points with barbed shoulders, to those with side notches (Cleland 1966; Mason 2002; Schrab and Bozshardt 2016).

While the Early and Middle Archaic show high degrees of cultural continuity in the western Great Lakes region, the Late Archaic appears to be the earliest period in which regional adaptions blossomed (Cleland 1966). The "Old Copper Culture" was predominant in Wisconsin, with various tools made out of almost-pure copper: projectile points, knives, awls, ax and hatchet blades, fish hooks, celts, ornamental items, and more (Mason 2002: 181-182). By the end of the Archaic Period, chipped stone points were relatively small, but spear throwing was improved with carved weights called banner stones. Also by that time, more constricted territories, cemeteries, gardens, and woodworking tools such as axes, adzes, and gouges began to appear (Cleland 1966; Mason 2002; McCabe 2002; Schrab and Bozshardt 2016).

Chipped stone tools continued to be used to hunt large game animals such as elk, deer, and caribou (Mason 2002; Oswalt 1966). McCabe (2002: 123) observes that, "Boreal Archaic Indians may have been the first people to hunt elk to any great extent, and they are known to have hunted with spears or *atlatls* [throwing sticks] with flint points fluted on one or both sides." A flint point embedded in an elk bone was found in Logan County, Ohio, and is among the earliest

known instances of elk hunting in the Great Lakes region, dating to the time of the Boreal Archaic Indians (McCabe 2002).

Woodland

Lasting from approximately 3,000 until 1,000 years ago, the Woodland Period is marked by the introduction of pottery making, the expansion of gardening, and the transition to a more sedentary way of life (Cleland 1966; Lippold 1971; Mason 2002; McCabe 2002; Schrab and Boszhardt 2016). People during this time continued to rely on hunting, but they lived in villages, some of which remained occupied for generations, instead of following their ancestors' more nomadic lifestyle. Some groups lived in one place year-round and began planting corn around A.D. 950 (McCabe 2002; Schrab and Boszhardt 2016). Hafted points again changed: they grew larger with heavier stems, while banner stones disappeared from the archaeological record. The Late Woodland Period also saw the introduction of the bow and arrow in the upper Midwest, which improved deer hunting, possibly to the extent that it led to a human population increase. Overall, projectile points grew smaller over time (Mason 2002; Salzer 1997; Schrab and Boszhardt 2016).

Group territories were more clearly delineated, with earthen burial mounds erected in some places, including southern Wisconsin. Similarly, dome-shaped mounds containing pipes, pots, and other trade goods were constructed near summer villages. These objects reflect exchange with the Hopewell phenomenon, a vast trade network, and the rise of an artistic class. Although the Hopewell phenomenon ended around A.D. 400, the construction of round mounds persisted, as did the hunting, gathering, and creation of small gardens that defined Woodland

subsistence. Thus the "Effigy Mound" tradition in Wisconsin is folded into the Woodland period (Lippold 1971; Schrab and Bozshardt 2016).

Zooarchaeological studies of this time show that Woodland peoples were proficient hunters of deer, elk, and raccoons (McCabe 2002: 123). Yet overall, subsistence activities from this period seem more varied than from earlier times; fishing, trapping, gardening and the gathering of wild plants all contributed to a diffuse economy. Faunal remains show a diversity in subsistence strategies among different sites as well. Some contain a preponderance of fish bones, while others indicate a focus on large game. Agriculture also expanded during this time, as a warmer period between A.D. 800 and 1200 facilitated the cultivation of corn further north than had previously been practical (Cleland 1966).

Mississippian

The Mississippian period was a time of cultural change throughout the Midwest, including Wisconsin. Societies often showed greater political and social complexity than those of previous periods. Group territories were increasingly disputed, but interactions among groups also showed the sharing of ideologies and goods (Green 1997). Mississippians produced tools, pots, and figurines that were widely traded; they were also the first to intensively farm corn in the Midwest (Cleland 1966; Green 1997; Schrab and Bozshardt 2016). Mississippian cultures can be divided regionally between Middle and Upper Mississippian (the latter of which includes the Oneota cultural tradition, discussed below).

Middle Mississippians shared numerous artistic and cultural traits with peoples further south. The Cahokian culture in southwestern Illinois rose to prominence around A.D. 1050, and

though Wisconsin was outside of Cahokia's direct political control, it was not outside of its wide network of trade and cultural influence. Effigy mound construction ended during this period, and many villages show a blend of Woodland and Cahokian influences (Cleland 1966; Green 1997; Schrab and Bozshardt 2016). Green (1997: 204) explains, "Peoples in the hinterlands [i.e. Wisconsin] adopted, emulated, or obtained in trade short-lived art styles—principally pottery form and decoration—that probably originated in the American Bottom." Meanwhile, Upper Mississippian societies, although they share some characteristics with Middle Mississippians (Hall 1986), more likely developed out of Late Woodland cultures (Boszhardt 2004; Gibbon 1980; Jeske 1992; Richards and Jeske 2002; Theler and Boszhardt 2006).

Several regional adaptations arose during the Mississippian period. In Illinois, Indiana, Ohio, and southern Wisconsin, Michigan, and Ontario—areas where corn production was effective—large villages with relatively stable residences could be found (Cleland 1966). Aztalan in southeastern Wisconsin is one example of the expansive Woodland/Mississippian sites that developed during this time (Leigl 2014; Parmalee 1960a; Richards 1992; Warwick 2002). Further north, where corn production was not as efficient due to less favorable environmental factors, were smaller lakeshore villages. People in this zone—what Cleland (1966) refers to as the Carolinian-Canadian transition zone—relied more heavily on hunting and fishing for their subsistence, and only marginally on corn agriculture. Villages were occupied during the summer; during the winter months, groups dispersed into small hunting bands (Cleland 1966).

In far northern Wisconsin, Minnesota, and Michigan, and parts of Ontario (the Canadian biotic province), hunting, gathering, and fishing remained the staples of the subsistence economy. Agriculture was impossible, and bands were much more mobile, congregating on

lakeshores in the summer and dispersing to pursue moose, caribou, and other game throughout the colder months. In the three respective zones, these subsistence strategies represented basically an intensification of those developed during earlier periods (Cleland 1966).

Oneota

The Oneota period represents the most recent prehistoric tradition in the western Great Lakes. Because there are many phases, varying both spatially and temporally, within the Oneota tradition, it can be difficult to define. As part of the Upper Mississippian cultural tradition, it overlapped temporally with some Middle Mississippian and Late Woodland cultures. Conflict was more prevalent during this time, and Oneota settlements faced both physical and social stress (Karsten et al. 2019). Foley-Winkler (2011), McTavish (2019), Edwards (2017), Jeske (1999, 2000, 2003), among others, examine the conflicts and pressures faced by Oneota and contemporaneous peoples in eastern Wisconsin.

Ceramics, usually shell-tempered, are considered the most diagnostic artifacts in identifying Oneota sites. Other Oneota material culture includes pipes and inscribed tablets carved from Minnesota catlinite (pipestone), bison scapula hoes, small unnotched projectile points, grooved sandstone abraders, and snub-nosed endscrapers (Gallagher and Stevenson 1982; Jones 2014; Saleh 2019; Schrab and Bozshardt 2016; Stevenson 1985; Wilson 2016).

Subsistence was varied; corn cultivation continued, but its contribution to diet differed among localities, and a diversity of wild foods were gathered (Jones 2014; Karsten et al. 2019; Schrab and Bozshardt 2016; Stevenson 1985). Numerous Oneota sites are located near riverside bluffs or lakeshores, facilitating the exploitation of a wide range of both marshland and upland

species (Brown 1982). Permanent or semi-permanent villages, frequently reoccupied over many years, comprise many of these sites (Stevenson 1985). Between the Missouri River and Lake Michigan, several large Oneota villages were clustered. French explorers and missionaries encountered some of these villages in the 17th century, marking the start of the historic era in Wisconsin (Schrab and Bozshardt 2016).

2.3.2 Early Historic Period

During the late prehistoric and early Historic period, many of the tribes known today arose or moved into the western Great Lakes region. Like the peoples who came before them, they tailored their subsistence strategies to their environments. The western Great Lakes was neither a cultural nor an ecological monolith, although many similarities existed among the economic and social practices of different groups.

Hunting, fishing, gathering, and gardening were practiced in varying proportions by almost every tribe in the region (Trigger 1978). Figure 2.6 gives an overview of regional subsistence strategies, including the animals and plants most frequently exploited for food. Tanner (1987: 18-23) relied primarily on Cleland (1966, 1982), Jenks (1900), Rostlund (1952), and Yarnall (1964) in the creation of this map and associated discussion of subsistence strategies. Although elk seem not to have been hunted as frequently as deer or, west of the Mississippi, bison, they were an important big game species throughout the region (see Section 3.3 for more information about hunting and species preference).

Figure 2.6: Subsistence patterns in the western Great Lakes (Tanner 1987)

The Ojibwe are an Algonquian-speaking people culturally related to the Cree, Potawatomi, and Ottawa. With the latter two, they share a common ancestry and are known as the Anishinaabeg (Benton-Banai 1988; Clifton 1978; Feest and Feest 1978; Ritzenthaler 1978; Rogers 1978). Originating along the northern shores of Lakes Huron and Superior, the Anishinaabeg expanded throughout the 17th, 18th, and early 19th centuries. The Ottawa, Potawatomi, and southeastern Ojibwe made their home primarily in the lower peninsula of Michigan and southwestern Ontario, although the Potawatomi relocated around 1641 to the

Door Peninsula of Wisconsin (Clifton 1978; Feest and Feest 1978; Ritzenthaler 1978; Rogers 1978). The southwestern Ojibwe, also known as the Chippewa, lived throughout northern Wisconsin and Minnesota and relied more on wild rice than gardening for their subsistence (Hickerson 1962; Ritzenthaler 1978).

The Menominee are another Central Algonquian-speaking group, although their language is not closely related to others in the subgroup. Their precontact territory in northeast Wisconsin was bordered by Green Bay, Lake Michigan, and Lake Superior, and their reservation today is located in this ancestral homeland (Spindler 1978). Other Algonquian tribes with closer cultural and linguistic ties include the Kickapoo, Mascouten, Meskwaki, and Sauk. Unlike the Menominee, the Kickapoo moved frequently and extensively. Their prehistoric homeland was west of Lake Erie, but between the 17th and 19th centuries, they moved northwest into Wisconsin, then south into Illinois and Indiana, and finally west across the Mississippi (Callender, Pope, and Pope 1978). While the Mascouten were a distinct group, their amalgamation with the Kickapoo circa 1800 has somewhat obscured them in the historical record. Tradition places their precontact territory in the southwestern quadrant of the lower Michigan peninsula, west of the other three tribes just mentioned (Goddard 1972, 1978).

In prehistoric times, the Meskwaki (identified in many historic records as the Fox) are thought to have occupied southern Michigan and/or northwestern Ohio. Early historic accounts place them in northeastern Wisconsin, in a territory centered on the Wolf River, although they eventually relocated to Iowa along the western bank of the Mississippi River (Callender 1978a). Though closely related and treated as a single unit by the United States government, the Sauk (Sac) are culturally and historically distinct from the Meskwaki; for example, they exhibited more

northern traits such as the use of canoes (Callender 1978d). According to tradition, the prehistoric Sauk dwelt in Michigan's Saginaw Valley (Goddard 1978; Marston 1912). They resided in northern Wisconsin at the time of contact (Goddard 1978).

The Miami were consistently associated with the Mascouten and Kickapoo, but they were more closely related to the Illinois, who were themselves comprised of several independent tribes with a shared language, culture, and tradition of common origin (Callender 1978b, 1978c). During the immediate pre-contact and early contact period, the Miami occupied land around the southern tip of Lake Michigan, from the St. Joseph River around to northern Illinois and southeastern Wisconsin. Early in the 18th century, they relocated further south to the Wabash River drainage (Callender 1978c). At the first recorded European contact in 1673, the Illinois inhabited a vast territory. Some tribes were centered along the Mississippi and Illinois Rivers, spread through western Illinois, eastern Iowa and Missouri, and as far south as northern Arkansas. The upper reaches of the Illinois River, near Starved Rock in northcentral Illinois, was another cultural center (Callender 1978b).

In Wisconsin, the tribe historically known as the Winnebago call themselves the Ho-Chunk, roughly translated as "people of the parent speech" or "great voice" (Lurie 1978: 706). They speak a Siouan language similar to the Chiwere language spoken by the Missouri, Iowa, and Otoe, with whom they are believed to share a common origin. According to tradition, the three western tribes relocated, leaving the Ho-Chunk behind in Wisconsin. The Ho-Chunk also shared a common, though more distant, linguistic heritage with the Dakota. The Ho-Chunk's origin story places their creation at "red banks." While some sources point to this being a specific location on Green Bay, other locations in Wisconsin have also been proposed. The Ho-Chunk did live in a

somewhat restricted area in east central Wisconsin, near Green Bay, at the time of contact (Lurie 1978).

Tribes in the western Great Lakes made use of wild and domestic plants, and terrestrial and aquatic animals, in their diets (Trigger 1978). The Ottawa are even known to have gathered a type of edible lichen, used as emergency rations (Feest and Feest 1978). At the agricultural end of the spectrum are the Ho-Chunk, who were distinct among their neighbors as being more sedentary and heavily reliant on cultivated crops. As pressure from the fur trade increased in the Historic period, they continued to rely on their gardens, "looking with disdain on the Ojibwa who depended primarily on the hunt and uncertain harvests of wild rice" (Lurie 1978: 692). The Potawatomi, Ottawa, Mascouten, Kickapoo, Meskwaki, Sauk, Menominee, Miami, and Illinois also maintained gardens to some degree. Corn, squash, and beans were the most common crops; the Meskwaki and Illinois also planted pumpkins and melons, the latter having been introduced from Europe (Callender 1978a, 1978b, 1978c, 1978d; Callender, Pope, and Pope 1978; Clifton 1978; Feest and Feest 1978; Goddard 1972, 1978; Spindler 1978).

For most tribes, the practice of horticulture necessitated a seasonal subsistence cycle, in which summers were spent tending to crops in permanent or semi-permanent villages, often on riverbanks or lakeshores. Wild plants, including berries, choke cherries, plums, grapes, tubers, beeswax, honey, nuts, and milkweed, could also be collected during the warmer months and preserved for storage and later use. One particularly important plant resource for the Ojibwe, Potawatomi, and Menominee was wild rice, which was harvested in the fall. It was especially valued at northern latitudes where gardening was impractical. Another exciting "harvest," taking place in the early spring, was the collection of maple sap. The Anishinaabeg and Menominee

used the resulting maple sugar to season a variety of dishes and drinks (Callender 1978a, 1978b, 1978c, 1978d; Callender, Pope, and Pope 1978; Clifton 1978; Feest and Feest 1978; Lurie 1978; Ritzenthaler 1978; Rogers 1978).

Gardening and gathering were tasks primarily entrusted to women, while men were responsible for most of the hunting and fishing (Callender 1978a, 1978b; Feest and Feest 1978). Tribes with access to prairie habitat, including the Ho-Chunk, Potawatomi, Kickapoo, Menominee, Mascouten, Meskwaki, and Illinois, undertook seasonal communal bison hunts. Deer were also sometimes hunted communally, although they could usually be taken closer to villages, as opposed to bison, which some groups crossed the Mississippi to hunt. Other animals—elk, beaver, bear, wildfowl, turtle, moose (at northern latitudes, as seen in Figure 2.6), mountain lion, lynx, wolf, fox, raccoon, and various other small to mid-sized mammals—were hunted by individuals or small groups (Callender 1978a, 1978b, 1978c; Callender, Pope, and Pope 1978; Clifton 1978; Feest and Feest 1978; Goddard 1972, 1978; Lurie 1978; Ritzenthaler 1978; Rogers 1978; Spindler 1978). A boy's first kill could be a special occasion, celebrated with a ritual feast. In some instances, a man was not able to marry until he had proven his hunting ability (Callender 1978b; Callender, Pope, and Pope 1978; Forsyth 1912; Spindler 1978).

In keeping with the seasonal subsistence cycle, people usually spent the colder months in sheltered hunting camps away from their summer villages. During the winter, Ho-Chunk hunting parties traveled west and sent fresh meat back to their camps via snowshoed runners, who then returned with dried vegetables from the summer stores. For some tribes, fishing was also a seasonal activity. The Ottawa continued to rely on spring and autumn fishing even as they developed a greater focus on cultivated crops. Fishing was in general an important subsistence

strategy for the Anishinaabeg, especially for more northern groups, who sometimes practiced ice hole fishing as well. Some gathered annually near Sault Ste. Marie for summer fishing drives (Callender 1978a, 1978b, 1978c; Callender, Pope, and Pope 1978; Clifton 1978; Feest and Feest 1978; Goddard 1972, 1978; Hickerson 1970; Lurie 1978; Ritzenthaler 1978; Rogers 1978; Spindler 1978).

Other tribes, although they did not reside in the western Great Lakes region during the Historic period, previously lived in or passed through the area, and so are worth mentioning here. Some are thought to have descended from Wisconsin Oneota who relocated across the Mississippi River (Anderson et al. 1995; Saleh 2019; Sasso 1993). Among these are the Assiniboine, the Iowa, and the Santee Dakota. Historical records from the 1650s place the Assiniboine within 100 miles of Lake Nipigon, just north of Lake Superior, and further north and west. The bulk of their territory was reportedly in Manitoba and Saskatchewan, but they came to the lake to trade with the French (DeMallie and Miller 2001). Other sources indicate that the Assiniboine migrated out of the Whitefish Bay area in Ontario, under pressure from the Ojibwa, circa 1700 (Dewdney and Kidd 1962). The Iowa, according to oral tradition, split from an ancestral group in the vicinity of Green Bay, where their linguistic relatives, the Ho-Chunk, remained. At the time of contact, the Iowa had mostly relocated to the central and eastern regions of the state that today bears their name (Wedel 2001). While the Santee Dakota are neither a politically cohesive nor culturally uniform group, they are the descendants of four Sioux tribes who occupied southern Minnesota in the late 1600s. Over the next century, they consolidated their territory in southern Minnesota and adjacent regions of Wisconsin, Iowa, and South Dakota (Albers 2001).

These tribes were less sedentary than their neighbors to the east; they relied more on hunting and gathering on the prairies. Bison, deer, elk, bighorn sheep, antelope, wolf, fox, grizzly bear, and numerous other animals were available. The Santee Dakota, whose territory spanned a range of ecological zones, practiced more Woodlands traditions in some places and in others followed their Plains neighbors and hunted on horseback. A nomadic foraging lifestyle was predominant, with bison, deer, waterfowl, fish, and other animals pursued, and wild rice, fruit, beans, tubers, and nuts gathered (Albers 2001; DeMallie and Miller 2001; Wedel 2001).

Overall, subsistence strategies across the region shifted over time. Hunting and gathering cultures shifted to hunting, gathering, and farming, with decreased dietary reliance on hunting as time went passed. This was especially true at more southern latitudes, where the growing season was longer (Cleland 1966; Mason 2002). Figure 2.6 demonstrates the generally greater emphasis on hunting in the north and greater reliance on cultivated crops in the south (Tanner 1987).

Before closing this chapter, it seems worthwhile to reflect briefly on the ways in which animals were important to people, as Russell (2010: 1) says, "beyond protein and calories." For example, in some cases there is evidence for how elk were linked conceptually to a sense of time and season. Among the Sauk and Meskwaki, Forsyth (1912) reports, the "Elk Moon" corresponds with the month of August and the "Rutting Moon" with October. Another role played by animals was clan totems. Clans served as (frequently patrilineal) conceptual kin groups and were considered under the protection of the animal or spirit for which they were named. The specific roles of clans varied from tribe to tribe. They might be responsible for keeping sacred bundles, performing ceremonies, regulating exogamous marriages, governing the inheritance of political

offices, overseeing rituals, and governing the taboos and duties of the clan. Among the Ottawa, Potawatomi, Meskwaki, Sauk, Miami, and Ho-Chunk, each clan was also responsible for a stock of ancestral names that were bestowed at birth or one year of age (Callender 1978a, 1978b, 1978c, 1978d; Callender, Pope, and Pope 1978; Clifton 1978; Feest and Feest 1978; Goddard 1978; Hickerson 1970; Lurie 1978; Morgan 1959; Ritzenthaler 1978; Spindler 1978; Trowbridge 1938). When the Anishinaabeg signed documents with the French, they used their *nindoodem* (clan) symbols (Bohaker 2010). While the Ottawa are not reported to have had an Elk clan, the elk or moose was seemingly the totem of the Ottawa as a whole (Assikinack 1858; Blackbird 1887; Feest and Feest 1978; Lahontan 1703). The Meskwaki, Ho-Chunk, Kickapoo, and Sauk all had Elk clans (Callender, Pope, and Pope 1978; Forsyth 1912; Lurie 1978; Marston 1912).

In addition to being clan guardians, animal spirits could also be the guardians of individuals. The vision quest was an important ritual undertaken by boys, and sometimes girls, at puberty. Its exact format varied from tribe to tribe, but the general structure consisted of a period of fasting, for which the child had trained, and isolation during which he or she prayed to receive a dream from a guardian spirit. The spirit, usually represented by an animal, would offer its guidance, protection, power, and patronage through the dream (Callender 1978a, 1978b, 1978c; Feest and Feest 1978; Ritzenthaler 1978; Spindler 1978). Among the Southeastern Ojibwe, after receiving this vision, the boy would kill a member of the animal species that had blessed him. Part of the animal would then be displayed in his family's lodge, and a feast would be given in its honor (Rogers 1978). A somewhat different guardian spirit relationship existed among the Menominee. Individuals relied on their personal guardian spirits for power—

strength, energy, and spiritual influence—and in return were under certain obligations to them (Spindler 1978).

2.4 Conclusions

Humans and elk have lived in the western Great Lakes region for thousands of years, adapted to its environments, and impacted one another. Both populations developed subsistence strategies to deal with the region's intense seasonal shifts in climate. Both also underwent extreme changes within the first few centuries of European contact, and yet have persisted. This chapter laid out, in relatively broad strokes, how, where, and when elk and indigenous peoples lived in prehistoric and early historic times. It is already made clear regarding two of the main ways in which elk were valued: as sustenance (via hunting) and as symbols (via clan names and guardian spirits). In future chapters, I will examine specific archaeological and artistic evidence for the importance of elk in the daily lives of western Great Lakes peoples.

CHAPTER 3: THE ARCHAEOLOGICAL AND HISTORIC RECORD

3.1 Introduction

This chapter deals primarily with the tangible remains of human-elk interactions, from the carvings and paintings depicting elk dotted across the landscape in the form of rock art, to the bones left behind in the archaeological record, to historic documents that record elk sightings. My literary survey of archaeological sites and historic records is restricted to Wisconsin. Rock art examples are drawn from a wider scope: Wisconsin, Minnesota, and Ontario.

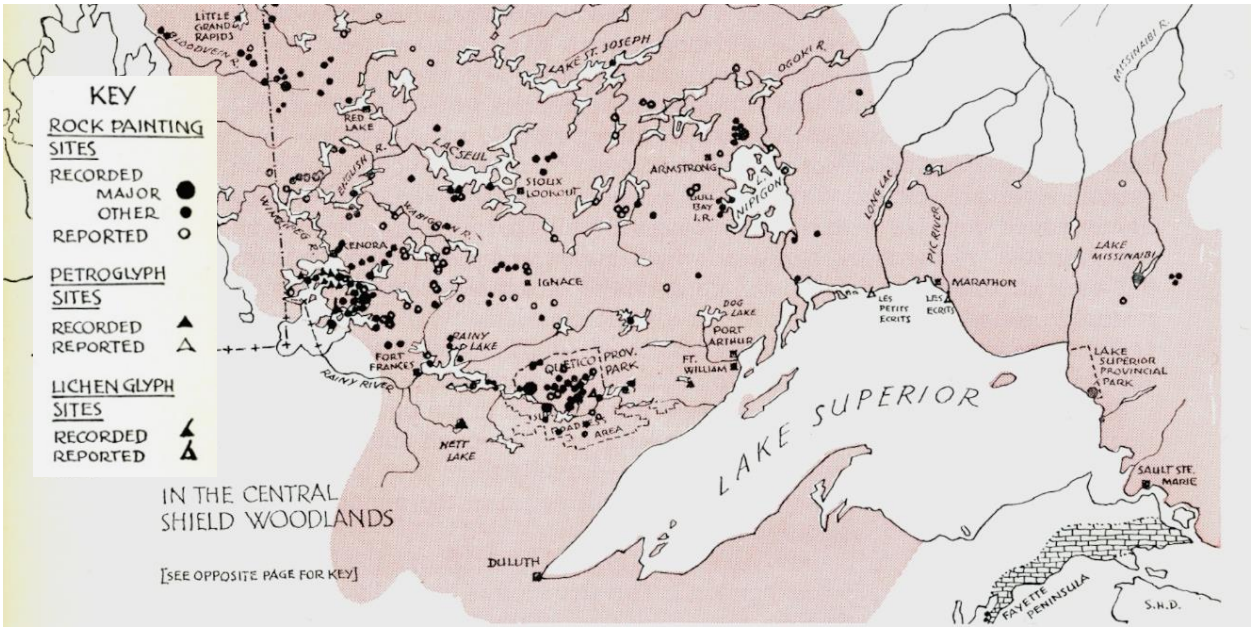


Figure 3.1: Rock art sites of the southwestern Canadian Shield and northern Minnesota (Dewdney and Kidd 1962)

3.2 Rock Art

Rock art encompasses a vast artistic tradition found the world over in various forms and styles, from the cave paintings of Lascaux, France, to the distinctive aboriginal art of Australia.

The western Great Lakes region has its own rich history of rock art, including petroglyphs, pictographs, and petroforms. Petroglyphs, or rock carvings, are images that have been scraped, abraded, pecked, or incised on non-portable rock surfaces such as bluffs or cave walls. Pictographs are images composed of natural pigment painted, drawn, or otherwise applied on such surfaces. Petroforms are composed of boulder or stone outlines arranged on the ground in some shape, whether animal, human, or symbolic (Dudzik 1995; Grant 1967; Salzer 1997).

For Native peoples of the western Great Lakes, rock art sites have great significance as "sacred and spiritual places" (Hoffman 2016: xi). Mike Hoffman (Cīhkwānahkwat), a Menominee and Ottawa descendent, explains, "The theme is basically the same throughout: respect for Creation and the Creator (Great Spirit and Father of All)" (Hoffman 2016: ix). Pictographs in this region may be as many as 2000 years old, while petroglyphs likely postdate A.D. 900, but for the most part, rock art in the Midwest cannot be dated with any precision. Attempts to date pigments have been largely unsuccessful, as discussed below. Patination and weathering are similarly unreliable in the region due to climate and humidity (Dudzik 1995; Rajnovich 1994; Salzer 1978a).

Both pictographs and petroglyphs may be small isolated designs or large complex scenes, and they may occur together at the same site (Dudzik 1995). In some cases, rock art is found with stratified archaeological sites, e.g. in caves, and ages can be estimated based on association (Salzer 1987a, 1987b, 1997; Schrab and Boszhardt 2016). Petroforms are also considered a form of rock art and date from Woodland through early historic times, but they are generally too stylized to confidently identify to species; therefore I do not discuss them further here (Dudzik 1995; Peet 1890).

Before delving into various examples and interpretations of elk in Great Lakes rock art, it is first useful to consider the places chosen for its placement and the ways in which it was created and viewed. As previously mentioned, rocky surfaces such as outcrops, bluff faces, caves, and rock shelters served as the primary canvas for this form of artistic expression (Dudzik 1995). Vertical rock faces, often limestone and even more often adjacent to a body of water, comprise most of the known rock art sites in the region. Cliff paintings frequently occur two to five feet above the water level. Artists could access these sites via canoe, or by walking across the ice in winter (Coles 1991; Dewdney and Kidd 1962; Grant 1967).

Shallow caves and rock shelters, such as at the Gottschall Site, Gullickson's Glen, and Tainter Cave, seem like obvious choices for rock art that was meant to be frequently seen and perhaps discussed by people (Salzer 1987a, 1978b; Schrab and Boszhardt 2016). Salzer (1987a, 1987b) suggests that rock art at the Gottschall Site in Wisconsin was created for accessible viewing and was likely illuminated for that purpose. Why, then, would other artists select largely inaccessible cliff faces for their art? Hoffman (2016: x) offers some perspective: "I use the Menominee language to convey my message and prayer as Algonquian dogma tells us to do. Many rock art sites were created to fulfill a similar spiritual purpose. These ancient rock art sites are considered places of special powers chosen for the same purpose that a modern-day altar of any religion would be chosen." Dewdney and Kidd (1962: 13-14) and Rajnovich (1994: 145-157) also discuss the sacredness of rock art sites at the water's edge and the offerings left there. These sites—"where sky, earth, water, underground and underwater meet"—were places where manitous (spirits) dwelt and where they and medicine people could enter each other's worlds

(Rajnovich 1994: 160). These may have been places where specific offerings were made, prayers were said, or images of powerful spirits were painted (Dewdney and Kidd 1962; Rajnovich 1994).

With respect to choices of color as seen in pictograms, red is the most commonly seen pigment; yellow, white, gray and black occasionally appear. While I am unaware of any tests that have attempted to determine the exact composition of rock art pigments used in the western Great Lakes, the suggestions presented below are based on experimental archaeology, comparisons with known pigments, and consideration of available materials (Cole 1991; Dewdney and Kidd 1962; Grant 1967; Salzer 1987a, 1987b). Red and yellow pigments were presumably derived from an ocher such as iron oxide hematite. White may have been developed from pale deposits of chalk or clay, and black from organic sources like charcoal or roasted graphite (Dewdney and Kidd 1962; Grant 1967; Rajnovich 1994; Salzer 1987a). The unique blue-gray pigment at the Gottschall site may have been partially derived from burnt animal bone (Salzer 1987b: 463). What binders were used to adhere these pigments is a source of debate and speculation. Anything from animal blood, gull or fish eggs, bear grease, beaver tail, fish glue, sturgeon oil, rabbit skin, deer or moose hoof, and vegetable oils, to water alone has been suggested (Coles 1991; Dewdney and Kidd 1962; Grant 1967).

One point on which most sources agree is that, whatever adhesive agents were used, they have been remarkably resilient to the test of time. In the 1960s, Dewdney and Kidd (1962: 11) reported centuries-old pictograms, their pigments cleaving vividly to the rock face, alongside modern graffiti whose paint was already wearing thin. Dewdney and Kidd (1962: 37) also offer a plausible explanation as to how some pigments could have been applied. By chalking a line on a rock face with a piece of hematite, and then tracing over it with a wet finger, a strong red line

was produced. Application by finger or hand (in the case of larger images) seems to be the most commonly suggested method of creating pictograms. Small brushes or fibrous branches may have been used to create thinner lines (Dewdney and Kidd 1962). In some cases in Wisconsin, ancient pictographs seem to have been refurbished with fresh paint by more recent Native people (Salzer 1997).

Having briefly discussed the "where" and "how" of rock art, it would be appropriate to address the "when" and "who." Unfortunately, these questions are even more challenging to answer satisfactorily. While it is sometimes possible to date pigments, using accelerator mass spectrometry (AMS) for example (Schrab and Bozshardt 2016), such techniques are expensive and destructive to the art. Relative dating and stylistic elements can be used to inform educated guesses, and the study of lichen growth over rock surfaces has also been proposed as a possible dating method. There are many variables that make this technique unreliable, however (Dewdney and Kidd 1962; Salzer 1997). Stratigraphy and patination (the natural weathering and discoloration that takes place on exposed rock) have been attempted to some degree. However, since patination occurs rapidly in the relatively humid Midwestern climate, this technique is not as useful here as it is for rock art in the western United States (Grant 1967; Salzer 1997).

Some rock art can be said to positively postdate a certain era; for example, depictions of bow and arrow must have been made after A.D. 500, when these implements were introduced to the upper Midwest (Mason 2002; Salzer 1997; Schrab and Boszhardt 2016). Because of these various problems in dating rock art, it is nearly impossible to ascribe specific works to specific groups of people. On the one hand, art may have been created in the distant past, before the existence of the discrete cultural/political groups we recognize today. On the other hand, our

knowledge of the late prehistoric and early Historic periods indicates that many tribes relocated extensively throughout the region. Thus, determining exactly who was at a particular rock art site when it was created is not possible.

An exception may be made to the previous statement when taking oral histories into account. Both the Menominee and Ho-Chunk have oral traditions about the creation of rock art by them or their ancestors. The latter told stories about using the blood of water spirits to create pictographs near McGregor, Iowa, directly across the Mississippi River from Prairie du Chien, and pictographs done in red pigment have been found in that area (Salzer 1997).

One major question regarding rock art remains: why? The simplest answer, as for any form of art or writing, is communication. Images painted or carved onto rocky surfaces could serve as markers of territorial boundaries, illustrations of historical or mythical events, depictions of dreams, records of names and lineages, mnemonic devices, instructions for hunting or other activities, magical symbols to invoke special powers, markers of significant sites, or, for lack of a better word, doodles. In any case, they were a means of communicating a message from the artist to human and/or spiritual viewers (Dewdney and Kidd 1962; Dudzik 1995; Grant 1967; Meighan 1981; Salzer 1987a, 1997). Although Mithen's (1988) focus is on the Upper Paleolithic rock art of Europe, his ideas are broadly applicable. He proposes that the animals depicted in rock art were not necessarily those that were most frequently hunted, but the image may have been linked to hunting magic or instructions for pursuing particular game (Mithen 1988).

Because of its visual nature, rock art can cut across linguistic and cultural boundaries. But what can rock art communicate about elk specifically? Hoffman (2016: ix) notes, "in the words of the late Menominee artists James Frechette Jr. (Nǣtamowekow, "He Helps People"),

'Symbolism is an important part of any culture. We all use symbolism in our lives. I think we have to be careful not to place the value on the symbol and forget about what it stands for.'" Without being able to speak directly with the artists who created it, interpreting depictions of elk in rock art is fraught with complications. One such complication is one of identification: images of elk are frequently difficult to distinguish from other cervids—deer, caribou, and moose. Images of these species are provided in Figure 3.2 below.

Figure 3.2: Comparison among elk, deer, moose, and caribou (Missouri Department of Conservation 2020; National Park Service 2019a; National Wildlife Federation 2020)

Elk without antlers are even more challenging to differentiate from other quadrupeds. Rock art is not known for its hyper-realistic detail, and North American rock art even less so than

in some other areas of the world. Interpretations, without an understanding of the artist's symbolic conventions, tend to be subjective. Nevertheless, some generalizations can be made; for example, one characteristic by which moose are often defined is a small "beard" under the chin (Dewdney and Kidd 1962). Keyser and Poetschat (2005: 5) suggest that depictions of male elk can be differentiated from those of deer based on antler shape, the former having one main beam with side tines, and the latter having a branching antler.

What follows is an attempt to describe, by no means comprehensively, rock art sites in Minnesota, Wisconsin, and Ontario in which elk are depicted. Where there is uncertainty as to the taxonomic identification, I offer alternate possibilities. Cultural, temporal, and spatial context is given when known. My interpretation of rock art pertains primarily to those sites for which I could find photographs or depictions. Other known sites are listed but, without visual representations, cannot be interpreted in this thesis.

3.2.1 Minnesota

Fifty-five sites of petroglyphs, pictographs, and petroforms have been recorded in Minnesota (Dudzik 1995). The most common motifs are humans, canoes, handprints, shamans and supernatural beings, thunderbirds, bison, bear, moose, and elk (Grant 1967). Sadly, some sites have been destroyed since their discovery over a century ago. Among these are the Dayton's Bluff petroglyphs in St. Paul, which were recorded by Theodore Hayes Lewis in 1890. Lewis documented various human, animal, and other figures, including two apparent cervids lacking antlers (Dudzik 1995).

At the Crooked Lake site, on the Minnesota side of the border south of Quetico, Ontario, an elegant elk pictograph is accompanied by images of a moose with a scraggly beard, a heron and several other birds, a fish in a net, and a horned human figure (Dewdney and Kidd 1962). The elk's neck is outstretched, his head angled back, and his long antlers parallel to his back: the posture of a bugling male (see Figure 3.3).

Figure 3.3: Crooked Lake pictograph (adapted from Dewdney and Kidd 1962) **and bugling male elk** (National Park Service 2017b)

The distinctive bugling of male elk was recognized as "irresistible medicine" by many North American tribes and mimicked with the flute, an instrument used specifically for courting (Erdoes and Ortiz 1984: 273). The Meskwaki (Callender 1978a; Jones 1939), Ojibwe (Ritzenthaler 1978) and Kickapoo (Callender, Pope, and Pope 1978) are all known to have used the courting flute. Ethnographic accounts from two Plains tribes, the Crow and the Dakota, also tell of the amorous power ascribed to elk (Keyser and Poetschat 2015; Wissler 1905). Keyser and Poetschat

(2015) interpret images of elk at the Gateway site in Wyoming as pertaining to this "love medicine." The Crooked Lake elk, perhaps, references a similar belief.

3.2.2 Wisconsin

Most rock art in Wisconsin is found in the southwest corner of the state, called the Driftless Area (see Figure 3.4). This area, unlike the rest of the state, was not covered by glaciers during the last Ice Age. Its rock-walled valleys provided shelter (and canvases for rock art), and its diversity of plant and animal life provided ample sustenance for the prehistoric humans who made this area their home (Salzer 1987b).

Figure 3.4: Map of the Driftless Area in Wisconsin (State Cartographer's Office, University of Wisconsin-Madison 2018; United States Department of Agriculture 2012)

Figure 3.5: Map of relevant Wisconsin rock art sites (Schrab and Boszhardt 2016; State Cartographer's Office, University of Wisconsin-Madison 2018)

Petroglyphs are the most common type of rock art found in the state; pictographs are significantly rarer (Salzer 1997). Salzer (1997: 65) reports that cervids are "well represented in Wisconsin rock art." He goes on to list numerous sites at which such representations of cervids can be found: Bode-Wad-Mi, Door County, Elk Ledge, Gullickson's Glen, Hole-in-the-Wall, Hunter's Point, Lucas, Prickly Ash, and Samuel's Cave. Schrab and Bozshardt (2016) also note, among others, petroglyphs of cervids with antlers and heartlines at the Hanson-Losinki complex in Trempealeau County. The heartline motif, consisting of a line starting at an animal's mouth and terminating in an arrow in its chest, is associated with hunting magic and having spiritual control over the animal with which it is depicted (Salzer 1997).

Gottschall Site, Iowa County. This rock shelter in southwestern Wisconsin boasts over 40 petroglyphs and pictographs from at least two different periods. Archaeological excavations reveal a long-term pattern of repeated use at the site: multiple stratigraphic deposits, with the Late and Middle Woodland periods particularly well represented. Pottery sherds, stone tools and waste flakes, charcoal, animal bone, and mussel shell have been uncovered (Salzer 1987a, 1987b).

An older style of blue-gray paintings has been dated to the Mississippian period, circa A.D. 900. They are the most common type of rock art at the site and include the head and neck of a probable elk, whose antlers follow the "main beam with side tines" pattern. Evidence for fires along the rock walls directly below artwork around A.D. 900-1000 suggests that these works were illuminated multiple times for viewing (Salzer 1987a, 1987b). Orange-red pigment represents another period of painting activity. In a couple of cases, the orange-red paint was applied over earlier blue-gray figures, and in one instance, both colors appear together in the same image.

This period of orange-red paintings has been linked to the 19th and early 20th centuries, based on the presence of European numbers and letters, as well as stylistic similarities to other Wisconsin sites from that time (Salzer 1987b).

Gullickson's Glen, Jackson County. The petroglyphs at Gullickson's Glen are among the most impressive in the state. An arching rock cavity 25 feet across and 10 feet deep, the site contains evidence of human habitation from both the Woodland and Oneota traditions. An excavation by archaeologist Warren Wittry in 1958 revealed upper layers dating to the late prehistoric Oneota culture. Straight-edged stone arrowheads and pottery dated to A.D. 1300-1400 were recovered. A lower level revealed serrated-edged arrowheads dating to the Late Woodland period; many of the stone points found had extensive wear on their ends, suggesting possible use in carving the petroglyphs. Unfortunately, Wittry seems not to have published on his work at Gullickson's, so more details about his excavation are not known (Schrab and Bozshardt 2016).

Not only the cave floor, but also the glyphs themselves are layered stratigraphically. For example, a large fragmented elk head is carved over a smaller cervid glyph, suggesting multiple episodes of carving (see Figure 3.6 for images and line drawings of Gullickson's Glen). The elk head, immediately to the right of the opening, is carved in bold lines and was likely once part of a more complete image, the rest of which has broken away. Although it lacks antlers, this glyph seems to be a clear-cut depiction of an elk. Slashed lines along the upturned neck resemble an elk's shaggy neck mane; white-tailed deer have smooth necks, moose are typically depicted with characteristic "beards," and the site lies significantly to the south of the historic range of caribou

(University of Wisconsin-Stevens Point 2020). Two parallel lines within the elk's neck may be the remnants of a heartline (Schrab and Bozshardt 2016).

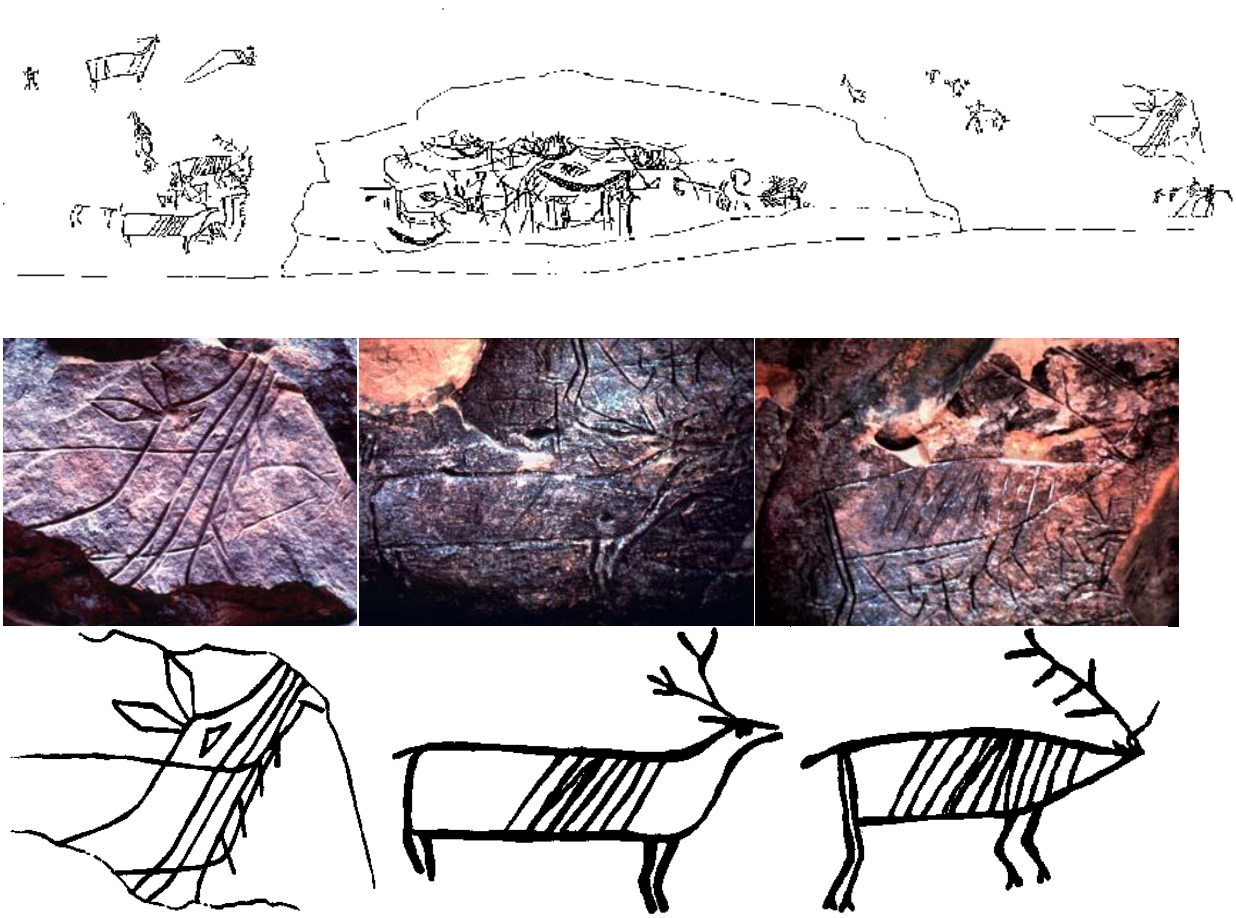


Figure 3.6: Petroglyphs from Gullickson's Glen, Jackson County, Wisconsin (Mississippi Valley Archaeology Center 2019)

Gullickson's Glen also boasts images of humans, canines, birds, fish, and several other deer or elk, two of which are also depicted in Figure 3.6 (Schrab and Bozshardt 2016). Following Keyser and Poetschat's (2005) system for differentiating elk and deer based on antler shape, mentioned above, the image on the far right should be considered an elk, and the one in the center, a deer. The head on the far left is the probable elk mentioned in the preceding paragraph.

Both complete cervids have slashing "rib" lines across their bodies (Schrab and Bozshardt 2016). Schrab and Bozshardt (2016) speculate that the depiction of ribs might indicate a period of starvation. Rajnovich (1994) reports that, among the Ojibwe, these lines are used to represent the spirit of the animal.

Tainter Cave, Crawford County. While the herd of antlerless cervids painted at Tainter Cave have been interpreted as deer, it is not unreasonable to imagine that the animals depicted could just as easily be female elk. The pictographs are highly stylized, with boxy bodies, stick legs, and tiny linear heads (see Figure 3.7); there is nothing that would definitively distinguish one type of cervid from the other. While I concede that the art at Tainter Cave more likely depicts white-tailed deer due to their greater abundance, I include this example because of its utility in illustrating part of the relationship between humans and cervids, including seasonality and hunting strategies.

Schrab and Bozshardt (2016) link the Tainter Cave rock art, which includes both pictographs and petroglyphs, to the Effigy Mound culture circa A.D. 900-1050. One panel in the cave portrays seven antlerless cervids, three of which are pregnant, surrounded by nine bow hunters. The pregnancy suggests winter, as does the hunting scene. Herds congregating on smaller winter ranges would be easier to pursue, especially if the animals became mired in deep snow or ice. Nearby, two similar cervids are shown running away. One possible interpretation of this scene is a successful hunt that sustains people during a lean season. The escaping animals could represent those that preserve their population into the future (Schrab and Bozshardt 2016: 165).

A black deer or elk in a different part of the cave is unique in that it is the only animal at Tainter with a filled-in body. Schrab and Bozshardt (2016) used this abundance of pigment to obtain a sample for AMS dating. Their results indicated that the image is approximately 1,300 years old. Furthermore, they draw an interesting connection between this "black deer" and the origin story of the Ho-Chunk Deer clan, which was recorded by Paul Radin in the early 20th century. In the story, a black deer is accompanied by an elk, who is referred to as his younger brother (Radin 1923: 247; Schrab and Bozshardt 2016).

Figure 3.7: Pictographs from Tainter Cave, Crawford County, Wisconsin (Mississippi Valley Archaeology Center 2019)

3.2.3 Ontario

Dewdney and Kidd (1962) report numerous rock art sites from the Canadian Shield in Ontario, many of which depict cervids. At Lac la Croix, among moose, humans, handprints, animals, and other less decipherable shapes, is the head and upper body of an elk or caribou. The antlers are finely detailed compared to other sites: both are shown in profile with the brow

and crown tines clearly defined. The site consists of large slabs of granite bedrock rising from the lake and must have been painted from canoes or from the ice. According to an elderly local Native American man interviewed by Dewdney, the pictographs at Lac la Croix predate a treaty that was signed in 1873. Another enigmatic reference to date is the initials "L.R." and the year "1781" pecked lightly into the rock near a pipe-smoking figure. The L appears to have been filled in with the same red pigment used to create the pictographs (Dewdney and Kidd 1962).

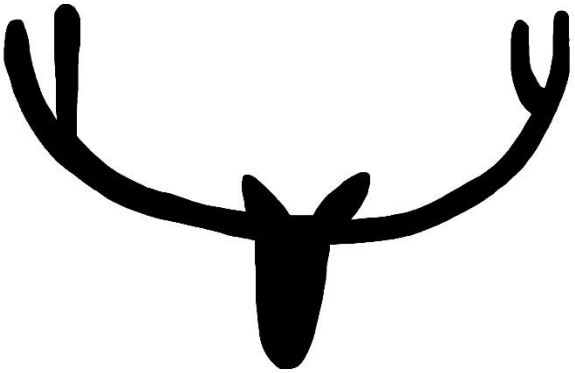


Figure 3.8: Outline of cervid head pictograph from Quetico Lake, Ontario (adapted from Dewdney and Kidd 1962)

The Quetico Lake site is unusual in that it depicts a cervid—elk, or possibly caribou—head-on rather than from the side, as at other known sites (see Figure 3.8). Red pigment is also used to portray a smaller possible cervid to the left of and below the head, and a human figure with outstretched arms, among others. Like Lac la Croix, this site is accessible only from the water (Dewdney and Kidd 1962).

Dewdney describes two cervid pictographs on a Namakan Lake island, one of which lacks antlers and appears to have been only partially finished. The other has a single long antler with many small tines branching off; elk or moose are the most likely identifications (Dewdney and Kidd 1962).

Sioux Narrows is noteworthy for its pictograph of an apparent historic fort with a flag on a flagpole. Another pictograph worth mentioning is that of a female deer or elk in a canoe

(Dewdney and Kidd 1962; Coles 1991). Densmore (1929: 176-177) explains how, among the Ojibwe, such an image could be used to communicate the clan of a person in the canoe, as opposed to a literal interpretation of a boating cervid.

The Cuttle Lake site offers a dense, diverse array of overlapping pictographs, including canoes, dots, handprints, cervids, and other quadrupeds. One of the cervids, ostensibly with male genitalia, lacks antlers (Dewdney and Kidd 1962), which suggests that it represents a bull in late winter/early spring, or one that is very young.

An intriguing grouping of three figures graces a rocky ledge at the Agawa site on Lake Superior. From left to right is a human figure in a boat with a solid diagonal line projecting towards the bow, a standing cervid, and a reclining cervid with its legs folded underneath its body (Dewdney and Kidd 1962). Rajnovich (1994) suggests that the repetition of the cervid could mean a change over time: an elk or caribou being hunted and killed. Based on comparison with similar paintings in Manitoba and on birchbark, and ethnographic material collected by Hoffman (1896) in the 19th century, the line in the boat is a pine torch used in night hunting (Rajnovich 1994: 119).

While the sites in northern Minnesota and southern Ontario differ ecologically, culturally, and artistically from those in the southwest corner of Wisconsin, a few conclusions can be drawn about elk from the rock art of this region. In Wisconsin, the style is generally boxier and more linear, while the Minnesota and Ontario style consists of smoother, filled-in shapes. The depiction of elk at places of spiritual importance implies a relationship in which spiritual power played a role. Perhaps, as at the Gateway site, elk were tied to love medicine, or perhaps they represented clan or personal totems that offered protection and guidance. In any case, elk were important enough to represent at sacred sites. Another aspect of the human-elk relationship

that can be elucidated from rock art is a social one. Depictions of elk in caves or rock shelters that were occupied on a temporary or permanent basis were a form of communication. They may have been used to illustrate stories or convey hunting strategies.

3.3 Wisconsin Archaeological Record

As a starting point for my examination of Wisconsin archaeological sites, I searched FAUNMAP, a database created by the Illinois State Museum to show the late Quaternary distribution of mammals across the United States (FAUNMAP Working Group 1994). More data about FAUNMAP are available in Section 1.3. My search fields were as follows. Database: FAUNMAP, State: Wisconsin, Family: Cervidae, Genus: Cervus, Species: elaphus. (For species, "canadensis" was attempted first, but the database did not recognize that specific designation and yielded no results.) All other fields were left blank. My search returned 40 archaeological sites in Wisconsin at which elk remains have been found. Table 3.1 below shows the results of this search. Other site data provided by FAUNMAP but not included in the table are quadrangle, township, precision, alternate names, maximum and minimum age and the methods used to determine them, depositional environment and system, facies, and recovery method.

Where elk remains were noted as present, but no quantity was given, or when MNI was not calculated, a dash indicates an unknown number. A dash also represents an unknown when a site number was not provided. Specific citations for the sources from which FAUNMAP retrieved these data were not provided, but sites marked with an asterisk represent those for which I was able to find more detailed site information and which are discussed below. An explanation of time period codes appears below the table.

Table 3.1: Elk remains at Wisconsin sites (from FAUNMAP Working Group 1994)

Site	County	Latitude, Longitude	Site Number	Time Period	Elk NISP	Elk MNI
47LC44	La Crosse	434500, 910700	47LC44	HIST	2	1
Armstrong*	Pepin	442200, 920000	47PE12	LHOL	7	-
Aztalan*	Jefferson	430000, 885500	-	LHOL	46	-
Bell*	Winnebago	440000, 883000	47WN9	HIST	9	-
Bigelow II*	Portage	442800, 893300	47PT29-2	LHOL	4	1
Bluff Siding	Buffalo	435500, 881800	47BF45	LHOL	1	1
Bornick*	Marquette	434800, 891500	47MQ65	LHOL	7	1
Cooper's Shore*	Rock	424500, 890000	47RO2	LHOL	15	-
Dietz*	Dane	430700, 892200	47DA12	LHOL	-	-
Durst Zone I	Sauk	432200, 895200	SK2	LHOL	1	-
Durst Zone II	Sauk	432200, 895200	SK2	LHOL	2	-
Durst Zone III	Sauk	432200, 895200	SK2	LHOL	3	-
Durst Zone IV	Sauk	432200, 895200	SK2	LHOL	1	-
Durst Zone V*	Sauk	432200, 895200	SK2	LMHO	2	-
Durst Zone VI*	Sauk	432200, 895200	SK2	MHOL	5	-
Furman*	Winnebago	440700, 882200	47WN216	LHOL	3	1
Lasley's Point	Winnebago	440800, 884100	-	LHOL	-	-
Midway*	La Crosse	435500, 911500	47LC19	HIST	1	-
Mill Pond	Crawford	431500, 910000	47CR186	LHOL	-	-
Millville*	Grant	430200, 905700	47GT53	LHOL	31	5
Pammel Creek*	La Crosse	434500, 910700	47LC61	HIST	4	2
Pipe	Fond du Lac	435500, 881800	47FD10	LHOL	11	3
Preston Rockshelter (PR) Durst*	Grant	424500, 903700	47GT157	LMHO	20	1
PR Late Woodland	Grant	424500, 903700	47GT157	LHOL	21	1
PR Pre-Durst*	Grant	424500, 903700	47GT157	LMHO	13	1
Raddatz Rockshelter (RR) Unknown*	Sauk	432100, 895600	SK5	HOLO	34	-
RR Level 2	Sauk	432100, 895600	SK5	HIHO	1	-
RR Level 3	Sauk	432100, 895600	SK5	LHOL	2	-
RR Level 5	Sauk	432100, 895600	SK5	LHOL	2	-
RR Level 7	Sauk	432100, 895600	SK5	LHOL	4	-
RR Level 8	Sauk	432100, 895600	SK5	MHOL	5	-
RR Level 9	Sauk	432100, 895600	SK5	MHOL	1	-
RR Level 10	Sauk	432100, 895600	SK5	MHOL	1	-
RR Level 11	Sauk	432100, 895600	SK5	MHOL	1	-
RR Levels 13-15	Sauk	432100, 895600	SK5	WIHO	1	-
Sand Lake	La Crosse	434500, 910700	-	HIST	2	2

Site	County	Latitude, Longitude	Site Number	Time Period	Elk NISP	Elk MNI
Sanders I*	Waupaca	441600, 885100	47WP26	LHOL	1	1
State Road Coulee*	La Crosse	434500, 910700	47LC176	HIST	86	7
Tremaine*	La Crosse	434500, 910700	47LC95	HIST	2	1
Walker-Hooper*	Green Lake	433000, 890000	47GL65	LHOL	20	2

* discussed in greater detail below

FAUNMAP Age Codes (Illinois State Museum 2019)

HIST (Post-Columbian) = 0-550 years B.P.

LHOL (Late Holocene) = 450-4500 years B.P.

HIHO (Post-Columbian/Late Holocene) = 0-4500 years B.P.

MHOL (Middle Holocene) = 3500-8500 years B.P.

LMHO (Late Holocene/Middle Holocene) = 0-8500 years B.P.

HOLO (Holocene) = 0-10,000 years B.P.

WIHO (Holocene/Pleistocene) = 0-110,000 years B.P.

Elk remains have been found at the historic component of the Bell site, which appears in the FAUNMAP table above. However, as my archaeological analysis focuses on the pre-contact period, I have not included it in my more detailed discussion. Koziarski (2004), Parmalee (1963), and Wittry (1963) provide more in-depth information about the Bell site and the faunal remains found there, including three arrowshaft wrenches presumed to have been made from elk ribs (Wittry 1963: 12).

I use Optimal Foraging Theory (OFT) as a lens through which to examine the relationship between humans and their environment, especially the animals on which they relied for food.

According to OFT, humans make choices in food procurement that maximize efficiency and yield and minimize effort (Broughton 1999). Prey rank modeling and patch choice modeling are two hypotheses that can be applied to OFT. The first model expects human foragers to pursue prey that provide the highest return (in meat or energy/calories) per time spent obtaining it. According to this hypothesis, pursuing large prey such as deer and elk would be optimal, since they provide more meat and a higher caloric return than smaller species (Broughton 1999: 9; Kelly 1995; Koziarski 2004: 14). Alternatively, patch choice modeling would predict a human forager to focus on the most resource rich areas, or patches, in order to maximize caloric return. In this model, a wider variety of species would be easier to obtain and incorporate into the diet (Kelly 1995; Koziarski 2004: 14). Overall, prey rank modeling puts more emphasis on the size of fauna recovered, while patch choice modeling emphasizes spatial distribution and areas in which more fauna can reliably be found (Broughton 1999; Kelly 1995; Koziarski 2004).

The rise of agriculture and associated population growth introduces a new set of variables into OFT. With a larger human population and resulting intensification of resource use, a shift to smaller game would be expected (Russell 2010). Although agriculture traditionally refers to large scale, intensive cultivation and horticulture to smaller scale gardens, the degree of reliance on domestic plants varied both spatially and temporally throughout Wisconsin (Edwards 2017; Karsten et al. 2019). For simplicity's sake I use the term agriculture here and throughout to refer the cultivation of crops, without commentary on the degree of reliance on or scale of that cultivation. Agriculture also ties people to a specific location and generally restricts group territory, which would be more consistent with patch choice modeling; gardens themselves can also be seen as patches to exploit (Keegan 1986; Koziarski 2004: 15-17; Linares 1976). Sometimes

the animals that are drawn to gardens, which could be considered pests, are themselves exploited as a food resource, thus increasing the value of the garden as a patch even more (Linares 1976). Lippold (1971: 167) also remarks on the interplay between agriculture and hunting in her analysis of Wisconsin Woodland sites: "Where agriculture was more reliable, less emphasis would be placed on mammals, specifically large mammals… Where agriculture was less reliable one would expect to see a proportionate rise in the dependence on large mammals. And mammals or other animal species utilized to supplement the agricultural products would most often be those available near the site."

The following sections present a summary of the data and interpretations of numerous authors regarding Wisconsin archaeological sites. I offer my own summary at the end of each section; further interpretations are offered in Chapter 5. Within this chapter, I refer to a few different metrics used to analyze the presence and abundance of elk remains. First is the number of identified specimens, or NISP. This represents the total number of bones or bone fragments that could be identified as elk, although it doesn't necessarily represent the total number of elk remains at a site. Next, MNI (minimum number of individuals) is a derived statistic, typically obtained by counting the number of identical bones from one side of the body. For example, two left femurs would indicate a minimum of two individuals. Meat weight contributions, unless otherwise stated, were calculated by multiplying the MNI by the estimated pounds of usable meat as determined by White (1953). For elk, the estimated meat weight is approximately 350 lbs. or 158.76 kg. (White 1953).

All three of these metrics can help elucidate the importance of elk to a particular group, but none of them are capable of producing the entire picture. For example, elk and other large

mammals can have a disproportionately high NISP because of differential preservation. Their bones might be more likely to preserve in the archaeological record due to their greater size and density relative to the bones of smaller animals. At some sites, smaller bones may be overlooked, especially where screening is insufficient. In other cases, a high degree of bone fragmentation can make positive identifications difficult if not impossible.

While MNI estimates the number of individual elk represented, large game animals may be dismembered and deboned near the kill site, with only some of their bones transported back to the residential site of consumption and discard. For example, Theler and coauthors (2016: 14) interpret a high frequency of phalanges as evidence of a selective transport model in which the skin was carried back with the feet still attached, and portions of meat were deboned to make them easier to carry. Lupo (2006) provides an ethnographic example of the phalanges of large game (impala and zebra) being transported back from the kill site among contemporary African Hadza hunter-gatherers.

Transport decisions can also be examined from a utility perspective, such as the meat utility index (MUI) Binford (1978) developed for caribou. This metric calculates the proportion of total usable meat for different body parts. Femurs, scapulae, the ribcage, and the pelvis and sacrum have high MUIs, indicating that they have a lot of meat and are valuable to hunters. Cervical vertebrae and distal limb elements have very little usable meat associated with them, so their MUIs are lower. Thus, we might expect to find more high utility elements at habitation sites because they would have provided meatier portions (Binford 1978).

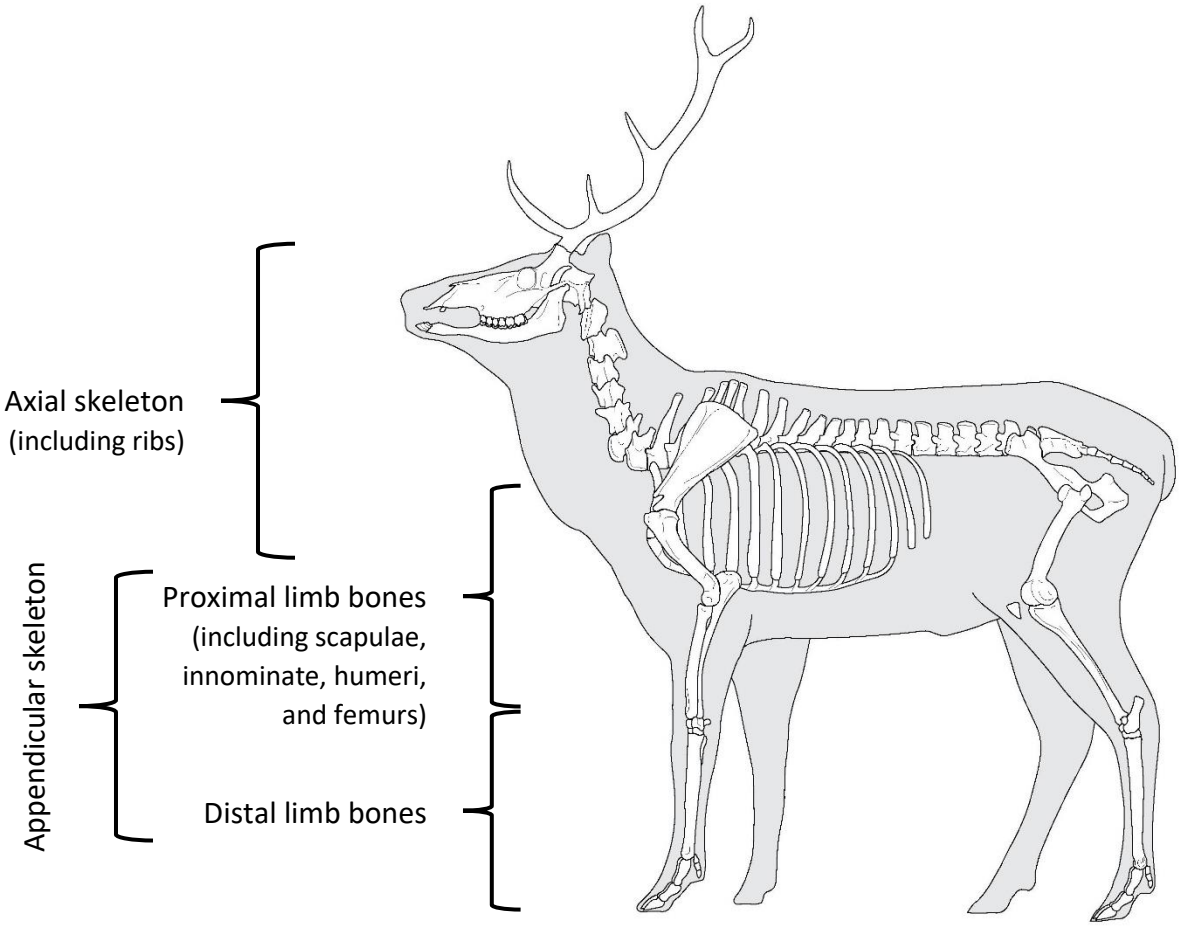


Figure 3.9 Elk skeleton (from Ferrié 2004)

Estimated meat weight contributions, when based on MNI, can be especially misleading when the sample size is small. A single bone can potentially make elk seem disproportionately significant, even with dozens of small mammals identified in the same assemblage, since elk provide much more meat weight per individual. Although meat weight is not the most accurate way to assess the relative dietary importance of different animals, it is a useful way to consider how size/weight impacts prey choice. Furthermore, since butchery practices, seasonality, age, and individual variation can all affect the amount of meat obtained from a single individual, this

statistic should only be viewed in the most general terms. Its main utility is in comparing the relative contributions of elk among different sites.

As a final caveat to this review of zooarchaeological literature, I wish to point out the challenges of cross-site comparisons of faunal data that were originally collected and analyzed by different authors with diverse research designs and approaches. Where some focus on a strictly quantitative analysis, others provided detailed information about the local prehistoric environment to complement their data. Some specify the nature of the elements recovered and speculate on their possible function as tools; others list only species and NISP. NISP, MNI, and meat weight are variably emphasized as the best means of assessing significance. In any case, I have attempted here to synthesize various theoretical perspectives and analytic approaches, working within the framework of OFT, and make note of meaningful similarities, differences, and patterns across sites.

3.3.1 Paleoindian-Archaic

A paucity of sites and poor faunal preservation from this period make a rigorous zooarchaeological analysis difficult. Nevertheless, Kuehn (1997, 1998) reports on the faunal remains of two Late Paleoindian-Early Archaic sites, the Deadman Slough site and the Sucices site. Mason (2002) and Kuehn (1997) consider the Late Paleoindian period, approximately 8000-6000 B.C., as a cultural transition between Paleoindian and Archaic. By that time, plant and animal communities in Wisconsin had adapted from the previous glacial phase and were essentially as they were pre-contact, although arranged in a patchier microhabitat mosaic (Kuehn 1997).

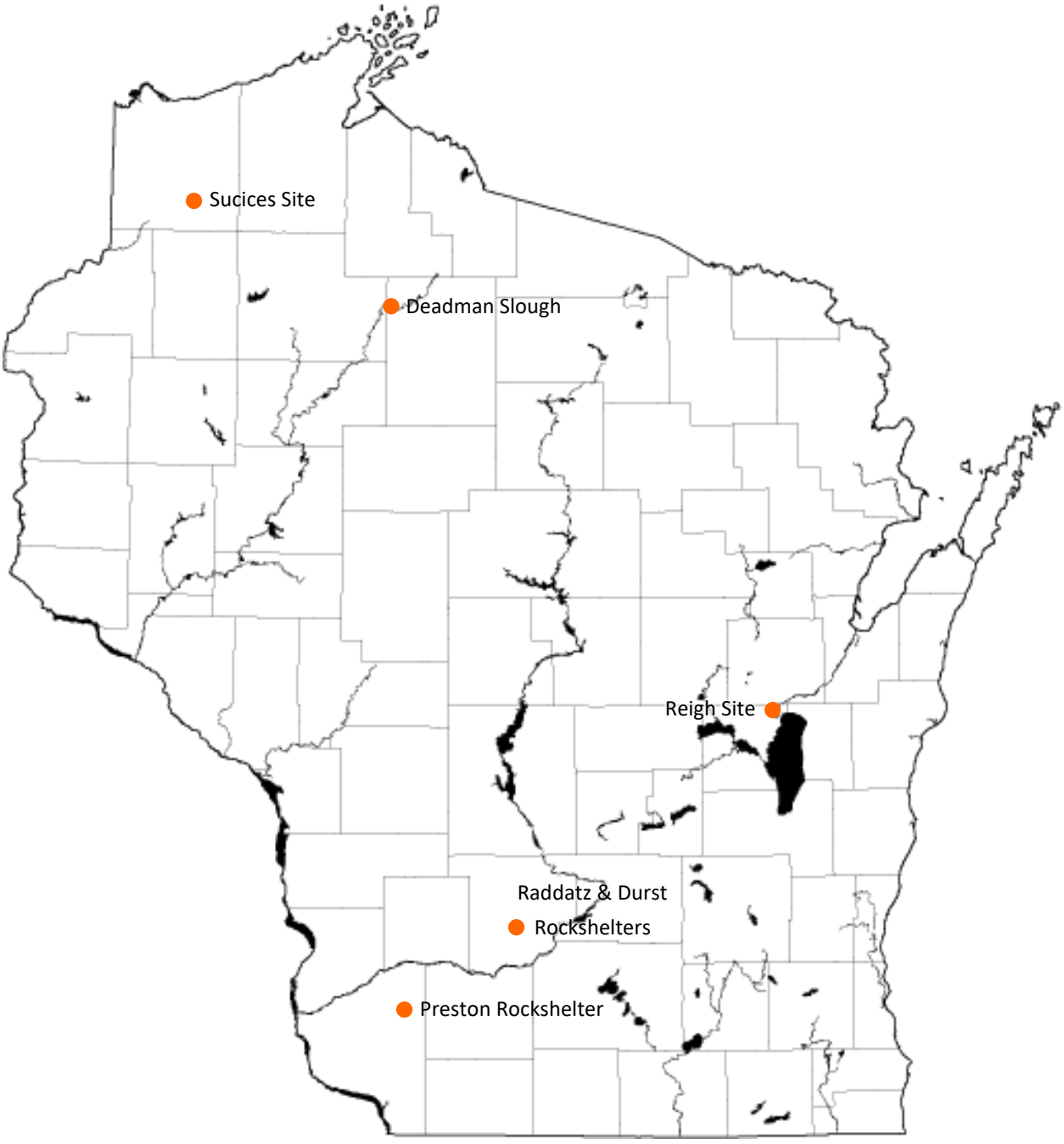


Figure 3.10: Wisconsin map of relevant Paleoindian and Archaic archaeological sites (Kuehn 1997, 1998; Parmalee 1959, 1960b; Ritzenthaler 1957; State Cartographer's Office, University of Wisconsin-Madison 2018; Theler et al. 2016; Wittry 1959)

Deadman Slough (47PR46) is a multicomponent site in northwestern Price County, overlooking the confluence of Deadman Slough and the Flambeau River. Lithic artifacts and raw material designate a Late Paleoindian component concentrated on an upland ridge, where shallow features and concentrations of faunal bone fragments indicate the site's use as a base camp (Kuehn 1997: 29).

The Sucices site (47DG11), located on a low terrace just west of the St. Croix River and about a quarter mile south of Upper St. Croix Lake in Dodge County, has also been dated to Late Paleoindian times based on diagnostic lithic tools (Kuehn 1997). Over 60% of the bone fragments (877 out of 1,409 total) from Deadman Slough were from large mammals, while more than one third of the remains from the Sucices site (480 total) were identified as large mammal (Kuehn 1997).

Fragments of large mammal bone were difficult to identify to the species level except for white-tailed deer (*Odocoileus virginianus*), but Kuehn (1997, 1998) notes that elk, moose (*Alces alces*), and black bear (*Ursus americanus*) may also be represented in the assemblages. While long bone shaft fragments were well-represented, the presence of pieces of large mammal cranial elements suggests that they were hunted intensively and most of the body was transported back to the site (Kuehn 1998: 468), and/or that they were killed nearby. Alternatively, cranial elements may represent a preference for retaining heads, which are higher in fat content and therefore in calories than lean meat (Enloe 2003: 14). The highly fragmented nature of the remains, particularly long bone fragments, is interpreted as due to breakage for marrow extraction and bone grease manufacture (Kuehn 1997: 36).

The Raddatz, Preston, and Durst Rockshelters all provide more explicit evidence of the exploitation of elk from Archaic times. All three are in the southwest corner of the state, known as the Driftless Area (Parmalee 1959, 1960b; Theler et al. 2016). The Raddatz Rockshelter (47SK5) is located in a hilly region in central Sauk County. Although some of the surrounding area was marshes and rivers, from which freshwater mussels were collected, the majority of vertebrate remains from the site show an emphasis on animal resources from upland, wooded areas. Thirty-four specimens were identified as elk, with an MNI of one. The majority of elk remains were phalanges; the jaws of an old individual were also recovered. White-tailed deer appeared far more significant, comprising 92% of the 4,846 identified mammal remains from the site (Parmalee 1959). In spite of this abundance of deer, less than a dozen pieces of antler were recovered from the site, suggesting that they were hunted during the antlerless season (mid-December – April) (Parmalee 1959: 89).

Lippold (1971) estimated meat weight contributions and found that for Early, Middle, and Late Archaic occupations at the Raddatz Rockshelter, elk and deer combined accounted for over 95% of the estimated pounds of meat. This suggests a heavy reliance on large mammals during that period (Lippold 1971: 152-153). While differential preservation of large bones could partially account for this skew toward large mammal resources, the presence of elk bones still indicates their significance as a meat resource.

The nearby Durst Rockshelter (47SK2) contains evidence of occupations from Archaic through Late Woodland times (Parmalee 1960b; Wittry 1959). Although bone preservation from the Middle Archaic is poor due to acidic soil, enough faunal material is present for a substantial zooarchaeological analysis. Five elk bones were identified from the Middle Archaic component,

and two from the Late Archaic. An additional 34,600 unidentified large mammal bones were assumed to belong primarily to white-tailed deer, which also made up the bulk of identified mammal bones (4,660 out of a mammal NISP of 4,808) from the site (Parmalee 1960b). Parmalee (1960b: 15) hypothesizes that "although elk were present in the area, the small number of bones recovered… indicates that this large animal was uncommon and/or rarely killed."

The Preston Rockshelter (47GT157) in Grant County also contains components from the Late Archaic through Late Woodland. Uncorrected radiocarbon dates from the two earliest components are 830 ± 65 B.C. (Late Archaic Preston phase) and 760 ± 65 B.C. (Late Archaic Durst phase) (Theler et al. 2016: 7). Thirteen elk phalanges or phalanx fragments were recovered from the Durst phase component (mammal NISP = 289), for an MNI of one. From the Preston phase (mammal NISP = 346), 15 phalanges or phalanx fragments, one humerus shaft, one naviculo-cuboid, and two calcanea were recovered. This preponderance of distal limb elements mirrors the pattern seen at the Raddatz Rockshelter (Theler et al. 2016).

An elk scapula awl was also found in the Preston phase component, and numerous bone awls found throughout the site indicate skin working activity (Theler et al. 2016). Theler and coauthors (2016) estimate the heaviest site occupation between September and January, based on the tooth eruption and male frontal bones (where antlers grow) of white-tailed deer. Large ungulates (deer, elk, bison) seemingly made the most significant contribution of meat to the diet, based on calculations of MNI and pounds of usable meat. Similar to other fall-winter occupied sites in the Driftless Area, the Preston Rockshelter has a high degree of fragmented bone, interpreted as possible evidence for marrow extraction and bone grease manufacture (Theler et al. 2016: 19-20).

Human burials at the Reigh site in Winnebago County are estimated to date to Late Archaic times, approximately 4,000 years before present. Among numerous copper grave goods and a few other faunal remains—including a canine skeleton, a modified partial deer mandible, antler projectile points, and shell beads—are three modified segments of elk antler which appear to have functioned as ax handles. One of these was found in a pit burial with two flexed male burials and one bundle burial. A copper spud from another "Old Copper Culture" site fits perfectly as a blade on one of these handles, as shown in Figure 3.11 (Ritzenthaler et al. 1957).

Figure 3.11: Elk antler ax handle (Ritzenthaler et al. 1957)

At both Late Paleoindian sites, remains of a wide range of taxa from a variety of habitats indicate the varied nature of Paleoindian subsistence (Kuehn 1997, 1998). While white-tailed deer was apparently the primary object of hunting efforts, both sites also exhibit a varied assemblage of smaller mammals, birds, turtles, and fish from forested, forest-edge, wetland, and river-edge environments (Kuehn 1997). The heavy emphasis on large prey, especially white-tailed deer, continues into the Archaic (Lippold 1971; Parmalee 1960b; Theler et al. 2016). This pattern is more consistent with the prey rank model, in which larger animals are prioritized. If the environment during Paleoindian-Archaic times was arranged in smaller microhabitat patches as Kuehn (1997) believes, more heavily exploiting a single area, as per the patch choice model, would likely be less efficient. Theler and coauthors (2016: 36) provide further insight into the possible seasonality of this subsistence strategy in southwest Wisconsin: "Driftless Area Late

Archaic and Woodland societies initially subsisted by hunting and gathering wild resources, a strategy that involved an annual cycle having at least two distinct seasonal segments. A fall-winter and early spring segment of this seasonal round focused on hunting large bodied mammals, particularly white-tailed deer, in the dissected uplands of the Driftless Area."

A few differences between the Paleoindian and Archaic sites are worth noting briefly. The Paleoindian sites are both in the northwest corner of Wisconsin, located on upland terraces or ridges near rivers. Both showed evidence of large mammal exploitation, but no remains that were conclusively identified as elk. Three of the four Archaic sites are rock shelters, located in the southwest corner, or Driftless Area, of the state. Distal limb elements comprise the bulk of elk remains from these sites, although a few axial and proximal limb elements (jaws, a scapula awl) have also been found. This pattern is unsurprising, given that elk have many more distal limb elements (e.g. 24 phalanges) than certain other elements (e.g. two humeri).

Differential preservation and challenges in identification could have contributed to this pattern as well. Axial elements such as vertebrae and ribs are spongier than limb bones, and thus less likely to remain over time in the archaeological record (Lyman 1992). When they are present, they may be fragmentary, degraded, and thus difficult to identify. Butchering and transport decisions also influence which bones appear in the archaeological record. It is easier to carry packages of meat from which the heavy long bones have already been removed, especially over long distances; this practice is known ethnographically and would especially be expected for large game such as elk (Bartram 1993; Lupo 2006).

3.3.2 Woodland

Wisconsin sites with Woodland components are more widespread than those with evidence for Paleoindian or Archaic occupations. The Driftless Area is again rich in sites, including the Durst (Lippold 1971; Parmalee 1960b; Wittry 1959) and Preston (Theler et al. 2016) Rockshelters, the Millville site (Pillaert 1969), and the Stonefield site (Lippold 1971). The Durst Rockshelter, introduced in the previous section, contains evidence (diagnostic pottery sherds) for Middle – Late Woodland occupation (Wittry 1959). Seven elk bone specimens were identified from this component (Parmalee 1960b).

Woodland occupation at the Preston Rockshelter (Grant County) can be divided into two phases: the Late Middle Woodland Millville phase (uncorrected radiocarbon date: A.D. 280 ± 65), and the Late Woodland Eastman phase (uncorrected radiocarbon dates: A.D. 730 ± 60, A.D. 800 ± 60). Nineteen elk bones, with an MNI of one, are associated with the Eastman phase (mammal NISP = 1068). Twelve are phalanges or phalanx fragments, three are mandibular fragments, and three are limb elements or fragments. The final elk specimen is an innominate fragment, the left ilium, which was pierced by a chert projectile point that remains partially embedded in the bone. The Millville phase component (mammal NISP = 564) contains only two unmodified elk bones: one phalanx and one phalanx fragment. Additionally, an elk proximal tibia shaft fragment represents a possible chisel, with flake scars on the proximal end, and use polish and coarse grinding striations on the distal end (Theler et al. 2016).

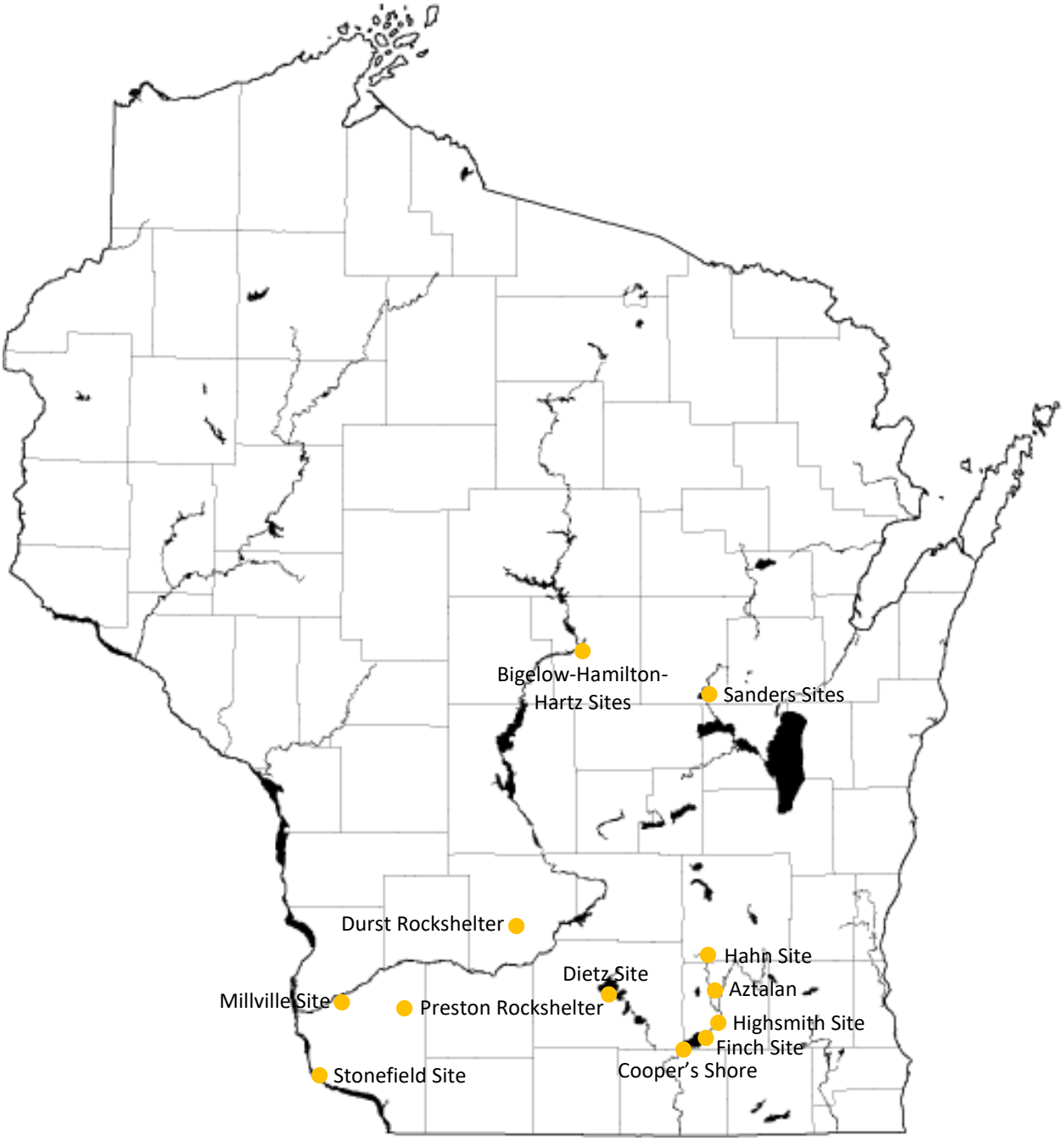


Figure 3.12: Wisconsin map of relevant Woodland archaeological sites (Dietz 1956; Leigl 2014; Lippold 1971; Parmalee 1960a, 1960b; Pillaert 1969; State Cartographer's Office, University of Wisconsin-Madison 2018; Stencil 2015; Theler et al. 2016; Wittry 1959)

The Millville site (47GT53) is a Middle Woodland site in Grant County, optimally located, like many other sites in the region, to take advantage of both forest-edge and floodplain/aquatic resources. Out of a total NISP of 1,850, thirty-one elk specimens have been identified, including a partial mandible, four vertebrae, one rib, eight scapulae, and 10 distal limb elements. The mixture of both axial and appendicular elements suggests that at least some elk were brought back to the site relatively completely and were perhaps killed nearby, facilitating transport. The high MNI of five reflects the number of scapulae, one of which was worked (Pillaert 1969). However, the disproportionate number of scapulae may reflect retention for tool use rather than the actual number of animals killed and eaten at the site. Elk scapula hoes are known from several later Wisconsin sites, including Pammel Creek (Theler 1989), State Road Coulee (Anderson et al. 1995), and Valley View (Stevenson 1985). The estimated meat contribution of elk was 27.67%. Only white-tailed deer were estimated to contribute more (66.4%) (Pillaert 1969).

Also in Grant County, the Stonefield site (47GT1) is located on the east bank of the Mississippi. Diagnostic ceramic and lithic artifacts date it to the late Middle Woodland period, while radiocarbon dates range between A.D. 170 $\pm$ 75 and A.D. 430 $\pm$ 70. A male white-tailed deer frontal bone from which the antler had been recently shed suggests a midwinter occupation. Despite the presence of only one unspecified elk bone, elk were estimated to have contributed 34.35% of the meat weight at the site. This was nearly as much as deer, which contributed an estimated 39.26%. This example illustrates one of the difficulties of extrapolating meat weight from small sample sizes. The number of mammal remains identified to species was 101; an additional 515 mammal bone fragments were also reported (Lippold 1971).

In southeastern and southcentral Wisconsin are Aztalan (Leigl 2014; Parmalee 1960a; Richards 1992), Cooper's Shore (Lippold 1971), the Dietz site (Dietz 1956), the Finch site (Stencil 2015), the Hahn site (Lippold 1971), and the Highsmith site (Lippold 1971). Although Aztalan (47JE01) in Jefferson County contains evidence for Late Woodland occupation, it is most well known for being the largest Middle Mississippian site in Wisconsin (Leigl 2014; Parmalee 1960a). As the two cultures, Woodland and Mississippian, occupied the site simultaneously from approximately A.D. 1100-1250 (Richards 1992), parsing out faunal remains becomes difficult. However, Warwick's (2002) analysis of a Late Woodland settlement component identified eight elk specimens, out of a total of 482 large mammal bones. These included several distal limb elements, one of which had cut marks, a rib with cut marks, and the shafts of two limb bones (Warwick 2002).

At the southern end of Lake Koshkonong in Rock County is the Cooper's Shore site (47RO2). Pottery from the site exhibits Middle to Late Woodland characteristics and has been dated to roughly A.D. 250-350 based on typology. Fifteen elk bones or bone fragments were found at the site, for an MNI of two and estimated meat contribution of 19.61%. The pattern of deer bones found at the Cooper's Shore suggests a butchering practice in which large mammals were dismembered at the kill site, axial elements (e.g. vertebrae and ribs) were left behind, and limbs, along with scapulae and innominates, were brought back to the residential area. Altogether, 631 mammal bones were identified to species; an additional 5517 fragments were also classified as mammalian (Lippold 1971).

Elk remains from the Dietz site (47DA12) in Dane County are scanty, limited to five burned antler fragments. Deer antler fragments were much more common, as were other deer bones.

The site's location at the northwest edge of Hemmersley Marsh likely provided an abundance of muskrats, waterfowl, and fish, although an ancient game trail attests that large mammals also used it as a watering hole. Pottery from the site has been dated to the Woodland tradition, approximately A.D. 1250 (Dietz 1956).

At the Hahn site (47DG2) in Dodge County, elk are even more scarce in the archaeological record, limited to a single deciduous mandibular molar from a juvenile between five and 12 months old (Lippold 1971). Assuming that elk are born in May and June (Nowak 1999), the individual was likely killed sometime between October and June. Two deer deciduous molars at the site are suggestive of occupation in October/November as well. Two hundred and forty-six mammal remains were identified in total. Ceramic and lithic analyses have been used to date this site to an Effigy Mound/Late Woodland occupation, approximately A.D. 900-1000 (Lippold 1971).

The Highsmith site (47JE4) in Jefferson County is a multicomponent site with evidence for occupation spanning much of the Woodland period. Ceramics have been dated to Early, Middle, and Late Woodland styles. No elk remains were found the in the Early component; only one recovered from the Middle component provided an MNI of one and an estimated meat contribution of 48.65%. The next highest contribution, from deer, was an estimated 41.7%. However, the sample size for this component was extremely small (NISP = 38) so the accuracy of these calculations in reflecting diet contributions is dubious. Mammal remains were much more abundant in the Middle Woodland/Early Effigy component, in which elk contributed a NISP of two, MNI of one, and estimated meat contribution of 20.96%. One of these specimens, the distal end of a humerus, exhibited cut marks indicative of butchering (Lippold 1971).

Moving further north into the central part of the state, we find the Bigelow-Hamilton-Hartz sites and the Sanders sites (Lippold 1971). The former (47PT29-2) is a multicomponent site on the east bank of the Wisconsin River in Portage County. Ceramics and lithics from both sites date them to Late Woodland times within the Effigy Mound tradition. Radiocarbon dates from Bigelow-Hamilton-Hartz sites span A.D. 670 to A.D. 1610, and a later historic occupation is also known. From the Woodland period, four elk specimens were identified. An overall scarcity of faunal remains from the site (mammal NISP = 22), possibly due to brief seasonal occupations, is a potential factor in the unusually high estimated meat contribution for elk. Even with an MNI of one, elk were estimated to contribute 43.37% of the site's meat weight; deer had only 24.75% (Lippold 1971).

The Sanders sites I (47WP26) and III (47WP70) are also unusual in that elk seem to have contributed more to the diet than deer based on meat weight estimates: 39.25% for elk and 22.43% for deer. However, as noted above, estimates of meat weight contribution are not necessarily accurate reflections of diet composition, especially with small sample sizes; only 145 mammalian elements from the Sanders sites were identified to species. The Sanders sites are located on the southeastern shore of the Wolf River in Waupaca County. Turtle remains suggest occupation sometime between May and October, and radiocarbon dates range between A.D. 630 and A.D. 1010 (Lippold 1971).

Woodland sites are more widely dispersed than those from either Paleoindian or Archaic times. They are found throughout the southern half of the state, frequently associated with rivers. The Rock River in particular boasts five sites from this period. Seasonality, when determined, is not uniform across Woodland sites, with some suggestive of autumn/winter

occupation and another seemingly occupied during the summer. Based on her analysis of 11 Woodland sites, Lippold (1971) found that deer and elk continued to provide the bulk of the meat supply, as during the previous Archaic period. Axial and appendicular elements continue to be represented in the assemblages, with scapulae and innominates found at a number of sites. Large mammals, including bear, seem to have been the focus of hunting efforts, while the exploitation of small mammals and other taxa (birds, reptiles, fish, mollusks) varied from site to site. At several sites—Highsmith, Bigelow-Hamilton-Hartz, and Sanders—elk seem to have contributed more to the diet than deer, based on MNI and meat weight calculations (Lippold 1971). While these calculations are merely estimates, they nonetheless indicate the continued importance of large mammals, consistent with the prey rank model, during this time.

3.3.3 Mississippian

Aztalan (47JE01) is most well known for being the largest Middle Mississippian site in Wisconsin, but occupations span Woodland through Middle Mississippian times, with both cultures occupying the site simultaneously after approximately A.D. 1100 (Leigl 2014; Parmalee 1960a; Richards 1992). The site is thought to have been established by Late Woodland people around A.D. 820 (Richards 1992). Between A.D. 1100 and 1250, the inhabitants of Aztalan constructed three platform mounds and a palisade surrounding the town (Leigl 2014).

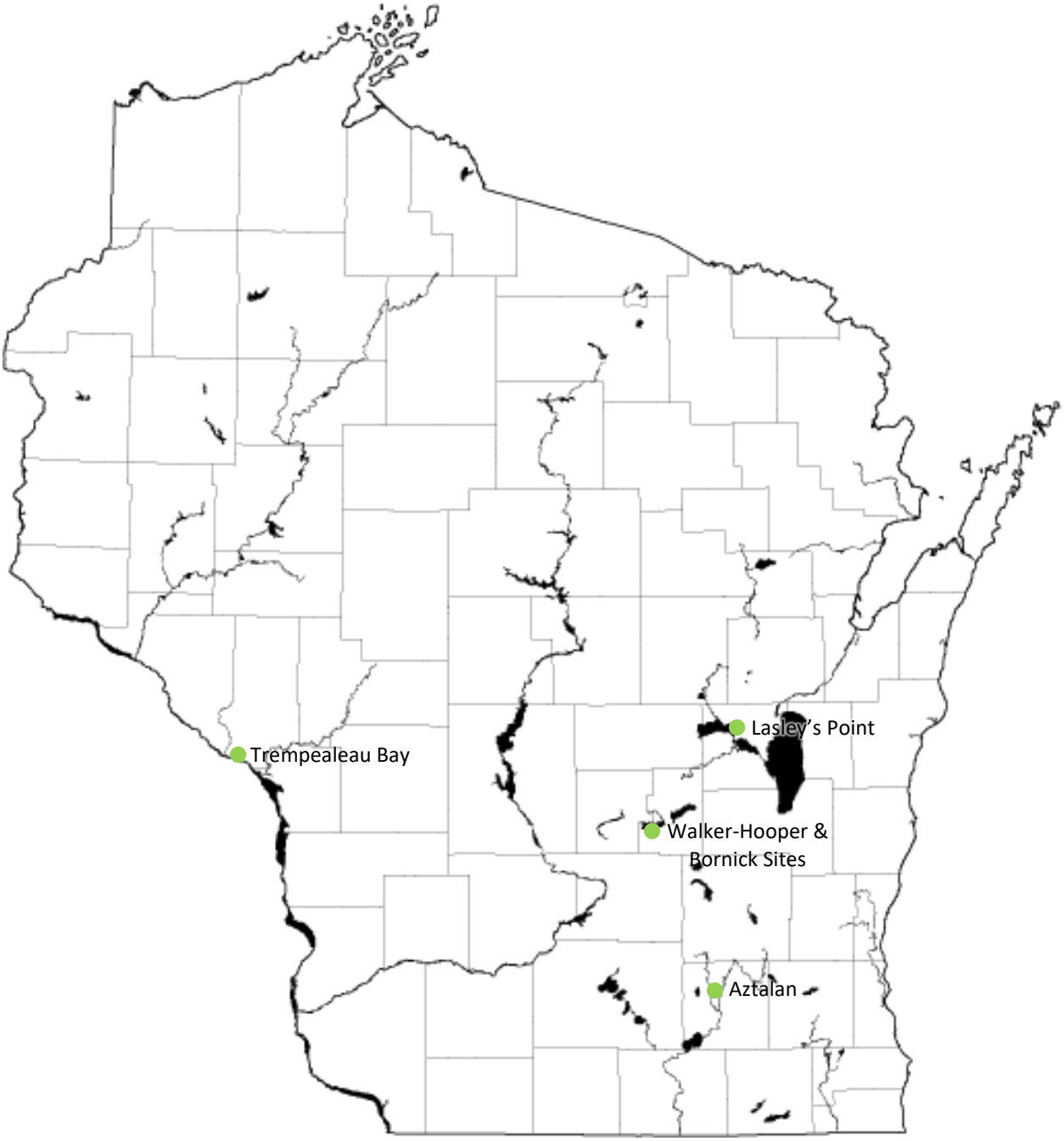


Figure 3.13: Wisconsin map of relevant Mississippian archaeological sites (Gibbon 1969; Leigl 2014; Lippold 1971; Parmalee 1960a; State Cartographer's Office, University of Wisconsin-Madison 2018)

Parmalee (1960a) analyzed faunal material from excavations carried out at Aztalan in the early and mid-twentieth century by Barrett and Baerreis, respectively, and a list of mussel species from Chandler Rowe of Lawrence College (Leigl 2014). He has little to say about elk at the site, noting, "Elk were apparently uncommon in the vicinity of the Aztalan Site as indicated by the small number of bones found. An elk scapula was recovered that had a rectangular section cut out, the implement being used for the purpose of shredding fibers" (Parmalee 1960a: 8-9). He reported a NISP of 46 for elk, out of 1,763 mammal remains.

Warwick, in analyzing faunal material from a Late Woodland/Mississippian village component, reported a NISP of only three for elk: fragments of a tibia, metatarsal, and cervical vertebra. The total NISP of this component was 536. Both analyses found that deer and canid remains were more common, and deer is recognized as the primary animal staple of the diet (Leigl 2014; Parmalee 1960a; Warwick 2002). Warwick also found that subsistence at Aztalan shifted slightly over time from the Late Woodland component to the mixed Woodland/Mississippian village. Both components showed exploitation of game from both aquatic and terrestrial habitats, but the latter was more generalized, with a higher proportion of fish and small mammals (Warwick 2002).

The Trempealeau Bay site (47TR34), on the east bank of the Mississippi River in Trempealeau County, is a multicomponent site that spans the Middle Woodland through Upper Mississippian. Historic vegetation maps place the site within a lowland hardwood community, with a nearby prairie surrounded by an oak stand. Two elk elements were recovered, the MNI was one, and the estimated meat contribution was 20% (Lippold 1971). Although the site had multiple components, Lippold (1971: 54) notes that "all of the bison and much of the elk was

recovered from the first level. This is important to note since it is believed that this level is representative of the Upper Mississippian occupation of the site." Faunal remains from the site were scarce, with only white-tailed deer and three species of mussels additionally identified. Twelve bones or fragments were identified to species, while another 88 were unidentified (Lippold 1971).

Lippold (1971) also gives a very brief and incomplete analysis of three other sites with Mississippian components: Lasley's Point, the Bornick site, and the Walker-Hooper site. She did not analyze these sites herself but drew her data from Cleland (1966) and Gibbon (1969); her focus is on the utilization of animal resources in Woodland Wisconsin. Elk are one of the many faunal species whose use she addresses. Her results are summarized in Table 3.2 below. The latter two sites are discussed in greater detail in the following section. Four of the five Mississippian sites are distributed throughout southeastern Wisconsin, near bodies of water, with only Trempealeau Bay at the far western edge of the state. Warwick's (2002) observation that subsistence strategies became slightly more generalized from the Late Woodland to the Mississippian at Aztalan may hold true for other sites from this period, but with such a small sample size, making any generalizations about the hunting of elk during the Mississippian period is difficult.

Table 3.2: Comparative mammal utilization, by estimated meat weight contribution (adapted from Lippold 1971: 159-160; Pillaert 1969)

Period	Site	NISP	MNI	Elk meat weight contribution	Average meat weight contribution
Archaic	Raddatz Early	-	-	15.7 %	18.23 %
	Raddatz Middle	-	-	1.6 %	
	Raddatz Late	-	-	37.4 %	
Middle Woodland	Millville	31	5	27.67 %	31.97 %
	Cooper's Shore	15	2	19.61 %	
	Highsmith Middle Woodland	1	1	48.65 %	
Late Woodland	Sanders I	1	1	39.25 %	27.79 %
	Hahn	1	1	16.34 %	
Mississippian	Bornick	-	-	16.67 %	16.29 %
	Walker-Hooper	-	-	8.48 %	
	Lasley's Point	-	-	23.72%	

3.3.4 Oneota

As the most recent prehistoric component, Oneota sites are more common and generally exhibit better faunal preservation than sites from previous periods. The Driftless Area, specifically La Crosse County, again provides a bounty of sites: the Gundersen site (Arzigian et al. 1993), Midway Village (Gibbon 1970), Pammel Creek (Theler 1989), the State Road Coulee site (Anderson et al. 1995), the Tremaine site (Jones 2014), and the Valley View site (Stevenson 1985).

Figure 3.14: Wisconsin map of relevant Oneota archaeological sites (Anderson et al. 1995; Arzigian et al. 1993; Gibbon 1969, 1970; Grimm 2010; Jones 2014; Kreisa 1986; Savage 1978; State Cartographer's Office, University of Wisconsin-Madison 2018; Stevenson 1985; Theler 1989)

Gallagher and Stevenson (1982) defined six environmental resource zones in the La Crosse locality: Open Water, Wet Bottomlands, Dry Bottomlands, Savanna, Sandy Prairie, and Dry Upland. All Driftless Area Oneota sites had access to multiple if not most of these ecozones (Anderson et al. 1995; Arzigian et al. 1993; Gibbon 1970; Jones 2014; Stevenson 1985; Theler 1989). Elk were most commonly found in the Savanna and Dry Upland zones on terraces and bluff slopes, where they were probably available year-round (Anderson et al. 1995; Stevenson 1985).

The Gundersen site (47LC394) is part of a larger complex of Oneota sites located near downtown La Crosse in La Crosse County. Its location provided access to prairie- and savanna-covered hilltops, hickory and oak groves, wetland forests, and stream valleys and floodplains, providing access to a diversity of floral and faunal resources. There are two phases of occupation, identified through ceramic analysis: the Brice Prairie phase (A.D. 1350-1400) and the Valley View phase (A.D. 1450-1550) (Arzigian et al. 1993). Arzigian and coauthors (1993) identify the subsistence strategy at the site as village-based agriculture (corn, little barley, wild rice) supplemented with wild animal resources for protein, and wild fruits and berries.

Of the faunal remains at the Gundersen site, 58 were identified as elk bones or bone fragments (MNI = 2). Thirty-three of these were distal limb elements, consistent with the butchering and transport model mentioned above, in which large game is partially dismembered at the kill site and only certain elements are carried back. However, vertebra, innominate, femur, and mandible fragments suggest that at least one elk was killed near the site and brought back in its entirety. Elk are estimated to have contributed 46.1% of the meat at the site; together with deer and black bear, their combined contribution is greater than 85%. Although elk was the third

most common mammal at the site based on NISP, the higher MNI of beaver (6) and muskrat (7) suggests a greater focus on these wetland species. In total, 429 non-artifactual mammal bones were recovered from the site (Arzigian et al. 1993).

The Midway Village site (47LC19) is an Orr phase Oneota site located on the upland terraces near the flood plains of the Black and Mississippi Rivers. Although many refuse pits were excavated at the site, no post molds or house trenches were found. In Area 1, which was radiocarbon dated to A.D. 1420 ± 70 from a charcoal sample, a single unspecified elk bone was identified. In the estimated meat yield of the site, elk contributed 9.7%. The mammal NISP was 69. Many projectile points and scrapers found at the site indicate extensive hunting and hide processing; corn, beans, and bison scapula hoes provide evidence for gardening (Gibbon 1970). Altogether, "the occupation refuse from the Oneota component of the Midway site reflects an economic pattern characterized by hunting, fishing, gathering, and gardening" (Gibbon 1970: 152).

Four unmodified elk bones, all distal limb elements, were identified from the Pammel Creek site south of modern-day La Crosse (47LC61). Two possibly modified antler sections, two elk scapula hoes, eleven modified antler tines, three miscellaneous antler tools, and a dropped antler base with evidence of the groove and split technique were also recovered (Theler 1989). Theler (1989) calculated a minimum of two individuals, since dropped antlers could easily be picked up and don't require a kill. The distal elements suggest the common pattern of deboning at the kill site; the scapula hoes may have been obtained through trade along with the 19 bison scapula hoes found. Although the local landscape could have sustained a bison herd (Saleh 2019), Theler (1989) thinks it unlikely that bison were killed in great numbers near the Pammel Creek

site. More likely, scapula hoes were obtained through trade with more western groups, or during seasonal hunting excursions across the Mississippi River. The numerous scapula hoes and bone projectile points demonstrate both hunting and agricultural activity (Theler 1989). Regarding faunal exploitation, Theler (1989: 237) explains, "The remains indicate a wetland-floodplain-riverine pattern of animal exploitation during a warm-season occupation. Even the white-tailed deer and elk might have been harvested occasionally in the bottomlands and along the terrace margins." In total, Theler analyzed over 17,600 bone and shell specimens from this site (Theler 1989).

Nearby is the State Road Coulee site (47LC176), a Valley View phase village midden. Radiocarbon dates of A.D. 1550 $\pm$ 60 and A.D. 1530 $\pm$ 70 are consistent with the site's ceramic assemblage, dated to between A.D. 1500 and A.D. 1600. The site's location, in a large coulee near the bluff base, provided access to both floodplain and upland habitats. Floodplain and aquatic habitats seem to have been more heavily exploited, based on the faunal assemblage; approximately 27,000 bone and shell fragments were analyzed in total. Eighty-six elk specimens (MNI = 7) were identified, in addition to 10 specimens that could have been either elk or bison and 13 that could be attributed only to Cervidae. The elk remains included both axial and appendicular elements, numerous cranial fragments, vertebrae, ribs, and long bones. Antler, whether deer or elk, was heavily utilized at the site to make projectile points, possible knapping aids, and other tools. Five tine elements show use wear and groove and snap fractures at the proximal end. An elk scapula hoe shows modification—the removal of the posterior ridge and scapular spine—and use wear (Anderson et al. 1995).

Jones (2014) analyzes material recovered from a 2012 field school undertaken by the University of Wisconsin-La Crosse at the Tremaine site (47LC95), midway on a terrace between the Black River and bluff line. Her sample consisted of faunal remains (total NISP = 1052) recovered from eight features. These remains indicate a heavy exploitation of fish; subsistence strategies at the site also seem to have been focused less on hunting—specifically hunting of deer and other large mammals—and more on agriculture than in previous periods. Five elk specimens were identified from the site (MNI = 1), all of which were distal limb elements. Elk were estimated to have contributed 76% of the mammal meat obtained at the site, but this number is undoubtedly skewed by the extremely small sample size; only 33 mammal specimens, attributed to six species, were identified to more than the class level (Jones 2014).

The Valley View site (47LC34) is a multicomponent site with Oneota and early historic occupation, the latter of which is not discussed here. It consists of a small palisaded village on a terrace overlooking the La Crosse River. The Oneota occupation likely occurred between the mid-15th century and early 16th century A.D., based on ceramic artifact styles. Radiocarbon dates were initially inconsistent, suggesting a much earlier occupation than expected, but later tests came back with dates of A.D. 1550 $\pm$ 70 and A.D. 1600 $\pm$ 70, closer to the expected values. There is evidence for hunting and the cultivation of corn, squash, beans, and tobacco. In total, 6,966 faunal remains were identified (Stevenson 1985).

Although large mammals—deer, elk, bison, and bear—had relatively small MNIs, they contributed a large portion of the estimated meat yield at the site. Elk, with an MNI of four, represented an estimated 44.5% of that yield. The NISP for elk was 75, including numerous cranial, mandibular, and dental fragments, one antler, 54 distal limb elements, two scapulae, two

humeri, and one ulna (Stevenson 1985). Although the preponderance of distal limb elements suggests selective transport, the presence of long bones and bones from the head indicates that elk also may have been killed near the site and transported back in their entirety. It might also mean that selective transport focused on elements other than the distal limbs; skull elements, for example, could be indicative of transport of the head, which is high in fats (Enloe 2003).

Antlers and scapula were likely retained for use as tools. Numerous modified pieces of antler, both deer and elk, were found at the site. These include hollowed rings of antler, socketed projectile points, probable needles, a probable perforator, tube fragments, and tine tips that were likely used as flakers. One broken elk scapula, possibly a hoe, was found. A final modified piece of elk bone, of great interest but unknown use, was a cut cranial fragment with red ocher staining on its surface (Stevenson 1985).

North of the Driftless Area, the Armstrong site (47PE12) lies on the east bank of the Mississippi River in Pepin County. It is believed to have been occupied roughly A.D. 1100-1300. Occupation at the site, which consists of at least four houses and various features, may have been seasonal, with an abundance of remains of avian fauna that would have passed through the area during spring and fall migrations. Seven elk bones were identified from the site, all of which were distal limb elements except for one scapula. Two were recovered from within House 1, the other five from a feature immediately to the north of the house. All seven bones could conceivably have been from a single individual (MNI = 1), contributing an estimated 13.84% of the site's meat weight. Twenty-five additional specimens, mostly antler fragments, could be identified only to Cervidae, and thus might belong to either deer or elk. Five antler tines were found modified into awls and one into a scraper-like artifact. The mammal NISP for the site was 955 (Savage 1978).

In central Wisconsin are two Grand River phase Oneota sites, the Bornick (47MQ65) and the Walker-Hooper (47GL65). Radiocarbon dates place the occupation of both sites within the 13th century: approximately A.D. 1290 for the Bornick site, and between A.D. 1200 and 1240 for the Walker-Hooper. Faunal remains from both sites show a heavy reliance on aquatic habitats, less on forest and forest edge communities, and even less on grassland species (Gibbon 1969). While elk accounted for an estimated 29.81% of the non-fish vertebrate meat weight at the Bornick site, the estimated combined weight of fish, mussels, and aquatic species accounted for 49% of the site's total meat weight, reflecting an emphasis on the exploitation of aquatic resources (Gibbon 1971). This lack of focus on large herbivores, which was seen in earlier periods, is consistent with a more agriculture-based economy (Gibbon 1969).

Located near the Grand River Marsh in Marquette County, the Bornick site is a small, probably single family, habitation site. Its isolated location suggests its possible use as either a winter camp or a defensive setting (Gibbon 1971), although the substantial exploitation of aquatic resources makes the former hypothesis unlikely. Seven elk bones (MNI = 1), out of 385 identified mammal remains, were identified from the site, as well as two cervid antler projectile points. Evidence for other contributions to subsistence include large quantities of smashed bone, interpreted as evidence for bone grease production, smashed hickory shells, which could also have been boiled to produce oil, and corn grains distributed throughout the site, suggestive of agriculture (Gibbon 1969, 1971).

The Walker-Hooper site, like the Bornick site, is well-situated amid prairie, oak opening, and marshy habitats. It is much larger, however, comprised of a large village site, mound group, and smaller village site along a two mile stretch of the Grand River in Green Lake County.

Excavations uncovered two houses, one or two palisades, numerous sheet middens, and 66 pits. Twenty elk remains from this excavation were identified, with an MNI of two and estimated meat contribution of 16.38% (mammal NISP = 1,494). In addition, numerous projectile points and possible flakers made from either deer or elk antler were found. Evidence for non-meat subsistence sources include large quantities of smashed bone (interpreted as the remains of bone grease manufacture), corn, beans, squash, hickory, and hazelnuts (Gibbon 1969).

In Winnebago County in east central Wisconsin, the Furman site (47WN216) is a human burial site dated to the early Lake Winnebago phase based on pottery types. Forty-one individuals are interred in 31 separate burials, thought to have been in or near a village or trash disposal area. While Furman is near an ecological transition zone, providing access to a variety of forest communities, prairie, and riverine-lacustrine environments, 70% of the faunal species identified from the site are associated with aquatic habitats (total NISP = 323). The location, assuming it was located near a habitation site, may also have allowed for the cultivation of corn and the gathering of wild rice (Kreisa 1986).

Of the site's 31 burials, two contain pieces of elk bone or antler. Burial 23 is a male over 50 years old; his grave contained a couple of ceramic sherds, a fish spine awl, and an elk antler tine. Burial F/1 consists of two males 21 or older, one 10-year-old juvenile, and one child four or five years old. Among pottery and lithic artifacts, stone and shell tools, and other bones were an elk antler tine and carpal. Both of the tines exhibited pitting and smoothing on their distal ends (Kreisa 1986). Kreisa (1986: 91) hypothesizes: "Both artifacts may represent hammers for stone tool manufacture, but more probably were digging tools, perhaps used to dig the grave."

The McCauley site (47WN222), also in Winnebago County, has a Lake Winnebago phase occupation dating to sometime between A.D. 1350 and 1650, and a Middle Historic occupation dated approximately A.D. 1670 to 1760. Within the prehistoric component, only a single elk phalanx has been identified. Of the other faunal species identified from the site (total NISP = 5,378), 77% were from aquatic habitats, 10% from deciduous forest, and 13% from forest edge habitats. Although the species present seem to indicate a year-round occupation for both components, elk seem to have been exploited minimally in comparison with other species. Heavy bone fragmentation at the site is suggestive of bone grease manufacture or cracking for marrow (Grimm 2010).

Overall, subsistence strategies from Oneota sites seem to focus more heavily on horticulture and the exploitation of lowland/wetland habitats, which is more consistent with the patch choice model of foraging. As Stevenson (1985: 151) observes, "animals such as elk and bear are widely distributed and risky to procure, and might involve considerable time and effort to find, kill, and transport. On the other hand, hunting these animals could be a fairly labor-efficient activity, because of their high individual yield… In addition, these animals would have provided hides, bone for tools, and sinews." Elk remains are present at Oneota sites, and their importance in the production of various tools is evident, but their overall contribution to diet is diminished relative to earlier time periods. At the Gunderson, State Road Coulee, and Valley View sites, a significant number of axial and proximal limb elements indicate that elk were likely killed nearby and transported back without being deboned at the kill site. Scapulae, used to make hoes, may have been obtained through trade (Arzigian et al. 1993; Anderson et al. 1995; Saleh 2019; Stevenson 1985; Theler 1989). This is in keeping with Koziarski's (2004) suggestion that

agriculture restricts group territory; hunting parties may not have ventured as far to procure large game when there were numerous resource-rich habitats close to their habitation site. Despite their more intensive focus on agriculture, the Oneota sites discussed here are generally not seen as far south as Mississippian, Woodland, or Archaic sites. A majority are clustered close to or in the modern-day city of La Crosse, along the Mississippi River.

3.4 Wisconsin Historical Record

Among the written records of the first European explorers in Wisconsin, numerous references to elk can be found. The sources below were obtained primarily from Schorger (1982) and two databases of historic documents accessed through the University of Wisconsin-Milwaukee library: Early Encounters in North America: People, Cultures, and the Environment; and European Views of the Americas: 1493-1750. A combined map of historic records and the archaeological sites of the previous section can be found in Chapter 5.

Pierre Radisson (1883: 79) mentioned encountering "staggs," which Schorger (1982) supposes to be elk, during his 1661-1662 exploration of northwestern Wisconsin. More definitively, Schoolcraft (1851) reported elk on the prairies around Rice Lake, Barron County, in August of 1831. Nicolas Perrot, a French explorer who chronicled his travels in North America in the late 17th century, wrote about the Saulteurs, who are better known as the Ojibwe. They lived "at the south of Lake Superior," i.e. in the upper peninsula of Michigan and northern Wisconsin. About their subsistence, Perrot wrote,

> They have for neighbors and friends the Sioux, on whose land they hunt, when they wish, buffaloes, elk, and deer, and other game, which they take by surprise with the discharge of guns and arrows… They hunt all the other beasts with guns, although they have also arrows, but they are not so skilful [sic] in using these weapons as are the people

> of the north and of the prairies, because the use of firearms is not so general among them as in those tribes; and because in the distant regions to which they are accustomed to go for hunting there are bears, elk, deer, wild-cats, beaver, some *pekans* [fishers] and otters (Blair 1911: 109-113).

Father C. Dablon, in 1670, described the country surrounding the Upper Fox River Valley in eastern Wisconsin: "...in every direction, prairies only, as far as the eye can reach... All this prairie country extending... more than three leagues (ca. 10 miles) in every direction... affords ample subsistence to the elk not infrequently encountered in herds of four or five hundred each" (Gibbon 1969: 7). Around the same time, Claude Allouez (1899: 219) reported "large and small stags" at the mouth of the Wolf River in Winnebago County. Schorger (1982: 9) makes note of a mail carrier who, in the winter of 1827-1828, transported mail between Green Bay and Chicago. Outside of Milwaukee, he came upon a prairie that "teemed with elk and other game." Aside from this, there are apparently no other mentions of live elk in southeastern Wisconsin (Schorger 1982: 9).

Elk were also observed in the far western part of the state. In southwestern Wisconsin, Charles Hoffman (1835) reported elk in early 1834 in the vicinity of Prairie du Chien, where they were chased by dogs kept by army officers at the fort. A decade later, Brunson (1843) observed elk in the prairies between Black River Falls and Chippewa Falls: "The elk and deer tracks were very numerous. Some of the company saw elk but we killed none."

Le Seur gives an interesting anecdote from his voyage up the Mississippi River in 1700. Near the Black River in La Crosse county, some members of his party killed an elk:

> On the 10th [September], at daybreak, they heard a stag whistle on the other side of the river; a Canadian crossed in a little Sciou [Sioux] canoe that he had found. He soon after returned with the body of the animal, which is easy to kill in the rutting season, that is from the beginning of September to the end of August [October]. During that season

the hunters make a little whistle of the first bit of wood or cane, and when they hear a stag whistle, they answer; the animal supposing it to be another stag that whistles comes to them, and they kill it without any difficulty (Penicaut 1902: 183).

Bunnell (1897) also chronicled the hunting of elk in western Wisconsin:

> Elk were also abundant there [mouth of the Chippewa River] in the Mississippi bottoms, on the prairie, and in the oak thickets below and east of Eau Claire, extending their range over the headwaters of all the streams south of the pine-belt as far as Black River. The writer saw a band of sixty elk, in 1845, on a prairie about eight miles below Eau Claire, two of which were killed by William Richmond and myself (Schorger 1982: 10).

Copway (1850: 35), in a 19th-century ethnography of the Ojibwe, wrote:

> The Elk is to be found in the west, on the neutral ground lying between the Sioux and Ojibway nations; at the head waters of the Wisconsin; in the northern parts of Michigan, and near the Chippeway, St. Croix, Rum and Red rivers. This is one of the noblest looking animals in our country. When on the run, its head is held high, its back curved, on which its large horns appear to rest. At one time, in 1837, I saw a drove of five hundred; and a more animating sight I never beheld. I shot one, and being at that time a prisoner at the foot of Lake Pepin, and wishing to be generous to my enemies, I took it to the chief of the tribe that held me.

Carver (1781: 54) also reported "large droves of deer and elk" on the plains in the vicinity of Lake Pepin. The following year, he returned and wrote,

> Having concluded my business at La Prairie le Chien, I proceeded once more up the Mississippi as far as the place where the Chipéway River enters it a little below Lake Pepin... Near thirty miles up it separates into two branches, and I took my course through that which lies to the eastward. The country adjoining to the river, for about sixty miles, is very level, and on its banks lie fine meadows, where larger droves of buffaloes and elks were feeding, than I had observed in any other part of my travels (Carver 1781: 102-103).

3.5 Conclusions

Evidence for the significance of elk to peoples of the western Great Lakes is apparent in both the archaeological and historic records. During prehistoric times, elk appeared in rock art decorating cliffs and caves across Minnesota, Wisconsin, and Ontario. These depictions have

symbolic and likely spiritual significance not only to the people who created them but also to their descendants today (Hoffman 2016). Elk imagery may appeal to the spiritual power of elk, depict mythical or historic stories, represent clan totems, or provide hunting instructions, among many other possible interpretations.

Elk remains from the contexts of villages, burials, middens, and habitation sites further attest to their importance in Wisconsin. Along with deer, elk represent the primary source of animal protein during the Paleoindian, Archaic, and Woodland periods (Lippold 1971; Parmalee 1960b; Theler et al. 2016). Although their relative importance as a food resource diminished during the Oneota period, they remained a source of food, hides, sinews, and bones and antlers for making tools. Elk antler may have been purposely collected and retained for tool manufacture (Anderson et al. 1995). Antler projectile points are found across Wisconsin's archaeological record; antler scrapers and flakers, elk scapula hoes, and other tools have been discovered at multiple Oneota sites.

During the early Historic period, Europeans and Euroamericans marveled at the number of elk in Wisconsin. They seem to have been found primarily on the prairies, where they were likely more visible than in wooded areas, and more commonly in the west than in the east. Written records of these encounters provide information about hunting strategies, seasonality, and ecology of elk. Some of them also convey a sense of awe at the appearance or sheer quantity of elk.

CHAPTER 4: A RELATIONSHIP REVISITED

4.1 Introduction

While I hope in this thesis to have provided an overview of human-elk interactions in the past, it would be naïve to pretend that the influence of or interest in elk in the western Great Lakes died out when they did. Rather, such interactions are ongoing today, even if they manifest in different ways. While the Eastern elk was eliminated from North America (see Section 2.2.4), other subspecies live on; some have been reintroduced into areas where their extinct relatives once roamed (Bryant and Maser 1982; O'Gara and Dundas 2002). In several states, these reintroduction programs have been so successful as to allow for hunting, albeit limited, of elk (Albert 2017a; O'Gara and Dundas 2002; Wisconsin Department of Natural Resources 2019). Elk bones from centuries past continue to be found, inspiring curiosity and, in some cases, bringing communities together (for example, see Section 4.4). Ultimately, museums have an important role to play in continuing to promote interest in and provide education about the past, present, and future of elk in the western Great Lakes region.

4.2 Elk Reintroductions

Of the six subspecies of elk that formerly roamed North America, four now remain: the tule elk (*Cervus canadensis nannodes)* in California, the Manitoba elk (*C. canadensis manitobensis*) in Manitoba and eastern Saskatchewan, the Roosevelt elk (*C. canadensis roosevelti*) along the west coast, and the Rocky Mountain elk (*C. canadensis nelsoni*) (Bryant and Maser 1982; O'Gara 2002). This latter subspecies is native to the Rocky Mountains but, due to

its adaptability and varied diet, has been intentionally introduced into at least 21 states in other regions (United States Department of Agriculture 1999).

Such reintroduction programs have not been universally successful. In some cases, elk have been greeted not with open arms but with an open season; poaching has threatened reintroduced herds in Michigan, Minnesota (Bryant and Maser 1982; O'Gara and Dundas 2002), and Wisconsin (Laine Stowell, personal communication September 27, 2019). Because much of the territory formerly occupied by elk has since become residential or agricultural land, finding suitable habitat is an ongoing challenge, and in some places, conflict with farmers and landowners has curtailed or prevented reintroduction efforts (Albert 2017a; Bryant and Maser 1982; O'Gara and Dundas 2002). A state-by-state review of reintroductions of elk follows.

Wisconsin. An initial attempt to reintroduce elk took place in 1913. Rocky Mountain elk from Yellowstone National Park were released in an enclosure at Trout Lake in northern Wisconsin. By 1917, the population was declining, so additional elk from Jackson Hole, Wyoming, were brought in to bolster the small Wisconsin herd. Only 15 elk remained in 1932, at which point the reintroduction program was terminated and the elk released (Jackson 1961).

In 1989, the Wisconsin DNR began to reconsider bringing elk, moose, and/or caribou back to the state (Wisconsin Department of Natural Resources 2019). Reintroducing caribou or moose seemed risky due to the possible transmission of a brain worm parasite from local populations of white-tailed deer. However, the DNR decided to move ahead with an elk program (Laine Stowell, personal communication September 27, 2019). The Chequamegon-Nicolet National Forest near Clam Lake was identified as a potential site for this reintroduction, and in 1995, 25 elk were released there. At that time, the Black River State Forest (BRSF) near Black River Falls was

earmarked as another potential reintroduction site. By May of 1999, four years after the initial release, there were approximately 40 elk present in the Clam Lake herd (Wisconsin Department of Natural Resources 2019).

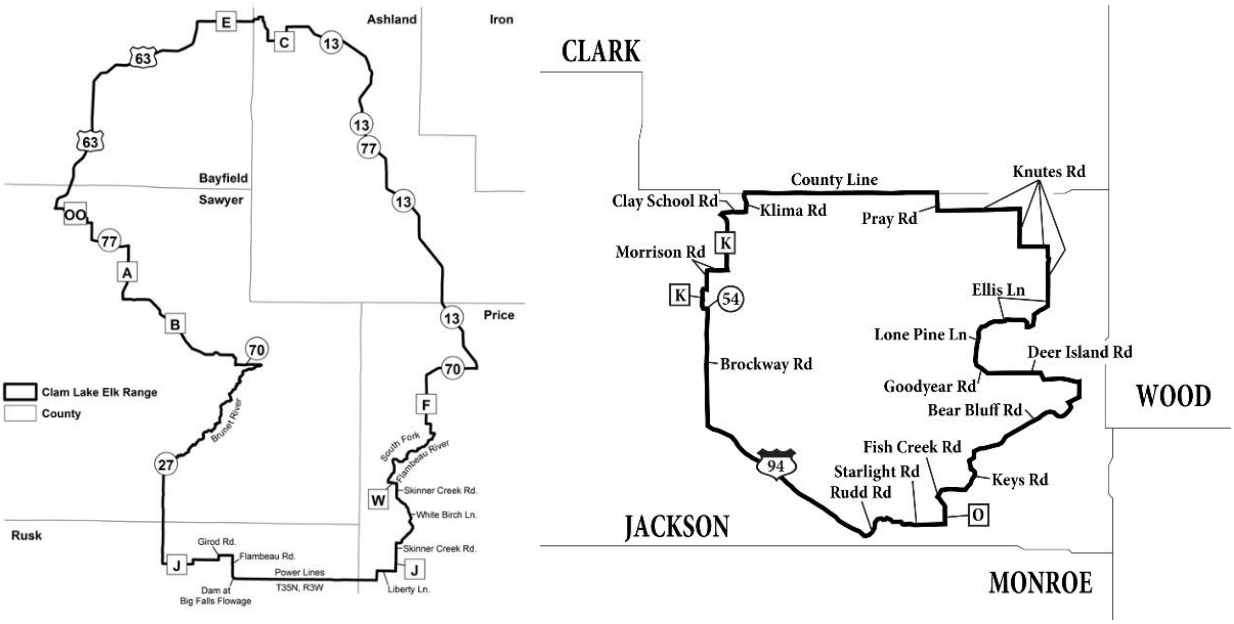


Figure 4.1: Clam Lake elk herd range, left, and Black River elk herd range, right (Wisconsin Department of Natural Resources 2019)

The DNR ramped up its reintroduction efforts in 2014, entering into an agreement with the state of Kentucky to import and release up to 150 wild elk over a five-year period. As many as half of these elk would be released in the BRSF, with a long-term population goal of 390 elk at that site. This plan was put into action in 2015 and 2016, with 73 elk released in the BRSF. In 2017, 31 elk were transported to the Flambeau River State Forest to join the existing Clam Lake herd. The long-term population goal for this herd is 1,400 individuals. As of early spring 2019, the Black River herd was estimated to contain around 60 elk, with up to 20 calves expected to be

born that spring. The Clam Lake herd was estimated at about 190 individuals, with as many as 52 calves expected. Later in 2019, forty-eight more elk were also transported from Kentucky to join the Clam Lake herd (Wisconsin Department of Natural Resources 2019).

Limited elk hunts have taken place in 2018 and 2019, with ten bull-only tags given annually: five to state hunters and five to members of the Ojibwe Tribes. Of the five state hunter tags, four were awarded through a state drawing, and one was selected through a raffle sponsored by the Rocky Mountain Elk Foundation (RMEF). The DNR reports that the initial hunt in 2018 drew strong interest. More than 38,400 applicants entered the state drawing, and an additional 5,000 raffle tickets were sold by the RMEF (Wisconsin Department of Natural Resources 2019). Numbers for the 2019 season were not reported.

Minnesota. A reintroduction program was attempted starting in 1914, with 70 elk released into a 700-acre enclosure at Lake Itasca. The population was greatly in flux over the next 50 years: only 13 elk reported in 1915, approximately 250 individuals by the mid-1940s, and back down to 15 in 1976 (Bryant and Maser 1982). Elk had become a nuisance to local landowners by damaging crops, and in turn, poaching had severely depleted their numbers. That year, the state DNR drafted a proposal to mitigate crop destruction and manage elk habitat on state land (Albert 2017a).

State legislators passed a bill ordering the removal of elk from four counties during the 1984-1985 legislative session, as elk had continued to damage commercial crops such as sunflowers and soybeans. This decision was reversed in 1986; instead, a lottery-based elk hunting season was announced for the following fall, and farmers were compensated for their elk-sustained losses (Albert 2017a). Annual state-sponsored elk hunts have continued, with 27

elk hunting licenses available for specific zones of Kittson County in 2019 (Minnesota Department of Natural Resources 2019).

As of 2017, just over 100 elk dispersed among three herds lived in the far northwest corner of the state. Discussions among the Fond du Lac Band of Lake Superior Chippewa, the RMEF, the University of Minnesota, and the Minnesota DNR about introducing elk into several counties in northeastern Minnesota are ongoing. Wildlife managers believe that elk may be more accepted in that part of the state than in northwestern Minnesota because it has less agricultural land. Population goals for the three currently existing herds are between 230 and 298 individuals total (Albert 2017a; University of Minnesota 2019).

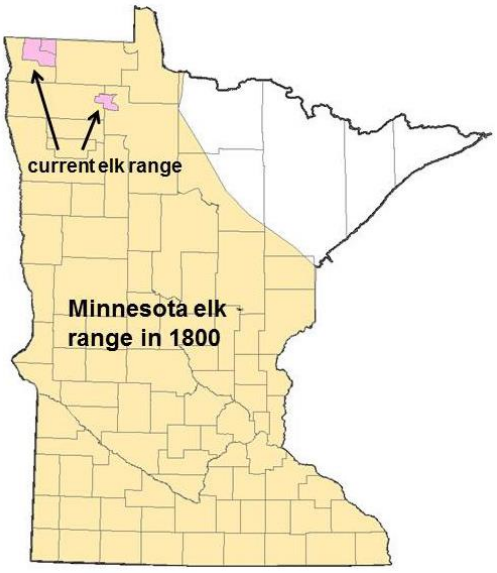


Figure 4.2: Minnesota elk range, past and present (University of Minnesota 2019)

Illinois. In 1996, the state DNR conducted several studies to determine whether it would be possible to reintroduce elk into southern Illinois. Ultimately, because of vocal opposition due to the potential threat to crops, no action was taken (O'Gara and Dundas 2002). Nevertheless,

Illinois is home to one tiny herd of elk in Elk Grove Village, Cook County, in the northeastern corner of the state. Elk are the official symbol for both the village and the Elk Grove Township (Robb 2018). In 1925, ten elk were shipped from Yellowstone National Park and greeted with great enthusiasm by local residents. Since then, the herd has fluctuated from as many as 80 individuals to as few as two, with new bulls brought in periodically to prevent inbreeding. As of late 2018, there were three elk in the herd, and plans were in motion to bring four more from Texas in the near future. The elk remain in public view in their enclosure in Busse Woods, under the jurisdiction of the Forest Preserve District of Cook County (Leszczewicz 2012; Robb 2018).

Indiana. An unsuccessful reintroduction program was undertaken with Rocky Mountain elk in several Indianan counties in the late 1950s and 1960s. With current suitable habitat in the state marginal, future reintroductions of elk seem unlikely (Bryant and Maser 1982).

Michigan. In 1915, twenty-three Rocky Mountain elk from Wyoming were released in various locations as part of a reintroduction program. The fewer than 10 individuals released in Cheboygan County grew to a herd of approximately 1,500 by the early 1960s. At that time, the herd had expanded into Otsego, Montmorency, and Presque Isle Counties as well. Controlled hunts held in 1964 and 1965, followed by 10 years of population decline, caused the Michigan elk population to shrink to 200-300 by 1976 (Bryant and Maser 1982). Numbers went up again to 720 elk in 1980. Since 1988, elk hunts have been held nearly annually in Michigan, excluding 1991 (O'Gara and Dundas 2002). A 2017 survey revealed approximately 1,100 elk in the state. In commemoration of a century of successful reintroduction efforts, the image on Michigan's specialty wildlife license plate was changed from a loon to an elk in 2018 (Keen 2018).

Figure 4.3: Michigan elk range, 2018 (Keen 2018)

Ontario. As in Wisconsin, the government made a reintroduction attempt in the early 1930s. Twenty-four Rocky Mountain elk from Alberta were transported to Ontario; roughly a decade later, their population had expanded to 300 individuals (Bryant and Maser 1982). Bryant and Maser (1982: 37) hypothesize that remnant populations of Eastern elk contributed to this population boom, which would be otherwise improbable given the original population size and standard production rates of elk. However, genetic testing undertaken at the University of Alberta indicated no significant genetic differences between the herd in Ontario and other herds of Rocky Mountain and Manitoban elk (O'Gara and Dundas 2002: 89).

In the mid-1940s, an infestation of giant liver flukes led the government to attempt to eradicate the elk population, with around 1,000 individuals killed by the early 1950s. A few small herds remained and continued to increase. It wasn't until 1978 that elk were given special protection in the province, with a distinction finally made between elk and deer hunting licenses in an attempt to protect the remaining elk (O'Gara and Dundas 2002).

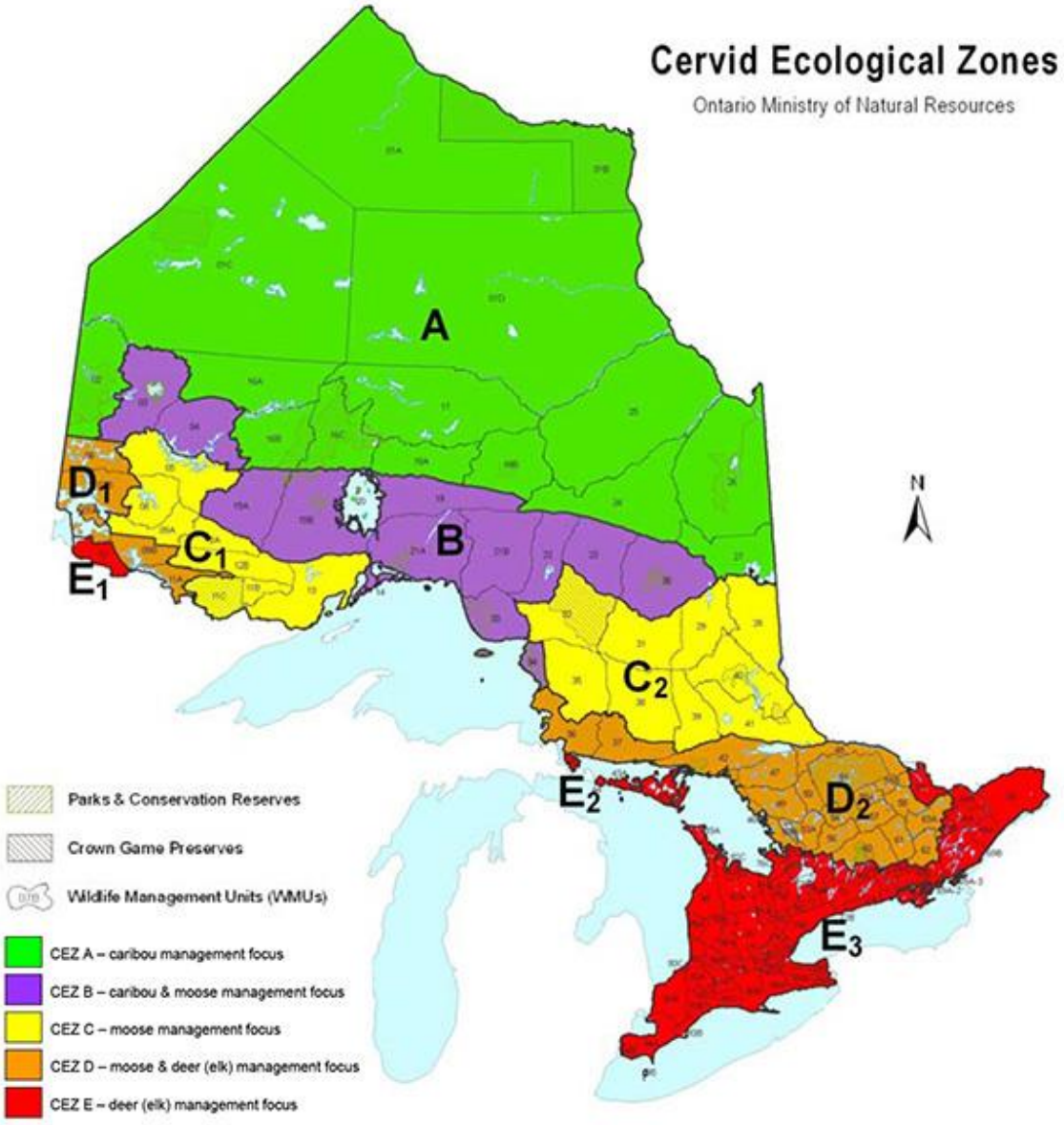


Figure 4.4: Ontario elk reintroduction zones (Ontario Ministry of Natural Resources and Forestry 2019)

4.3 Popular Discoveries of Elk Remains

It is not uncommon for elk to drown after falling through ice in the winter (Bowerman 2016; Eaton 2017; Romans 2015; Schorger 1982). The cold, anaerobic environment of a lake bottom then provides nearly ideal conditions for the preservation of organic remains. Antlers in

non-aquatic environments have a much lower chance of remaining in the archaeological record due to their porosity, weathering, and animal activity (Schorger 1982). Amateur discoveries of centuries-old elk bones and antlers continue to delight, intrigue, and provide opportunities for education.

Ron Kurowski, of the Kettle Morraine Natural History Association, reports on a couple historic discoveries of elk antlers near Whitewater, Wisconsin (Kurowski 2019). The first, in 1876, was by E.B. Warner in a spring on his farm. According to the Delavan Republican (1876: 4), the antlers were "nearly four feet in length and weighed 23 lbs." Warner had previously noticed the antler tines sticking out of the spring, until flooding washed away some of the mud and revealed the antlers and associated skeleton. Kurowski (2019) notes that the whereabouts of these remains today are unknown.

Another discovery less than 50 years later also sparked the interest of the Whitewater community. Asa Dowd, assisted by several men in digging a trench to lay drainage tile on his farm, came upon a set of antlers and bones. Though the antlers were originally reported to "resemble very much those of a moose and yet are different" (Whitewater Register 1919: 1), they were later correctly identified as elk antlers. The low-lying field in which they were found was said to have been a spring or a swamp, and it was postulated that the elk had drowned there. The antlers themselves have spent the past century being handed down among various Whitewater residents and are currently in the possession of the Findlay family (Kurowski 2019).

More recently, Jeff Bosek discovered a set of elk antlers still attached to a partial skull in the fall of 2009. Bosek had been teaching a diving class in Lake Carlos, Minnesota, and, while at a depth of around 74 feet, noticed the tines of an antler sticking out of the mud. One of the tines

broke off in his hand when he tried to pull it out, but Bosek returned to the site the following summer and succeeded in excavating the rest of the rack. He also felt part of the spine in the soft mud as he was digging. Following the excavation, Bosek contacted scientists at the Science Museum of Minnesota, who estimated the antlers to be between 2,000 and 12,000 years old (Alexandria Echo Press 2009).

In 2014, Sonja "Sunny" Moehle and her father, David, found antlers and a number of other elk bones at the bottom of a lake in northern Michigan. They determined, through conversations with experts at the University of Michigan Ann Arbor, that the remains likely belonged to the extinct eastern elk subspecies. After raising money for carbon dating, they learned that the bones were 97.5% likely to be from A.D. 1850 or earlier. They also learned, by contacting a biologist at New Mexico State University, that the elk was approximately five years old when it died (Payne 2014; Xu 2014).

Gary Thompson, of Detroit Lakes, Minnesota, discovered an ancient elk antler at the bottom of a lake in the summer of 2016. Thompson has been scuba diving for over 50 years and displays the treasures he brings up in his dive shop. One such treasure is the five-foot-long, nearly 30-pound antler, which he found on the southwest side of Buffalo Lake in northern Becker County. Radiocarbon dating places the antler at about 570 years old, indicating the elk died between roughly 1440 and 1532 (Albert 2017b; Gerdes 2017).

All of these discoveries demonstrate that elk, especially large elk antlers, continue to capture people's imaginations. They provide a link to the past, a glimpse of natural history, and a connection to an animal that is today an exotic sight to most Midwesterners.

4.4 Bringing Home the Silver Beach Elk: A Case Study

In considering the numerous ways in which elk continue to interest and inspire humans in the western Great Lakes, a contemporary case study involving zooarchaeology, community investment, and the development of a local museum seems an appropriate epilogue. This section delves more deeply into a popular discovery like those discussed above. It also allows me to end this project the way I began it: with the Silver Beach Elk.

In July of 2005, Jacob Voelker, a vacationer in Barnes, Wisconsin, stumbled upon the remains of an elk at the bottom of Middle Eau Claire Lake. What he originally thought to be a large piece of driftwood underfoot turned out to be a set of antlers. Over the next few days, he and others brought the antlers and many more bones to shore. A fluted point in the Clovis or Gainey style was also discovered in close association with the skeleton, inspiring speculation that both the point and the bones were from Paleoindian times. The skeleton came to be referred to as the Silver Beach Elk, after the nearby Silver Beach Resort owned by Quentin and Helen Ruprecht. Their granddaughter, Nikki, helped recover the skeleton and was the one to find the fluted point (Olivo 2006).

The Ruprechts contacted Dr. Jean Hudson, a zooarchaeologist at UWM, about the finds. She conducted a swimming survey of the site, found an elk rib fragment that may have been dropped by the vacationers involved in the initial recovery, and inventoried all of the elements that had been found. Dr. Hudson then brought the skeleton and antlers back to UWM and sent a sample of bone to Beta Analytics for AMS dating. The results indicated that the elk had lived sometime between A.D. 1440 and 1640 (Hood 2006; Hudson 2007).

Another important event took place in Barnes in the summer of 2005: following the town's centennial celebration, the Barnes Area Historical Association (BAHA) was founded. BAHA took great interest in the Silver Beach Elk discovery and soon undertook plans to be able to display the skeleton in Barnes (Amundson 2006; Olivo 2006; Thorson 2008). Such a display would need to be climate controlled, able to protect the bones long-term, and meet state standards for the storage of archaeological artifacts (Amundson 2006). Meanwhile, in the summer of 2006, Dr. Hudson conducted an additional excavation, which yielded soil samples and an elk mandible, hyoid, teeth, and other small pieces of bone. She and her team found the additional elk remains *in situ*, which confirmed the site's archaeological integrity. In October, the second radiocarbon test came back with similar results to the first (A.D. 1458-1630) making it clear that the elk skeleton did not represent a Paleoindian kill (Hudson 2007).

Between 2005 and 2019, the Silver Beach Elk remained at UWM, in the custody of the ARL curation facility. Dr. Hudson and her students analyzed the bones and found hunting and butchery marks consistent with stone tools and projectiles. She hypothesized that the elk had been running when it was taken down by a couple of spears. One pierced the scapula and nicked a couple of ribs on its way into the thoracic cavity; the other wedged into the scapula at an angle but did not pass through (Hudson 2006; Hudson et al. 2006). Similar patterns of damage are seen on the scapulae of elk recovered from archaeological sites from around the world. Modern deer hunters also aim for the same region, just behind the foreleg, which shows a continuity in hunting techniques over centuries if not millennia (Goslin 1961; Leduc 2014; Murphy et al. 1985; Noe-Nyggard 1974).

In addition to the perimortem injuries on the scapula and ribs, the Silver Beach Elk had additional scrape marks on the interior surface of other ribs, chop marks on the right distal femur, and cuts on the mandible, cranium just below the orbit, and the left humerus (Hudson 2006; Hudson et al. 2006). The skeleton was incomplete; notably, the entire right front limb, sacrum, pelvis, most of the left hind limb, and both tibia were missing. Because it was recovered in roughly anatomical position and showed no evidence of carnivore or rodent damage, the elk seems to have been submerged very soon after and at the same location in which it was butchered. Hudson et al. (2006) hypothesize that the internal organs had been removed (possibly producing the nicks on the interior of the ribs), and the right forelimb and upper left hind limb would have comprised a reasonable amount of meat for two to three people to carry back to a habitation site.

Further skeletal and dental analysis indicated that the Silver Beach Elk was an adult male in its prime, probably 8-9 years old and approximately 1000 pounds (Hudson et al. 2006). Hudson (2007b) also determined that it had likely been killed in the winter or early spring, since its antlers were fully developed but still firmly attached. It may have been pursued onto the ice by hunters, killed and butchered there, and then sunk below the ice before scavengers could get to the carcass.

In the decade following the discovery, BAHA continued preparations to bring the antlers and other bones back to Barnes as a long-term loan from the ARL. According to the Town of Barnes website, “BAHA (Barnes Area Historical Association) is very enthused about this discovery, and even though not as old as originally thought, it is a significant and fantastic archaeologic find. Efforts are underway to create a local museum where the Silver Beach Elk can proudly be

displayed and its story told. Lost for 500 years, BAHA hopes to bring it back to 'life' for visitors to see and to learn about the wildlife and [N]ative people living here at the time of Columbus" (Thorson 2008). In June of 2016, BAHA finally opened the doors of a small museum of local history (LeBreck and Sarkauskas 2019). Exhibits offer information on early Euroamerican settlers, Native Americans, logging, fishing, natural history, and Gordon MacQuarrie, an author and duck-hunting outdoorsman who owned a cabin in Barnes (Barnes Area Historical Association 2019).

My involvement with the Silver Beach Elk—and indeed, elk in general—began in the spring of 2018, when I volunteered for an internship with Dr. Hudson. I helped prepare for the long-term loan of the Silver Beach Elk to BAHA, which occurred in the summer of 2019. In September of the same year, I was honored to accompany Dr. Hudson to Barnes for a celebration of the return of the Silver Beach Elk. Two talks, well attended by residents of Barnes and visitors from the surrounding area, were given on two successive days (see Figure 4.5). Laine Stowell, a DNR biologist who has worked with Wisconsin's elk reintroduction program for years, spoke about elk ecology and management. The next day, Dr. Hudson presented on the archeology of the Silver Beach Elk find, after which the audience was invited to the BAHA museum to continue to dialogue with Dr. Hudson and to see the elk for themselves.

Celebrating the Return of the Historic Silver Beach Elk ~ 1500

The Barnes Area Historical Association (BAHA)
Invites You to Join Us at the BARNES TOWN HALL

Friday, September 27

Special Guest

Laine Stowell

Elk Specialist Wisconsin DNR

6:30 pm Meet & Greet

7:00 pm **Wisconsin Elk Management: "Past! Present! and Future?"**

The history of elk in Wisconsin, the disappearance of our original elk, early efforts to re-introduce elk, and the convoluted background of Wisconsin elk restoration. Also described will be our management challenges and opportunities for future expansions.

Saturday, September 28

Special Guest

Jean Hudson

Archaeologist UW-Milwaukee

9:00 am Continental Breakfast

9:30 am **"Archaeological Perspectives on the Silver Beach Elk"**

Discovery of the elk and fluted point in the Middle Eau Claire Lake in 2005, underwater excavation, laboratory analysis the remains, identification of "kill and butchering" marks, radiocarbon dating, comparisons to other historic sites, remaining "mysteries", and perspectives on the find and what they might tell us about elk and hunters of the past.

Funded in part by the Henry and Sarah Wheeler Historical Awareness Fund of the Duluth Superior Area Community Foundation

Figure 4.5: Silver Beach Elk event flyer

The bones are divided between two cases. On the left, a tall case exhibits the antlers and elements of the skull, splayed in a vertical display, with broken tines lying below. On the right is a lower case with a slanted front and three shelves. The top shelf contains part of the upper jaw, both mandibles, and upper vertebral elements, and the middle tier holds additional cervical, thoracic, and lumbar vertebrae and ribs. Partial elements of one front limb and one hind limb are articulated on the bottom shelf. Each element (e.g. "left front limb") and bone (e.g. "left humerus") is labelled, and markers indicate where hunting and butchering marks can be found on the bones. On top of this case are "Elk in Wisconsin" brochures from the RMEF (see Appendix D) and a photo showing what a fully articulated elk skeleton looks like. Around the corner, a full-scale image of a live elk allows visitors to visualize how they would have measured up to the Silver Beach Elk. To the right of the lower display case is a stand with a binder full of information about the discovery and history of the Silver Beach Elk, and context about the lives of elk and humans in northern Wisconsin when it was alive.

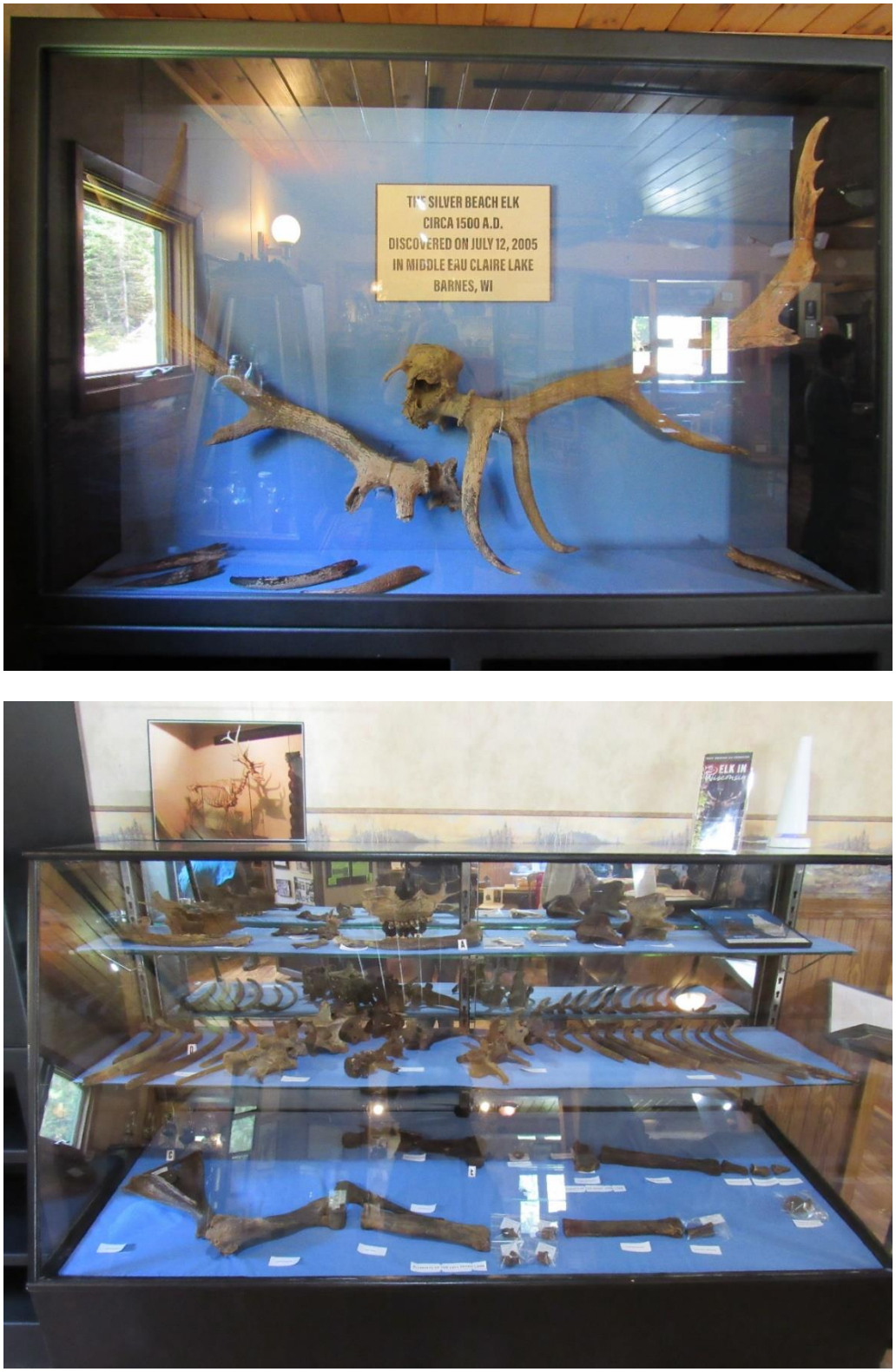


Figure 4.6: Silver Beach Elk display cases (author's photographs)

Altogether, the exhibit is intimately tied to the local community. Community members helped discover and care for the elk bones, raised money to confirm their age with a second test, created a museum for their display, and contributed to the exhibit's interpretive material. This is in contrast to a larger museum, such as the Milwaukee Public Museum (MPM) for example. One diorama at the MPM depicts a taxidermied elk in a natural scene of the Milwaukee region 1,000 years ago, but nothing explicitly links this particular elk to the region. Instead, the elk is one of many components used to illustrate how the Menomonee River Valley changed over time and only one of several taxidermied elk displayed throughout the museum. The other half of the diorama shows the same region being explored by biologists in the present day (see Figure 4.7). Both museums depict elk and discuss their prehistoric presence in the region, but the BAHA exhibit provides a more intimate perspective with strong community connections.

Figure 4.7: Menomonee River Valley/Milwaukee diorama at the MPM (author's photograph)

Americans consider museums the most trustworthy source of information, ranked above local newspapers, nonprofit and academic researchers, and the U.S. government (American Alliance of Museum 2019). Jeff Bosek's collaboration with the Science Museum of Minnesota (Alexandria Echo Press 2009) and BAHA's enthusiasm in founding their own museum (Thorson 2008) attest to this confidence in museums and their role in public education. As various states contribute to the resurgence of elk in the western Great Lakes region, it would be exciting to see a shift in museum exhibits concerning elk from hunting, habitat loss, and local extinction to stories of success.

4.5 Conclusions

In Chapter 2, I answered the question "what is an elk?" from a biological standpoint. This chapter offers several different answers to that question from a more social or cultural perspective, based on the experiences of people inhabiting the western Great Lakes region today. The remains of elk from the past can be buried—or, as is more often the case, sunken—treasure to members of the public. Media reports on such finds, from 19th century newspapers through modern websites, reflect ongoing interest in elk (Albert 2017b; Alexandria Echo Press 2009; Delavan Republican 1876; Gerdes 2017; Payne 2014; Whitewater Register 1919; Xu 2014). Kurowski's (2019) report of elk antlers being handed down from family to family for a century, as well as the case of the Silver Beach Elk, show antlers as relics or trophies from the past. For archaeologists and biologists, elk remains can be sources of information about prehistoric and historic ecologies and cultures (Goslin 1961; Hudson 2006, 2007b; Hudson et al. 2006; Murphy et al. 1985).

Numerous attempts to integrate modern elk into the region show that, to some, they are valued members of the ecosystem. To others, they are crop-damaging pests (Albert 2017a; Bryant and Maser 1982; O'Gara and Dundas 2002). Getting to hunt an elk is an exciting, once-in-a-lifetime opportunity for state hunters (Minnesota Department of Natural Resources 2019; Wisconsin Department of Natural Resources 2019). For the Ojibwe hunters who participate in Wisconsin's elk hunt, elk are a cause for ceremony and a source of food (Rasmussen 2019). Elk are also symbols, as is the case in Elk Grove Village (Robb 2018), Michigan's specialty wildlife license plate (Keen 2018), and the Great Lakes Indian Fish and Wildlife Commission 2017 poster featuring *omashkooz* (elk) (Great Lakes Indian Fish and Wildlife Commission 2019).

Figure 4.8 Great Lakes Indian Fish and Wildlife Commission *omashkooz* poster (Great Lakes Indian Fish and Wildlife Commission 2019)

CHAPTER 5: CONCLUSIONS

The goal of this thesis was to contribute to a deeper understanding of human-elk interactions in the western Great Lakes region, thereby contributing to a greater understanding of human culture, behavioral ecology, and relationships with animals. I hoped to provide a clearer picture of the spatial and temporal spread of human-elk interactions, especially in Wisconsin. I also aimed to understand the varied roles elk played, if any, in subsistence, material culture, symbolism, spirituality, and human social interactions.

The contributions of this thesis have been: a map and database of prehistoric archaeological and rock art sites where elk have been found in Wisconsin; a discussion of changes in subsistence strategies, body part transport, and optimal foraging models across Wisconsin's prehistoric periods; a discussion of the social, symbolic, and spiritual contributions elk may have made to the daily lives of prehistoric western Great Lakes peoples; a synthesis of historic literature concerning elk sightings in Wisconsin; a summary of the ways in which elk, both living and extinct, continue to impact people's lives in this region; and a discussion of the role of museums in education and fostering connections related to the human-elk relationship.

I present here a discussion of my results through my two primary theoretical frameworks. The first, optimal foraging theory (OFT) is derived from behavioral ecology and models subsistence-related decisions. The second, social zooarchaeology, takes into account cultural context, social practices, and personal factors such as age and gender in the analysis of zooarchaeological remains. Section 5.1 presents a discussion of the ecological and subsistence related aspects of prehistoric human-elk interactions. A map of elk remains, historic sightings, and elk rock art in Wisconsin helps illustrate temporal and spatial patterns of these interactions.

I first describe and then provide possible explanations and hypotheses for the patterns observed. Section 5.2 applies artistic, ethnographic, and historic data to draw conclusions about the social and symbolic roles that elk played in people's lives. In section 5.3, I present suggestions for future research, and in Section 5.4, I summarize my conclusions.

5.1 Optimal Foraging Theory, Subsistence, and Ecology

5.1.1 Transport Decisions over Time

In Section 3.3, I examined 34 prehistoric Wisconsin sites or site components at which elk remains have been found. These sites spanned Paleoindian through Oneota times and helped illustrate how subsistence strategies and hunting preferences changed over time. Two, dating from Paleoindian times, had likely but unconfirmed fragments of elk bone (Kuehn 1997, 1998). From the Archaic period, the elk bones identified were mostly distal limb elements, although a humerus shaft, mandible, scapula awl, and antler tools were also reported (Parmalee 1959; Ritzenthaler et al. 1957; Theler et al. 2016). Large mammals such as deer and elk continued to be the primary focus of hunting efforts during the Woodland Period. Across the twelve Woodland sites here reported, axial and proximal limb elements were relatively more common than during the Archaic. Whole or fragmentary ribs, vertebrae, mandibles, scapulae, and innominates are reported. My analysis of elk remains from Wisconsin sites with a Mississippian occupation is not robust, given that I was only able to find partial data for elk at five sites. Oneota sites are more abundant and show a greater diversity of elk remains, including three at which modified antler was found. The utility of elk seems to have diversified: their antlers were used

for tools, their scapulae were used for hoes, and an elk cranial fragment stained with red ocher hints at ritual use (Anderson et al. 1995; Stevenson 1985; Theler 1989).

One of the surprising results of my review of which elk skeletal elements have been identified at archaeological sites is the relatively high frequency of distal limb elements, especially phalanges. This pattern is especially robust for the Archaic sites. This is surprising because distal limbs rank low in nutritional value (Binford 1978), but OFT predicts that a hunter will bring home the most nutritional parts. This pattern may be attributed to multiple factors related to anatomy, taphonomy, and the decisions hunters make about transporting game home. There is a lower likelihood for axial elements, such as ribs, sternebrae, and vertebrae, to preserve and be identified in the archaeological record due to density-mediated attrition (Lyman 1992). While smaller, denser distal limb elements, such carpals, tarsals, and phalanges may preserve well, larger limb elements may become fragmented, and less identifiable to taxon, due to bone grease production and marrow extraction. Various authors (Gibbon 1969; Grimm 2010; Kuehn 1997; Theler et al. 2016) interpret high degrees of bone fragmentation as evidence for one or both of these practices. Incidentally, this suggests a way that elk could have provided food beyond simple meat weight estimates. Binford (1978) developed the Modified General Utility Index (MGUI) to measure how much meat, marrow, and grease was provided by different anatomical parts. Anatomy may also play a role in the relatively high frequencies of elk phalanges; each elk body has 24 of the major weight-bearing phalanges, but only two of each upper limb element, for example.

Relatively high proportions of distal limb bones from large mammals may also result from deboning at the kill site and selective transport (Lupo 2006; Theler et al. 2016). Sasso (2014: 179)

in a study of bison remains at Wisconsin Oneota sites, reports, “The real challenge we encounter is that almost invariably, such practices at the kill sites would result in a lack of faunal signature for bison, wapiti [elk], bear, and so on at home villages, belying the usage of food and other materials obtained from these animals at considerable expense in terms of time and food provisioning.” Daly (1969) explains this pattern with what she terms the “schlepp effect:”

> The larger the animal and the farther from the point of consumption it is killed, the fewer of its bones will get “schlepped” back to the camp, village, or other area. Transportation of whole Bos or Bison can obviously present a problem, and such cattle bones as we do find at Suberde [Turkey] probably arrived at the village in the form of articulated feet, probably still attached to the skins (Daly 1969: 149).

A similar practice is reported for deer by Fletcher and La Flesche (1911) among the Omaha and by Skinner (1923: 142) among the Sauk: “When it must be carried on the hunter’s back, the deer is gutted, the lower leg bone skinned out and thrown away, and the leg skins tied together, making a natural forehead strap which doesn’t readily untie because the dew claws, which are left on, catch in the knot.” This practice removes the larger limb elements, but the small distal bones are retained in the skin and carried back to the habitation site. While adult elk are too large to be carried using the “forehead strap” method described by Skinner (1923), a similar butchering practice may have been used. As carrying a 500-700 lb. elk carcass or even several hundred pounds of elk meat over any distance would be no mean feat, partial butchering at the kill site, including some deboning, would be a way to improve meat yield while decreasing transport effort.

It is also possible that distal limbs, which have low meat utility, were left attached to meatier upper limb elements to eliminate the work of separating them in the field. Binford (1978; 1981) referred to these low-ranked parts as riders and, due to their association with high-value

proximal limb elements, gave them a higher MGUI value (Metcalfe and Jones 1988). Alternatively, distal limb elements might have been valued in their own right; metapodials may have been retained for marrow, for example. Some distal limb bones, while they have little meat, have higher values (relative to their MUI) for marrow and grease (Binford 1978).

The numerous distal limb elements from Archaic sites suggest that elk may have been butchered and partially deboned at their kill sites, perhaps at a distance from the rockshelters where they have been found. The selective hunting of large mammals, even factoring in the high energetic costs of pursuit and transport over long distances, is in keeping with the prey rank model of OFT. Elk, deer, and other large mammals were highly valued game among early prehistoric peoples.

The higher number of axial elements, including ribs and vertebrae, from Woodland sites is likely in part due to the better preservation of these elements from more a recent period. While elk were probably still disarticulated at the kill site to facilitate their transport, the presence of these axial elements also suggests that pieces of the entire animal were able to be carried back to camp. Perhaps group territories, or at least hunting ranges, shrank and elk were pursued closer to habitation sites. Additionally, hunting parties may have been larger, facilitating the transportation of more meat.

As a general trend, subsistence strategies seem to have shifted during the Mississippian period, providing something of a transition between the prey rank model favored during earlier times and the patch choice model more commonly seen during the Oneota period. Although Lippold's (1971) approach to estimating dietary contribution may be viewed by modern zooarchaeological standards as overly simplistic, her study remains one of the few that took a

chronological approach and attempted to convert elk bone to a representation of food value. She found that the average estimated meat weight contribution for elk was only a little more than half of what it had been during the Woodland period, based on her analysis (see Table 3.2, page 99). The rise of corn agriculture/horticulture and diversification of subsistence during this period (Warwick 2002) can perhaps partially account for the decrease in elk remains, not only in quantity but also in the number of sites at which they were found.

The relative abundance of elk compared to other species seems to have decreased during the Oneota period, although elk body part representation is more complete. A much greater focus on wetland species (e.g. beaver, muskrat, fish, mussels) at most Oneota sites suggests a transition to the patch choice model of optimal foraging. Gilbert et al. (2010) found that forested wetland is highly suitable for elk during the winter and spring. Elk that were encountered in these habitats were likely taken opportunistically, rather than specifically pursued at greater distances from habitation sites. Both axial and appendicular, including distal limb, elements are reported, in keeping with this hypothesis. However, Sasso's (2014: 179) suggestion that large mammals are under-represented at Wisconsin Oneota sites means that elk may have been more prevalent than the physical remains indicate.

Increased conflict during the Oneota period may have influenced this model as well. McTavish (2019) explores how people at two localities in southern Wisconsin and northern Illinois responded to structural and potential physical violence. The threat of violence may have kept people from hunting at greater distances from their habitation sites, forcing them to take advantage of resources in the more immediate vicinity.

While elk appear to have been hunted throughout prehistory, the relative frequencies of different elements suggest that long-range hunting trips and more selective transport of certain parts of the carcass home may have been more common during the earlier periods, while more complete transport, and hunting trips closer to home, may have been common in later periods. This fits with an overall shift, in OFT terms, from prey rank to patch choice over time.

5.1.2 Discussion of Geographic Patterns

In addition to the temporal differences in the prehistoric pursuit of elk just discussed, geographic differences also exist. Figure 5.1 combines the maps previously presented in Chapter 3 with one from Schorger (1982), which plots historic references and findings of Eastern elk bones and antlers in Wisconsin. Colored dots represent archaeological sites at which elk remains have been found, while gray dots show other findings of elk bones or antlers as reported by Schorger. I have differentiated between pre-Woodland and post-Archaic sites (red vs. green, respectively) due to the increasing reliance on domestic plants that accompanied the cultural transition between Archaic and Woodland times.

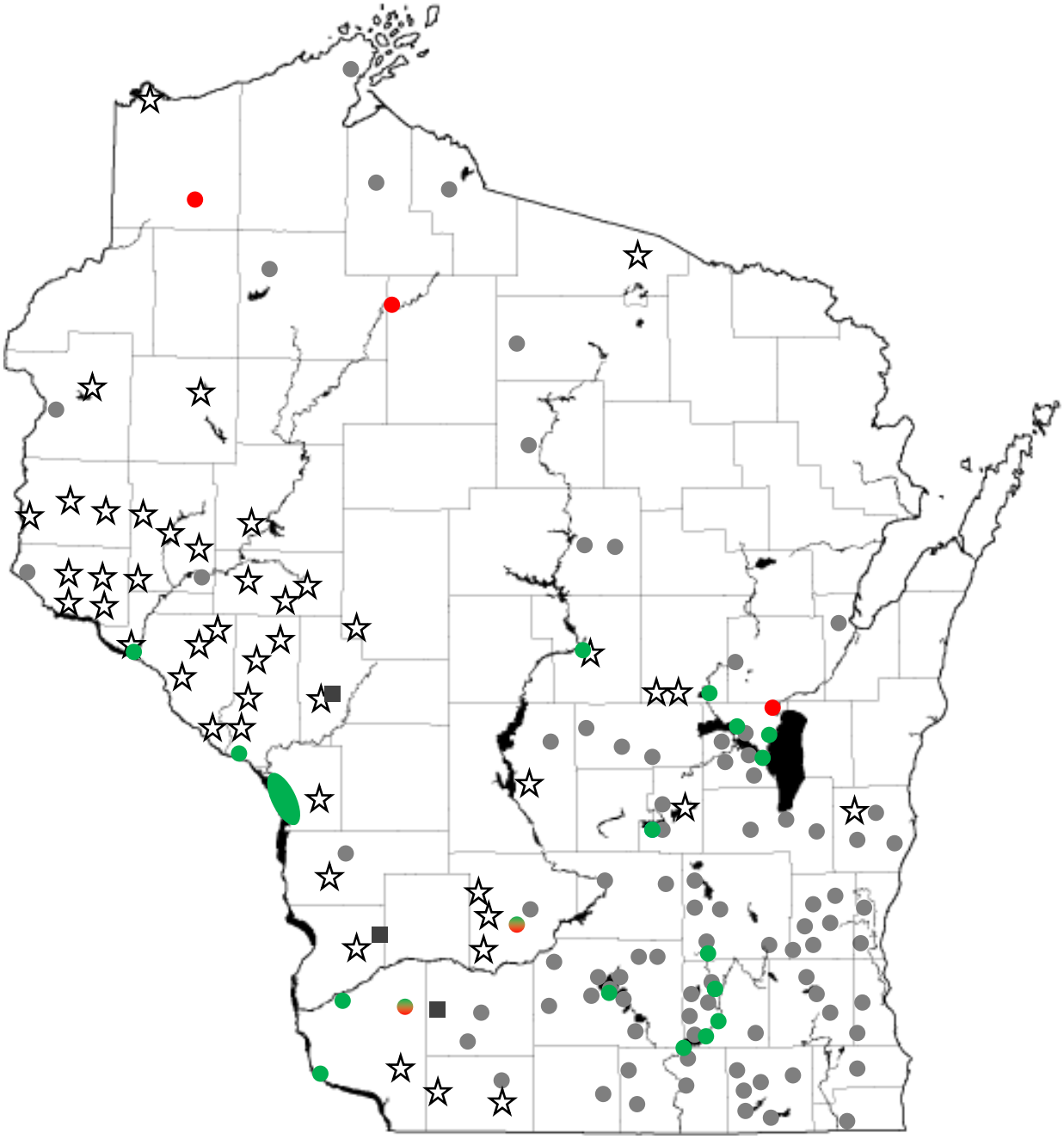


Figure 5.1: Records of elk in Wisconsin (Anderson et al. 1995; Arzigian et al. 1993; Dietz 1956; Gibbon 1969, 1970; Grimm 2010; Jones 2014; Kreisa 1986; Kuehn 1997, 1998; Leigl 2014; Lippold 1971; Parmalee 1959, 1960a, 1960b; Pillaert 1969; Savage 1978; Schorger 1982; Schrab and Boszhardt 2016; State Cartographer's Office, University of Wisconsin-Madison 2018; Stencil 2015; Stevenson 1985; Theler 1989; Theler et al. 2016; Wittry 1959)

This transition entailed a shift in subsistence as well as settlement strategies. While the pre-agricultural periods cover a much longer time frame than the Woodland through Oneota periods, lower human population density, more mobile settlements, and poor preservation perhaps account for the dramatically fewer sites. The two northernmost sites, Sucices and Deadman Slough, have suspected but not confirmed elk remains. Taking these two into account, however, pre-agricultural sites seem to take advantage of a wider variety of ecological zones than post-agricultural ones. In general, pre-Woodland sites are much more widely dispersed, are not as strongly linked to modern waterways (which could have shifted in the centuries since their occupation), and show in general a slightly more northern and western dispersal than post-agricultural sites.

Post-agricultural sites show clustering at a few localities which seem to have been highly suitable for human habitation: La Crosse, Lake Winnebago, the Rock River, and Lake Koshkonong. They are not as widely distributed, but their density is much greater than that of pre-agricultural sites. The rise of agriculture facilitated population growth and more permanent settlements. It also required adequate conditions for the cultivation of crops; while southern Wisconsin is within the frost-free zone and thus suitable for horticulture or agriculture, northern Wisconsin is not.

Wisconsin's three rock art sites that depict elk are also technically archaeological, but I have differentiated them (as dark gray squares) on the map because the record they represent is an artistic rather than organic one. All three are located in the Driftless Area where, as stated in Chapter 3, rocky hills and valleys provide suitable "canvases" for carved and painted art. Other instances of rock art in Wisconsin occur in much the same area and similar settings (Schrab and Boszhardt 2016), so it is difficult to draw conclusions about the individual decisions that led to

depictions of presumed elk at those particular sites. Perhaps elk and other cervids were especially valued as game in the time and place in which they were created, and the images are related to hunting.

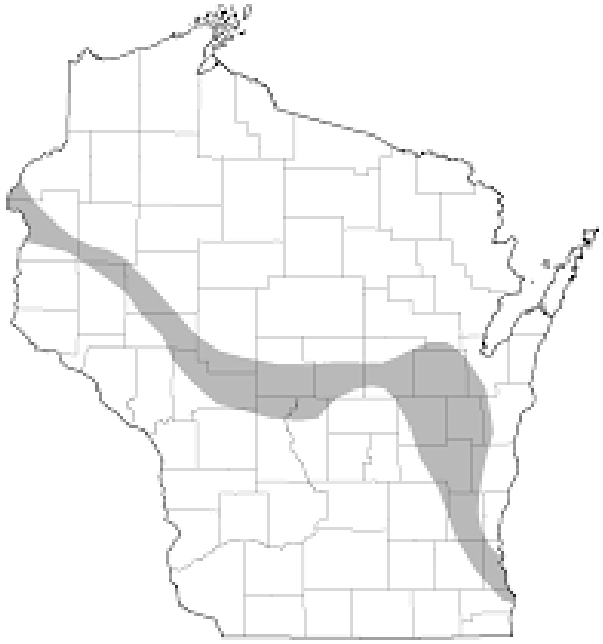


Figure 5.2: Wisconsin's ecological tension zone (Wisconsin Department of Natural Resources 2015)

The greatest density of both archaeological sites and historic sightings fall in or below Wisconsin's tension zone, the band (shown in gray in Figure 5.2) between the northern hardwoods and southern prairie-forest (Curtis 1959). This suggests that these environments were most suitable for both elk and the humans who hunted them. The map in Figure 2.4 (page 34) shows the area below the tension zone as filled with primarily oak savanna and southern mesic forest interspersed with prairie, southern oak forest, and sedge meadow, which would have provided an ideal habitat for elk (Gilbert et al. 2010; Miller 2002; Schorger 1982). Although

this map shows vegetation patterns for the mid-19th century, it is unlikely that the general distribution of these plant communities had changed drastically since Archaic times (Kuehn 1997; Mason 2002). Sasso (1993) and Saleh (2019) note several minor shifts—warmer temperatures A.D. 690-1100, a drier climate A.D. 1100-1550, and cooler and moister weather patterns during the Little Ice Age (A.D. 1550-1850)—that may have affected the expansion of the Prairie Peninsula into Wisconsin. Nevertheless, the general trend of grasslands in the south and west and forests in the north is unlikely to have been significantly affected. While elk are highly adaptive and were likely distributed throughout most of the rest of the state as well, the suitable habitat in southern and western Wisconsin may have supported a larger elk population, leading to a greater number of bones and antlers being found there.

Furthermore, given that roughly the lower third of the state is suitable for intensive farming (Tanner 1987), it could support a larger human population and more permanent settlements, leaving a more significant footprint in the archaeological record. Northern groups, which relied more on hunting than farming, are likely to have occupied larger territories and had fewer permanent settlements. It is worth noting briefly that while both archaeological and non-archaeological elk remains are distributed across southern Wisconsin, archeological sites tend to be clustered at major waterways and/or lakeshores. Elk were widely hunted (Blair 1911; Lurie 1978), but the most enduring records of these interactions are at more permanent settlements, optimally positioned near substantial bodies of water.

The lack of both historic references and remains in northeastern Wisconsin is striking. While this could be partially influenced by the lack of archaeological studies conducted in that part of the state, which is heavily forested, historic documents hint at a scarcity of elk there.

Perrot, who wrote about the Ojibwe living south of Lake Superior, reported that they hunted for elk not on their own lands, but on those of their "neighbors," the Sioux, who lived further west (Blair 1911: 109). Bryant and Maser (2002) note that no historic references to elk in Michigan's northern peninsula, immediately to the east, are known. Copway (1850: 35) observed that elk were found "in the west, on the neutral ground lying between the Sioux and Ojibway nations," near the St. Croix and Chippewa Rivers, but also at the headwaters of the Wisconsin River, which is further east.

While Gilbert and coauthors (2010) found that forests and forested wetlands have a high suitability index for elk based on the presence of winter cover and winter and spring foods, elk also eat grasses throughout the year, which is why forest edge habitats are particularly suitable for them (Bubenik 1982; Cook 2002; Schorger 1982). In his analysis of elk in Wisconsin, Schorger (1982: 8) wrote, "the elk was most numerous in the open woodlands, oak openings, and at the border of grassland and forest. These habitats prevailed in the southern and western parts of the state." Hence, the region north of the tension zone was likely not as suitable for elk. It was also a more inhospitable environment for human populations. Their hunting-dominant subsistence strategy would have been associated with smaller, less permanent settlements, leaving fewer traces in the archaeological record.

Non-ecological hypotheses must also be considered when examining the distribution of elk bones and antlers in Wisconsin. For example, the southeastern corner of Wisconsin boasts the highest number of archaeological and non-archaeological discoveries of elk remains and is the most densely populated part of the state to this day. This region has been significantly altered for both agriculture and urban development (see Figure 5.3). A high degree of alteration and soil

disturbance is bound to turn up more bones and archaeological materials. The discoveries of two separate elk skeletons, with antlers, on farms near Whitewater (Kurowski 2019) illustrate this point.

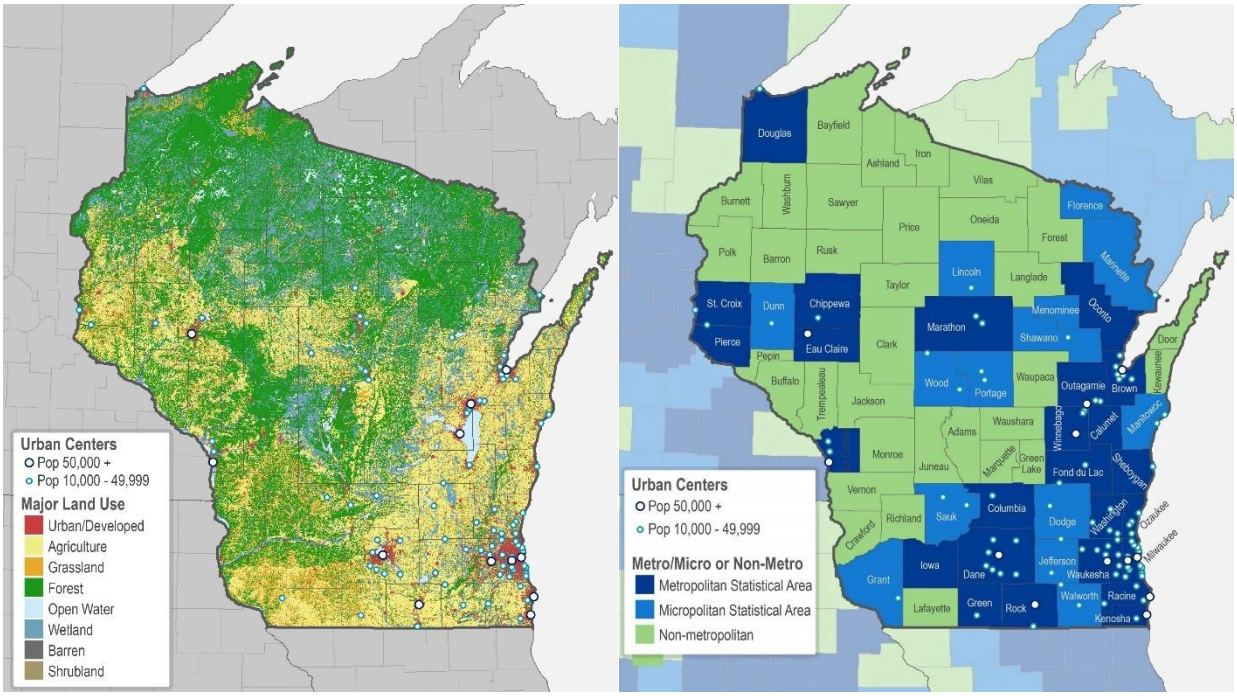


Figure 5.3: Wisconsin land use and metropolitan areas by county (Jones and Ewald 2017)

Tangentially, this begs the question whether elk remains without antlers are overlooked in farm fields (and elsewhere) because they are mistaken for cows, horses, or deer. To the untrained eye, and even to the trained eye, as discussed in the introduction to Chapter 1, elk remains can appear similar to those of other ungulates. Many more unreported and unidentified elk bones have likely been found throughout the state. Perhaps the reason why so many found elk skeletons boast spectacular antlers (including those in Sections 4.3 and 4.4) is that those that

don't are not recognized for what they are. A similar explanation may hold true for rock art, as depictions of antlerless elk would be virtually impossible to distinguish from those of other cervids (the large elk head at Gullickson's Glen is an exception). Are male elk—archaeologically, biologically, and artistically—more visible than female elk?

Returning to the issue of human population density and associated development, more recently, some projects such as the construction of roadways or buildings necessitate archaeological surveys before the site can be developed. This would also lead to more opportunities to potentially discover elk remains. In contrast, in areas with lower human population density and relatively lower soil disturbance such as northern Wisconsin, the bones and other archaeological materials that lie buried are more likely to remain so.

It is interesting to note a difference in the distribution of historic sightings of elk and historic antlers or bones. The former are most heavily concentrated in the western, particularly west central, part of the state, while the latter are densely clustered in southeastern Wisconsin. Why would historic references be largely absent from an area where both elk and humans lived in the past? Perhaps elk, which are not as tolerant of human disturbance as other species (e.g. deer), moved out of that part of the state as denser populations of humans moved into it. Meanwhile, although Euroamericans traveled throughout western Wisconsin, human population density and land disturbance were still not as great there as in the southeastern part of the state early in the historic period.

Figure 5.4 shows an 1850 census, in which Pierce County and parts of Eau Claire and Chippewa counties, along the Chippewa River, had a slightly higher population density compared to most of the rest of northern and central Wisconsin but were not as heavily populated as the

urban and suburban areas in southeastern Wisconsin. Numerous accounts reference this area, especially around the Chippewa River and Lake Pepin, including Schoolcraft (1851), Brunson (1843), Bunnell (1897), Copway (1850), and Carver (1781). The use of the Mississippi River by European and Euroamerican explorers can perhaps also partially account for this pattern. A handful of literature references to elk along the Wisconsin River may similarly be attributed to the utility of waterways for transportation.

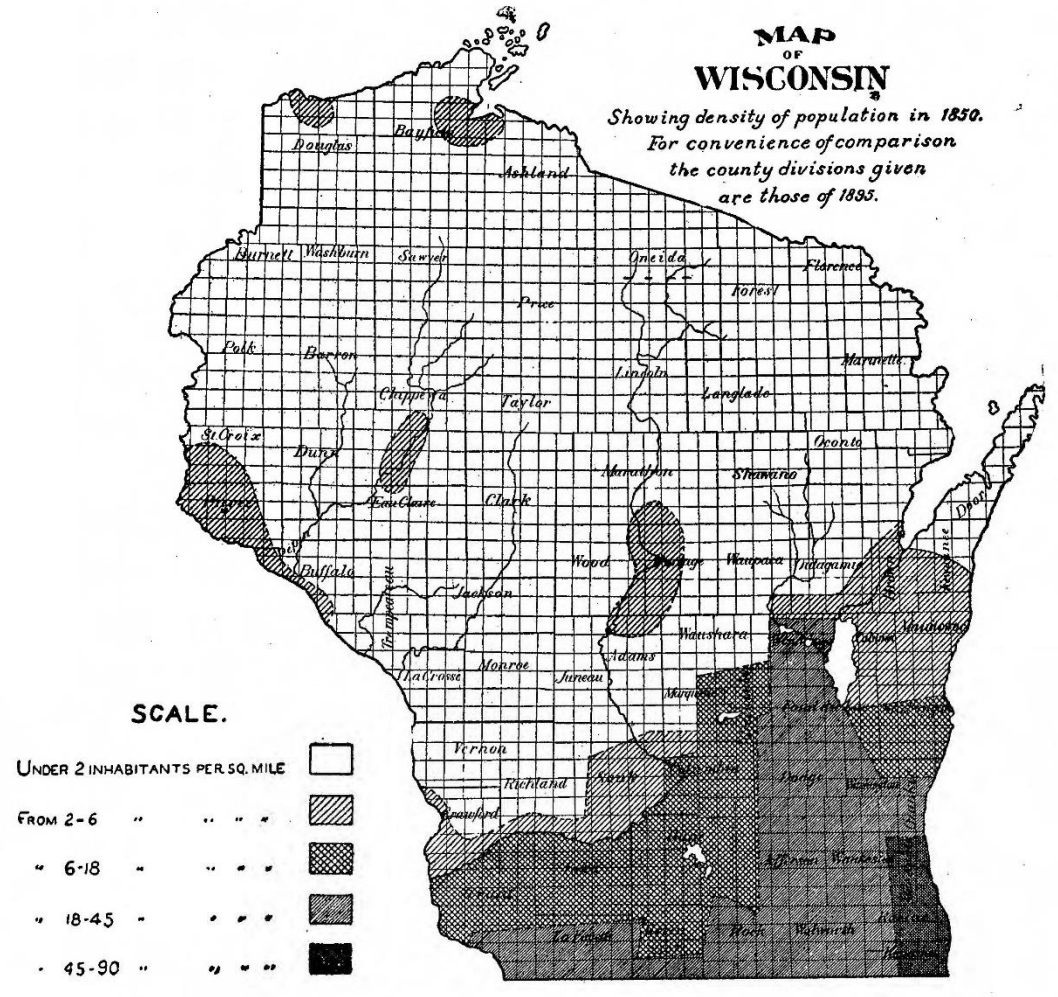


Figure 5.4: Wisconsin population density, circa 1850 (Libby 1895)

The hypotheses presented above are not mutually exclusive, and it is unlikely that any one of them explains the entire picture. Suitable habitat, favorable growing conditions, and abundant waterways in southern and western Wisconsin may have appealed to both prehistoric and historic populations of humans and populations of elk. There may also be other factors of which I am unaware that could explain the distribution of elk findings in Wisconsin.

Furthermore, the results here presented are partially a function of human (and elk) behavior and partially a function of the quality of my data. Our records of elk and human-elk interactions will never be complete, due to insufficient preservation and excavation among myriad other reasons, but nevertheless they provide a framework from which to extrapolate, contributing to a better understanding of the past. As is the case throughout this chapter, my hypotheses and interpretations are not meant to be the final word on the subject; rather, they are meant to identify patterns, provoke thought, and suggest possible avenues for further research. Over time, additional discoveries and publications will hopefully continue to expand our understanding of prehistoric human-elk interactions.

5.2 Social Zooarchaeology and Symbolism

5.2.1 Material Culture

In addition to their contribution to the diets of prehistoric peoples, elk also provided the raw materials for various tools and other products. A possible chisel made from a tibia and an awl made from a scapula are reported from the Archaic Preston Rockshelter, where skin-working seems to have been a common activity (Theler et al. 2016). Although skins seldom preserve in

the archaeological record, it is not unreasonable to assume that an elk contributed not only a bone for skin-working, but also its skin to be worked. Elk antler seems to have been used in conjunction with worked copper to create axes, which were found with human burials at the Reigh site (Ritzenthaler et al. 1957).

Scapulae continued to be used for tools through the Woodland and Mississippian periods. Eleven scapulae or scapula fragments, one of which was worked, were reported from the Middle Woodland Millville site (Pillaert 1969). A scapula tool, purportedly for shredding fibers, was reported from Aztalan (Parmalee 1960a). Hoes made from large mammal scapulae—primarily bison, but also elk—are well-documented during the Oneota period and may have been obtained through hunting or trade (Arzigian et al. 1993; Anderson et al. 1995; Saleh 2019; Stevenson 1985; Theler 1989). Thus, elk were important not only for hunting, but made a small contribution to farming as well.

Antler was also utilized to create a variety of tools. Because male elk shed their antlers annually, they can be obtained without the energetic expense of hunting and represent a somewhat "renewable resource." Since antler is more porous than regular bone, it tends to disintegrate more quickly (Schorger 1982), which is perhaps why antler tools are reported here primarily from Oneota sites and less from earlier periods. It is also possible that the usage of antler expanded greatly during this period. Whatever the case, Oneota articles made from antler are abundant and varied: projectile points, hollow rings, tubes, hide scrapers, flakers, awls, needles, perforators, and modified tines (see Figure 5.5).

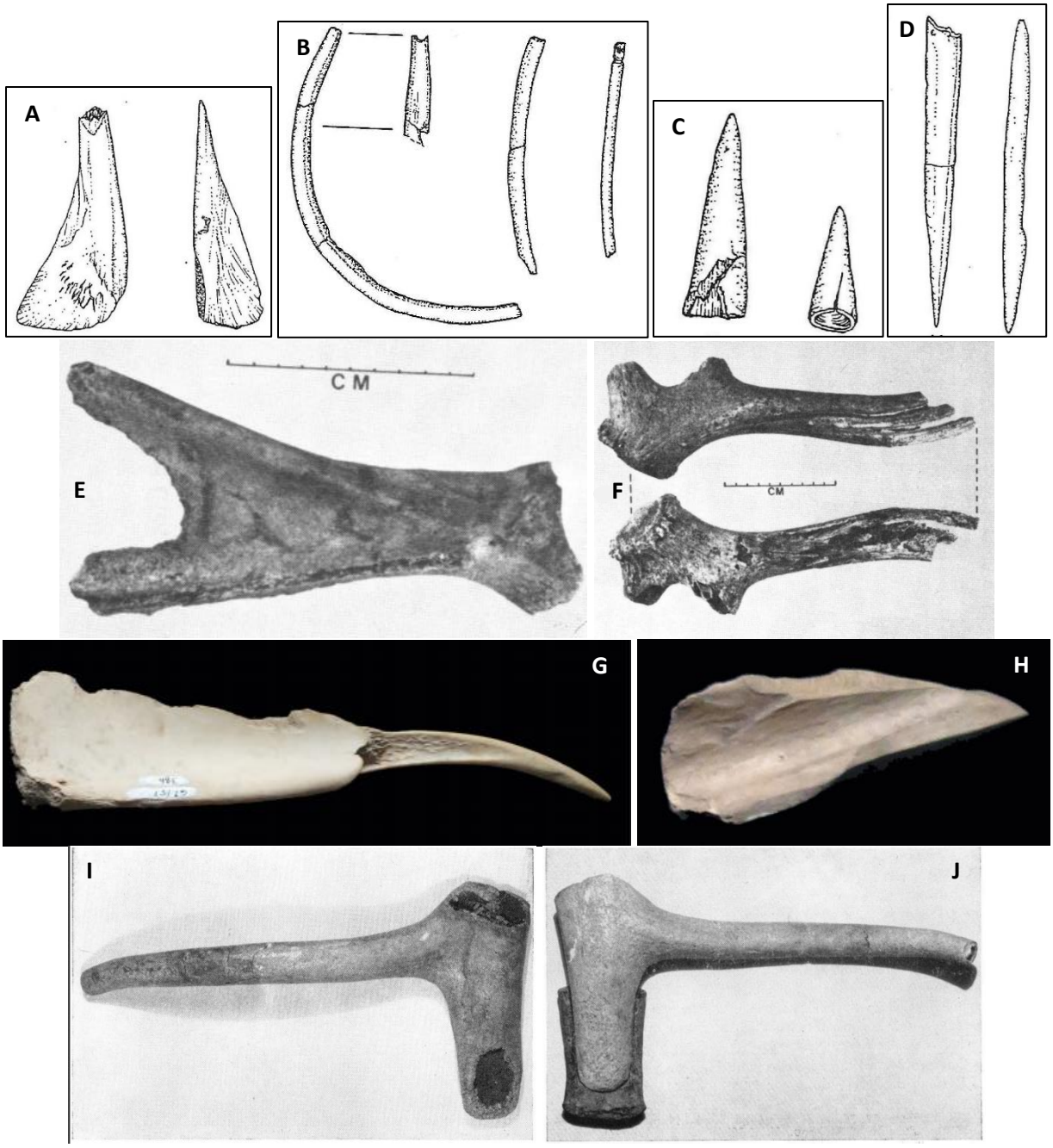


Figure 5.5: Elk bone and antler tools (not to scale)

A: Scapula awls from the Valley View site (Stevenson 1985)
B: Antler projectile points from the Valley View site (Stevenson 1985)
C: Antler "hoop" fragments from the Valley View site (Stevenson 1985)
D: Bone perforators from the Valley View site (Stevenson 1985)
E: Partial elk scapula hoe from the Pammel Creek site (Theler 1989)
F: Modified dropped elk antler from the Pammel Creek site (Theler 1989)
G: Elk scapula awl from the Preston Rockshelter (Theler et al. 2016)
H: Elk tibia chisel fragment from the Preston Rockshelter (Theler et al. 2016)
I-J: Elk antler handles from the Reigh Site (Ritzenthaler et al. 1957)

Both elk and deer antlers were used, but elk antler seems to have been favored in a couple cases. Intriguingly, two elk antler tine tools exhibiting pitting and smoothing on the distal ends were interred in human burials at the Furman site (Kreisa 1986). Kreisa (1986: 91) proposes that they "probably were digging tools, perhaps used to dig the grave," but acknowledges that they also may have been hammers used in stone tool manufacture. Other faunal remains were present in both burials, but the question remains: what about these antler tines merited their inclusion? Were they tools used by the decedents or by the people who interred them? Were they used for grave digging, as Kreisa suggests? Were they representative of some unknown belief or ritual?

Savage (1978: 129) reports on an unspecified cervid antler modified into a "scraper-like artifact" from the Armstrong site. Elk antler hide scrapers are well-known among historic Plains tribes such as the Iowa (Skinner 1926; Wedel 1970), who are thought by some to have descended from western Wisconsin Oneota (Anderson et al. 1995; Saleh 2019; Sasso 1993). Perhaps elk antler was used historically because its size, shape, or composition was in some way superior to deer antler, or perhaps it was simply more abundant on the plains, given that deer are more commonly a woodland species. If the former is true, it is probable that the Armstrong scraper is made of elk antler too.

5.2.2 Spiritual and Symbolic Significance

As mentioned above, animal skins are seldom found in the prehistoric record, but they were presumably used when they could be obtained. Historically, Carver (1781: 123-127) tells of

a Killistinoe priest in the vicinity of Grand Portage, Minnesota, who wrapped himself in a large elk skin, bound with elk hide cord, while communing with the Great Spirit. Another allusion to a possible ritual significance for elk is a cut cranial fragment with red ocher staining on its surface from the Oneota Valley View site (Stevenson 1985). In both cases, attempts to understand the significance of these objects to the people who used them would be no more than speculation; yet, that elk played some role in ritual is clear. Red ocher was found liberally in several human burials at the Late Archaic Reigh site (Ritzenthaler et al. 1957). It is also the most commonly-seen pigment in rock art of the western Great Lakes (Dewdney and Kidd 1962; Grant 1967; Salzer 1987a). Could there be a connection between the use of red ocher in both burial and artistic contexts, or was it simply one of the most readily available and enduring pigments available?

A discussion of ritual leads naturally to one of the most challenging aspects of this thesis, that is, an attempt to understand the spiritual and symbolic roles filled by elk in the lives of prehistoric peoples of the western Great Lakes. The significance of rock art sites as places of spiritual communion has been discussed in Section 3.2. The inclusion of elk images at these sites, alongside powerful mythic beings such as thunderbirds and horned serpents, seems to attribute to them a similar mythic power. The thunderbirds (*Pinasiwuk*), Great Lynx (*Mishipizheu*), and Horned Snake (*Ginebik*) that frequently appear in the rock art of Ontario, Minnesota, and Wisconsin are recognized as manitous, spirits who have some control over nature, whether good or evil (Rajnovich 1994). Maria Seymour, Director of the Lake of the Woods Ojibway Cultural Centre in Ontario, explains that each type of animal has a "master animal" in the manitou world. These master manitous are acknowledged for different reasons; for instance, a hunter who killed a moose would express his gratitude to the Moose Manitou for providing food for his family

(Rajnovich 1994: 36). Elk in rock art may represent the Elk Manitou. Perhaps such images were created to offer thanks for a successful hunt, to ask blessings for future hunts, or to in some other way invoke his power.

Elk in rock art may also represent the personal or clan totem of the artist. Perhaps artists depicted their personal guardian spirits as a way to honor them or invoke their power. In addition to personal totems, early historic peoples in the western Great Lakes had clan totems, which were also represented by animals or natural phenomena. The prevalence of a patrilineal clan system, although it varied slightly from tribe to tribe, indicates its likely origin in prehistoric times. Ethnographically, several tribes are known to have had an Elk Clan (Assikinack 1858; Blackbird 1887; Bohaker 2010; Forsyth 1912; Hickerson 1970; Lahontan 1703; Marston 1912; Morgan 1959; Trigger 1978; Trowbridge 1938). Densmore (1929: 176-177) writes about the clan system among the Ojibwe and how it could be depicted in drawings. Individuals in a family, for example, were represented by their clan animals drawn together in a canoe. The reference to a canoe is noteworthy because it provides a possible interpretation related to clan identity for the pictograph of an antlerless cervid in a boat at Sioux Narrows, Ontario.

While the spiritual significance of rock arts sites on cliffsides and at the water's edge in Minnesota and Ontario is well-documented (Dewdney and Kidd 1962; Hoffman 2016; Rajnovich 1994), relevant rock art sites in Wisconsin are found in different settings and thus beg additional explanations. The Gottschall Site, Gullickson's Glen, and Tainter Cave are all caves or rockshelters with evidence for some degree of human occupation. Evidence for fires along the walls at Gottschall and birchbark torches at Tainter indicate that these artworks were likely viewed by prehistoric people over multiple periods of time, not just during their creation (Salzer 1987a,

1978b; Schrab and Boszhardt 2016). Elk images at Gottschall and Gullickson's contain possible heartlines, while some of the art at Tainter Cave clearly depicts a hunting scene. Could the art at these sites have been used to convey information about hunting?

According to Salzer (1997: 540), the heartline motif consists of "a line that starts at the mouth of the animal and terminates in the chest area, at a point where, presumably, the "heart" is located." Rajnovich (1994) and Salzer (1997) remark that it implies a degree of spiritual control over the animal depicted. However, knowing that cervid hunters both in the past and today aim for the thoracic "heart" region (Goslin 1961; Hudson 2006; Leduc 2014; Murphy et al. 1985; Noe-Nyggard 1974) as exemplified by the Silver Beach Elk in Section 4.4, it could also be instructive, showing hunters where to aim.

Regarding rock art and hunting, Mithen (1990) proposes a different hypothesis in his study of European Upper Paleolithic cave art. Synthesizing work by Pfeiffer (1982) and Wright and Vlietstra (1975), he suggests that depictions of prey animals could have been used to teach young children about the environment. Teachers could have used the images in rock art as mnemonic aids for telling stories or giving instruction, with certain features of the art serving as visual cues. While the artwork to which Mithen refers is generally more detailed than that of the western Great Lakes, certain details, such as antler shape, or the presence of the neck mane on the Gullickson's Glen elk head, could still be used to illustrate identifying features. Mithen (1990: 246) also points out that "This explanation... does not exclude others since in a functional sense the art may be benefitting different sections of the population in different ways."

I mentioned in Section 3.2.1 a possible interpretation of an elk pictograph at Crooked Lake as pertaining to love medicine (Figure 3.3). While this interpretation is partially linked to Keyser

and Poetschat's (2015) analysis of elk imagery at the Gateway site in Wyoming, it is also based on ethnographic accounts from the western Great Lakes. Wissler (1905: 262) recounts beliefs held by the Dakota regarding the power of bull elk:

> At times he would stand on a hill and call or whistle in tones similar to those of the Indian flageolet [flute]. This call would bring the females to his side. From the Indian's point of view he seemed to draw them from afar in some mysterious manner. They say that he draws them with his flageolet. The flageolet thus becomes a courting charm, but it is the power of the mythical elk that is appealed to and symbolized by the music. It is well to note that while the elk is taken as the incarnation of the power over females, the real elk is regarded only as the recipient of such power. The power itself is conceived of in the nature of an abstraction similar to our conception of force. The fact that the elk seems to act in conformity with the laws governing this power is taken as evidence of its existence. Then the idea of the Indian is that the elk possesses the knowledge necessary to the working of the power. Thus a mythical, or hypothetical elk, becomes the teacher of man.

The Kickapoo, Ojibwe, and Meskwaki are also reported to have used the courting flute (Trigger 1978), although among the Meskwaki it was apparently not the preferred method of courtship (Jones 1939: 57-85). Whether or not the Crooked Lake elk represents a bugling male and alludes to the belief in "love medicine," these accounts serve to illustrate another role for elk. Among at least a few tribes, bull elk were symbolic of sexual power and desire, especially of males over females. Although this power did not belong to them intrinsically, they were apparently adept at using it. In this respect, they became, as Wissler (1905: 262) says, "the teacher of man."

5.3 Suggestions for Future Research

It would be interesting to see whether expanding the review of archaeological sites to other states in the region would contribute to or clash with the pattern of human-elk interactions

seen in Wisconsin. A similar review applied to another region of the country would also be interesting, as different ecological and cultural factors would undoubtedly be in effect. This type of analysis could also be applied to different species; although deer are seemingly ubiquitous in the western Great Lakes, were they used more heavily in certain times and places? Is their abundance in the archaeological record reflected by a similar abundance in historic records, rock art, cultural practices, and beliefs? Conversely, what other animals, like elk, may have the tendency to be overlooked? Reviewing faunal remains referenced in gray literature is one possible way to add to zooarchaeological data and better understand human-animal relationships. A physical review of faunal collections where reporting is ambiguous about the identification of large mammal remains might also be productive.

Other avenues for deepening this understanding could take a more contemporary focus. Through human action, occasionally requiring multiple attempts, elk have been brought back to the western Great Lakes. What do human-elk relationships look like today? How have they changed for the descendants of the people who encountered, hunted, and depicted elk here hundreds and thousands of years ago? What role do elk now play, if any, in the daily lives of people of diverse cultural heritage in this region? And how will these relationships continue to change in the future?

5.4 Conclusions

Elk are recorded historically and archaeologically in over two-thirds of Wisconsin's counties. These records are concentrated in the southern and western parts of the state below the tension zone, which may be a function of suitable habitat distribution, human population

distribution, or both. In terms of relative dietary contributions, as measured by relative abundance of elk remains in comparison to other faunal remains in archaeological sites, elk seem to have decreased in importance over time. High utilization is evident during the Archaic and Woodland periods, and lower utilization is observed during the Oneota. However, elk made other contributions to prehistoric (especially Oneota) culture, including antler tools, scapula hoes, and grave goods.

Furthermore, elk were seen as markers of group and personal identity, figures in stories, holders of spiritual power, and inspiration for rock art that may have invoked magic or provided instruction. Depictions of elk at spiritually important rock art sites may reference their power as manitous and guardians. Elk were perhaps also depicted artistically to reference the amorous power attributed to bull elk, which was signified by the courting flute.

As elk have been returned to the western Great Lakes region, modern human-elk relationships are no less complex than those of prehistoric times. Elk continue to be hunted, depicted in art, and used as markers of identity. A greater understanding of the past, through museums and other forms of public education, can enrich these relationships in the present and future.

REFERENCES CITED

Albers, Patricia C.

2001 Santee. In *Plains Part 2*, edited by Raymond J. DeMallie, pp. 761-776. *Vol. 13 of Handbook of North American Indians*, edited by William C. Sturtevant. Smithsonian Institution, Washington, DC.

Albert, Joe

2017a A New Chapter for Elk. *Minnesota Conservation Volunteer.* Electronic document, https://www.dnr.state.mn.us/mcvmagazine/issues/2017/jan-feb/restoring-elk-in-Minnesota.html, accessed November 9, 2019.

2017b Five-Hundred-Year-Old Elk Antler Found in Minnesota Lake. *Field & Stream.* Electronic document, https://www.fieldandstream.com/elk-antler-found-on-lakebottom-dates-back-to-1400s/, accessed September 16, 2019.

Alexandria Echo Press

2009 From the depths of Lake Carlos… Electronic document, https://www.echopress.com/content/depths-lake-carlos-1, accessed September 16, 2019.

Allen, J.A.

1871 Notes on the mammals of Iowa. *Proceedings of the Boston Society of Natural History* 13: 178-194.

Allouez, Claude J.

1899 Relation of 1669-70. *Jesuit Relations* 54.

American Alliance of Museums

2019 Museum Facts. Electronic document, https://www.aam-us.org/wp-content/uploads/2019/02/Museum-Facts-2019.pdf, accessed December 2, 2019.

Amundson, Sarah

2006 Wanted: home on the range. *The County Journal* 16 February.

Anderson, Adrian, Allan Westover, Terrance J. Martin, Mathew L. Murray, Susan M.T. Myster, Barbara O'Connell, and L. Anthony Zalucha

1995 The State Road Coulee Site: 17 LC 176. *The Wisconsin Archeologist* 76 (1-2): 43-230.

Andrews, Candice Gaukel

2013 *Travel Wild Wisconsin: A Seasonal Guide to Wildlife Encounters in Natural Places.* The University of Wisconsin Press, Madison, Wisconsin.

Armstrong, Benjamin G.

1892 *Early Life Among the Indians: Reminisces from the Life of Benjamin G. Armstrong; Dictated to and Written by Thomas P. Wentworth.* A.W. Bowron, Ashland, Wisconsin.

Arzigian, Constance, Robert Boszhardt, Holly Halverson, Douglas Connell, James Theler, and Michael Scott
1993 The Gundersen Site: An Oneota Village and Cemetery in La Crosse, Wisconsin. Mississippi Valley Archaeology Center at the University of Wisconsin-La Crosse. Report of Investigations No. 155.

Assikinack, Francis
1858 Social and Warlike Customs of the Odawah Indians. *Canadian Journal of Industry, Science and Art* 3 (16): 297-309.

Bacqueville de la Potherie, Claude C. Le Roy
1753 *Histoire de l'Amerique septontrionale [1722]*. 4 volumes. Nyon, Paris.

Barnes Area Historical Association
2019 BAHA Museum. Electronic document, http://bahamuseum.org/, accessed November 21, 2019.

Bartram, L.
1993 Perspectives on Skeletal Port Profiles and Utility Curves from Eastern Kalahari Ethnoarchaeology. In *From Bones to Behavior: Ethnoarchaeological and Experimental Contributions to the Interpretation of Faunal Remains*, edited by J. Hudson, pp. 115-137. Center for Archaeological Investigations, Occasional Paper No. 21.

Benton-Banai, Edward
1988 *The Mishomis book: The voice of the Ojibway*. Indian Country Press, St. Paul, MN.

Beyer, Dean E., Jr.
1987 Population and habitat management of elk in Michigan. PhD dissertation, Department of Fisheries and Wildlife, Michigan State University.

Binford, Lewis R.
1978 *Nunamuit Ethnoarchaeology.* Academic Press, Inc., New York.
1981 *Bones: Ancient Men and Modern Myths.* Academic Press, Inc., New York.

Blackbird, Andrew J.
1887 *History of the Ottawa and Chippewa Indians of Michigan: A Grammar of Their Language, and Personal and Family History of the Author.* The Ypsilantian Job Printing House, Ypsilanti, Michigan.

Blackburn, Ryan C.
2018 Diet and Vegetation Impacts of a Reintroduced Bison Herd. Master's thesis, Department of Biological Sciences, Northern Illinois University.

Blair, Emma Helen (editor)
1911 *The Indian Tribes of the Upper Mississippi Valley and Region of the Great Lakes, Vol 1.* The Arthur H. Clark company, Cleveland, Ohio.

1912 *The Indian Tribes of the Upper Mississippi Valley and Region of the Great Lakes, Vol 2.* The Arthur H. Clark company, Cleveland, Ohio.

Bohaker, Heidi
2010 Reading Anishinaabe Identities: Meaning and Metaphor in Nindoodem Pictographs. *Ethnohistory* 57(1): 11-33.

Boszhardt, Robert F.
2004 Blind Dates and Blind Faith: The Timeless Story of the "Emergent" Oneota McKern Phase. *The Wisconsin Archeologist* 85 (1): 3-30.

Bowerman, Mary
2016 41 elk die after falling through ice in Oregon. Electronic document, https://www.usatoday.com/story/news/nation-now/2016/12/28/41-elk-die-after-falling-through-ice-oregon/95904644/, accessed November 7, 2019.

Brayton, A.M.
1882 Report on the mammals of Ohio. *Ohio Geological Survey Report* vol. 4, pt. 1: 1-185.

Broughton, John M.
1999 *Resource Depression and Intensification During the Late Holocene, San Francisco Bay.* University of California Press, Berkley.

Brown, James A.
1982 What Kind of Economy Did the Oneota Have? In *Oneota Studies*, ed. Guy Gibson. University of Minnesota Publication in Anthropology 1, Minneapolis, Minnesota.

Brunson, A.
1843 Letter, June 21, 1843. Lancaster *Grant County Herald*, July 22, 1843.

Bryant, Larry D., and Chris Maser
1982 Classification and Distribution. In *Elk of North America: Ecology and Management*, edited by Jack Ward Thomas and Dale E. Toweill, pp. 1-60. Stackpole Books, Harrisburg, Pennsylvania.

Bubenik, Anthony B.
1982 Physiology. In *Elk of North America: Ecology and Management*, edited by Jack Ward Thomas and Dale E. Toweill, pp. 125-180. Stackpole Books, Harrisburg, Pennsylvania.

Buffalohead, Priscilla K.
1983 Farmers Warriors Traders: A Fresh Look at Ojibwa Women. *Minnesota History* 48(6): 236-244.

Bunnell, Lafayette Houghton
1897 *Winona (We-no-nah) and Its Environs on the Mississippi in Ancient and Modern Days.* Jones & Kroeger, Winona, Minnesota.

Callender, Charles
1978a Fox. In *Northeast*, edited by Bruce G. Trigger, pp. 636-647. *Vol. 15 of Handbook of North American Indians*, edited by William C. Sturtevant. Smithsonian Institution, Washington, DC.
1978b Illinois. In *Northeast*, edited by Bruce G. Trigger, pp. 673-680. *Vol. 15 of Handbook of North American Indians*, edited by William C. Sturtevant. Smithsonian Institution, Washington, DC.
1978c Miami. In *Northeast*, edited by Bruce G. Trigger, pp. 681-689. *Vol. 15 of Handbook of North American Indians*, edited by William C. Sturtevant. Smithsonian Institution, Washington, DC.
1978d Sauk. In *Northeast*, edited by Bruce G. Trigger, pp. 648-655. *Vol. 15 of Handbook of North American Indians*, edited by William C. Sturtevant. Smithsonian Institution, Washington, DC.

Callender, Charles, Richard K. Pope, and Susan M. Pope.
1978 Kickapoo. In *Northeast*, edited by Bruce G. Trigger, pp. 656-667. *Vol. 15 of Handbook of North American Indians*, edited by William C. Sturtevant. Smithsonian Institution, Washington, DC.

Carver, Jonathan
1781 *Travels Through the Interior Parts of North America in the Years 1766, 1767, and 1768.* C. Dilly; H. Payne; J. Phillips, London, England.

Caton, J.D.
1877 *The Antelope and Deer in America.* Forest and Stream Publishing Company, New York.

Caughley, G.
1971 An investigation of hybridization between free-ranging wapiti and elk in New Zealand. *New Zealand Journal of Science* 14 (4): 993-1008.

Cleland, Charles E.
1966 The Prehistoric Animal Ecology and Ethnozoology of the Upper Great Lakes Region. Anthropological Papers, Museum of Anthropology, University of Michigan, Number 29.
1982 The Inland Shore Fishery of the Northern Great Lakes: Its Development and Importance in Prehistory. *American Antiquity* 47: 761-784.

Clifton, James A.
1978 Potawatomi. In *Northeast*, edited by Bruce G. Trigger, pp. 725-742. *Vol. 15 of Handbook of North American Indians*, edited by William C. Sturtevant. Smithsonian Institution, Washington, DC.

Cole, Erik K.
2019 Use of *Cervus elaphus* versus *Cervus canadensis* in reference to North American elk (wapiti)? Research Gate. Electronic document, https://www.researchgate.net/post/Use_of_Cervus_elaphus_versus_Cervus_canadensis_in_reference_to_North_American_elk_wapiti, accessed November 22, 2019.

Coles, J.M.
1991 Elk and Ogopogo: belief systems in the hunter-gatherer rock art of northern lands. *Prehistoric Society* 57: 129-147.

Cook, John G.
2002 Nutrition and Feed. In *North American Elk: Ecology and Management*, edited by Dale E. Toweill and Jack W. Thomas, pp. 259-350. Smithsonian Institution Press, Washington, D.C.

Coop, K.J.
1971 Habitat use, distribution, movement, and associated behavior of elk, Little Belt, Montana. Complete Report, Project Number W-120-R-1 & 2. Montana Fish and Game Department, Helena, Montana.

Copway, George
1850 *The Traditional History and Characteristic Sketches of the Ojibway Nation.* C. Gilpin, J. Hatchard & Co., London, England.

Cowan, Ian McTaggart
1947 The timber wolf in the Rocky Mountain national parks of Canada. *Canadian Journal of Research* D (25): 139-174.

Curtis, John T.
1959 *The Vegetation of Wisconsin: An Ordination of Plant Communities.* University of Wisconsin, Madison.

Daly, Patricia
1969 Approaches to Faunal Analysis in Archaeology. *American Antiquity* 34 (2): 146-153.

Delavan Republican
1876 "E.B. Warner last week found a very large pair of elk horns…" 11 August: 4. Delavan, Wisconsin.

Deliette, Louis
1934 Memoir of De Gannes Concerning the Illinois Country [1702]. In *Collections of the Illinois State Historical Library* 23, edited by T.C. Pease and R.C. Werner, pp. 320-395. Springfield.

DeMallie, Raymond J., and David Reed Miller
2001 Assiniboine. In *Plains Part 1*, edited by Raymond J. DeMallie, pp. 572-595. *Vol. 13 of Handbook of North American Indians*, edited by William C. Sturtevant. Smithsonian Institution, Washington, DC.

Denig, Edwin Thompson
1930 *Indian Tribes of the Upper Missouri: 46th Annual Report to the Bureau of American Ethnology.* Government Printing Office, Washington, DC.

Densmore, Frances
1918 *Teton Sioux Music: 61st Annual Report of the Bureau of American Ethnology.* Government Printing Office, Washington, DC.
1929 *Chippewa Customs: 86th Annual Report of the Bureau of American Ethnology*. Government Printing Office, Washington, DC.

Dewdney, Selwyn, and Kenneth E. Kidd
1962 *Indian Rock Paintings of the Great Lakes.* University of Toronto Press, Toronto, Canada.

Dietz, Eugene F.
1956 A Report on the Dietz Site (Da 12), Dane County, Wisconsin. *The Wisconsin Archeologist* 37 (1): 1-19.

Dillingham, Betty Ann (Wilder)
1963 The Oklahoma Kickapoo. PhD dissertation, Department of Anthropology, University of Ann Arbor, Michigan.

Dion, Susan
1991 *Indian-white relations: historical foundations*. American Indian Language and Culture Education Board, Madison, Wisconsin.

Dorsey, James Owen
1894 *A Study of Siouan Cults: 11th Annual Report to the Bureau of American Ethnology.* Government Printing Office, Washington, DC.

Dratch, P. A.
1986 A marker for red deer-wapiti hybrids. *Proceedings of the New Zealand Society of Animal Production* 46: 179-182.

Dudzik, Mark J.
1995 Visions in Stone: The Rock Art of Minnesota. *The Minnesota Archaeologist* 54: 99-108.

Dzieciolowski, R.
1970 Relations between the age and size of red deer in Poland. *Acta Theriologica* 15 (17): 253-268.

Eaton, Nate
2017 Good Samaritans frantically rush to save herd of elk that fall through ice into frigid water. Electronic document, https://www.eastidahonews.com/2017/12/good-samaritans-rush-into-action-as-herd-of-elk-plunge-through-ice-into-frigid-water/, accessed November 7, 2019.

Edwards, Richard W.
2017 The canine surrogacy approach and Paleobotany: An analysis of Wisconsin Oneota agricultural production and risk management strategies. Doctoral dissertation, Department of Anthropology, University of Wisconsin-Milwaukee.

Ellerman, John R., and Terence C.S. Morrison-Scott
1951 *Checklist of Palaearctic and Indian Mammals, 1758 to 1946.* British Museum of Natural History, London.

Enloe, James G.
2003 Food sharing past and present: archaeological evidence for economic and social interactions. *Before Farming* 1 (1): 1-23.

Fashingbauer, Bernard A.
1965 The elk in Minnesota. In *Big Game in Minnesota*, edited by J.B. Moyle, pp. 99-132. Technical Bulletin No. 9. Minnesota Department of Conservation, St. Paul.

FAUNMAP Working Group
1994 FAUNMAP: a database documenting late Quaternary distributions of mammal species in the United States. *Illinois State Museum Scientific Papers* 25 (1-2): 1-690.

Feest, Johanna E., and Christian E. Feest
1978 Ottawa. In *Northeast*, edited by Bruce G. Trigger, pp. 772-786. *Vol. 15 of Handbook of North American Indians*, edited by William C. Sturtevant. Smithsonian Institution, Washington, DC.

Ferrié, J.-G.
2004 *Cervus elaphus* (Linneaus, 1758). *ArchéoZoothèque.* Electronic document, https://www.archeozoo.org/archeozootheque/picture/2937-cervus_elaphus/category/132-artiodactyles_langen_artiodactyls_lang_langes_artiodactilos_lang_, accessed March 4, 2020.

Fletcher, Alice C., and Francis La Flesche
1911 *The Omaha Tribe: 27th Annual Report to the Bureau of American Ethnology.* Government Printing Office, Washington, DC.

Flook, D.R.
1970 *A study of sex differential in the survival of wapiti.* Canada Wildlife Services Report Series Number 11. Queens Printer, Ottawa, Ontario.

Foley-Winkler, Kathleen M.
2011 Oneota and Langford Mortuary Practices from Eastern Wisconsin and Northeast Illinois. Ph.D. dissertation, Department of Anthropology, University of Wisconsin-Milwaukee.

Forsyth, Thomas
1822 Letter, May 12 1822, Thomas Forsyth to Lewis Cass. Forsyth Papers, Vol. 4., Draper Collection. State Historical Society of Wisconsin, Madison, Wisconsin.
1912 An Account of the Manners and Customs of the Sauk and Fox Nations of Indian Traditions [1827]. In *The Indian Tribes of the Upper Mississippi Valley and Region of the Great Lakes, Vol. 2*, edited by Emma H. Blair, pp. 183-245. Arthur H. Clark, Cleveland, Ohio.

Gallagher, James P., and Katherine Stevenson
1982 Oneota Subsistence and Settlement in Southwestern Wisconsin. In *Oneota Studies*, ed. Guy Gibbon. University of Minnesota Publication in Anthropology 1, Minneapolis, Minnesota.

Geist, Valerius
1982 Adaptive Behavioral Strategies. In *Elk of North America: Ecology and Management*, edited by Jack Ward Thomas and Dale E. Toweill, pp. 181-218. Stackpole Books, Harrisburg, Pennsylvania.
2002 Adaptive Behavioral Strategies. In *North American Elk: Ecology and Management,* edited by Dale E. Toweill and Jack W. Thomas, pp. 389-433. Smithsonian Institution Press, Washington, D.C.

Gerdes, Vicki L.
2017 500-year-old elk antler found by Minnesota diver. Electronic document, https://www.grandforksherald.com/sports/4222867-500-year-old-elk-antler-found-minnesota-diver, accessed September 16, 2019.

Gese, E.M. and S. Grothe
1995 Analysis of coyote predation on deer and elk during winter in Yellowstone National Park, Wyoming. *The American Midland Naturalist* 133: 36-43.

Gibbon, Guy E.
1969 The Walker-Hooper and Bornick Sites—Two Grand River Phase Oneota Sites in Central Wisconsin. PhD dissertation, Department of Anthropology, University of Wisconsin-Madison.
1970 The Midway Village Site: An Orr Phase Oneota Site in the Upper Mississippi River Valley. *The Wisconsin Archeologist* 51 (3): 79-162.
1971 The Bornick Site: A Grand River Phase Oneota Site in Marquette County. *The Wisconsin Archeologist* 52 (3): 85-137.
1982 Oneota Origins Revisited. In *Oneota Studies*, edited by G. E. Gibbon, pp. 85-90. University of Minnesota Publications in Anthropology Number 1. University of Minnesota, Minneapolis.

Gibbon, Guy E. (editor)
1998 *Archaeology of Prehistoric Native America: An Encyclopedia.* Garland Publishing, Inc., New York.

Gifford-Gonzalez, Diane P.
2007 Thoughts on a method for zooarchaeological study of quotidian life. *Treballs d'Arqueologia* 13: 5–27.
2018 *An Introduction to Zooarchaeology.* Springer International Publishing, New York.

Gilbert, Jonathan, Janet Sausen, and Brian Dhuey
2010 Wisconsin elk habitat suitability analysis. Research report 191. Wisconsin Department of Natural Resources. Madison, Wisconsin.

Gist, Christopher
1893 *Christopher Gist's Journals with Historical, Geographical and Ethnographical Notes and Biographies of His Contemporaries [1750-1753]*, edited by William M. Darlington. J.R. Weldin, Pittsburgh.

Goddard, Ives
1972 Historical and Philological Evidence regarding the Identification of the Mascouten. *Ethnohistory* 19 (2): 123-134.
1978 Mascouten. In *Northeast*, edited by Bruce G. Trigger, pp. 668-672. *Vol. 15 of Handbook of North American Indians*, edited by William C. Sturtevant. Smithsonian Institution, Washington, DC.

Goslin, R.M.
1961 Projectile Point in Elk Skeleton. *Ohio Archaeologist* 11: 84-85.

Grant, Campbell
1967 *Rock Art of the American Indian.* Crowell, New York.

Great Lakes Indian Fish and Wildlife Commission (GLIFWC)
2019 Publications. Electronic document, https://www.glifwc.org/publications/, accessed November 30, 2019.

Grimm, Peter
2010 Vertebrate Resource Utilization at the McCauley Site (47-WN-222): Impacts of the Fur Trade on Subsistence and Seasonality in Eastern Wisconsin. Master's thesis, Department of Anthropology, University of Wisconsin-Milwaukee.

Hall, Robert L.
1986 Upper Mississippi and Middle Mississippi Relations. *The Wisconsin Archeologist* 67 (3- 4): 365-369.

Harper, J.A.
1971 Ecology of Roosevelt elk. PR W-59-R. Oregon State Game Commission, Portland.

Hickerson, Harold
1962 The Southwestern Chippewa: An Ethnohistorical Study. *Memoirs of the American Anthropological Association* 92. Menasha, Wisconsin.
1970 *The Chippewa and Their Neighbors: A Study in Ethnohistory*. Holt, Rinehart, and Winston, New York.

Hoffman, Charles Fenno
1835 *A Winter in the Far West.* R. Bentley, London.

Hoffman, Mike
2016 Foreword. In *Hidden Thunder: Rock Art of the Upper Midwest*, pp. ix-xi. Wisconsin Historical Society Press, Madison, Wisconsin.

Hoffman, Walter James
1896 *The Menomini Indians: 14th Annual Report to the Bureau of American Ethnology.* Government Printing Office, Washington, DC.

Hood, Darren
2006 Radiocarbon Dating Result for Sample 47BA526RIB-1. Beta Analytic Radiocarbon Dating Laboratory, Miami, Florida.

Hoy, P. R.
1882 The larger wild animals that have become extinct in Wisconsin. *Transactions of the Wisconsin Academy of Sciences, Arts, and Letters* 5: 255-257.

Hudson, Jean
2006 Elk skeleton associated with fluted point in northern Wisconsin. *Current research in the Pleistocene* 23: 117-119.
2007a Prehistoric Elk in Wisconsin—Two Recent Cases; Updates on the Silver Beach Elk Site (Bayfield County) and The Moeller Pond Elk (Waukesha County). *The Wisconsin Archeologist* 88 (1): 97.
2007b Update on Wisconsin's Silver Beach Elk Site (47BA526). *Current research in the Pleistocene* 24: 104-106.

Hudson, Jean, K. Kaufman, Pete Fantle, and T. Revane
2006 "Gainey Elk Hunters in Northern Wisconsin?" Midwest Archaeology Conference, Urbana, Illinois.

Hudson, Robert J., and Jerry C. Haigh, with contributions by Anthony B. Bubenik
2002 Physical and Physiological Adaptations. In *North American Elk: Ecology and Management*, edited by Dale E. Toweill and Jack W. Thomas, pp. 199-257. Smithsonian Institution Press, Washington, D.C

Illinois State Museum
2019 List of Faunmap age codes. Electronic document, http://www.museum.state.il.us/research/faunmap/query/agecodes.html, accessed November 18, 2019.

ITIS
2020 *Cervus elaphus* Linnaeus, 1758. Electronic document, https://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=180695#null, accessed February 26, 2020.

IUCN Red List
2020 Wapiti *Cervus canadensis*. Electronic document, https://www.iucnredlist.org/species/55997823/142396828,accessed February 26, 2020.

Jackson, Hartley Harrad Thompson
1908 A preliminary list of Wisconsin mammals. Bulletin of the Wisconsin Natural History Society 6: 13-34.
1961 *Mammals of Wisconsin.* University of Wisconsin Press, Madison.

Jenkins, D. A., J. A. Schaefer, R. Rosatte, T. Bellhouse, J. Hamr, and F. F. Mallory
2007 Winter resource selection of reintroduced elk and sympatric white-tailed deer at multiple spatial scales. *Journal of Mammalogy* 88: 614–624.

Jenks, Albert E.
1900 The Wild Rice Gatherers of the Upper Lakes: A Study in American Primitive Economics. *19th Annual Report of the Bureau of American Ethnology for the years 1897-1898*: 1013-1137. Government Printing Office, Washington, DC.

Jeske, Robert J.
1992 Environment, Ethnicity, and Subsistence Change: The Late Woodland to Mississippian Transition in the Upper Midwest. *The Michigan Archaeologist* 38 (1-2): 55-70.
1999 The Physical Setting. In *Cedar Creek Valley: A Systematic Archaeological Survey in Ozaukee and Washington Counties, Wisconsin*, edited by R. J. Jeske, pp. 19-40. Report of Investigations, no. 138. University of Wisconsin-Milwaukee Archaeological Research Laboratory, Milwaukee.
2000 The Washington Irving Site: Langford Tradition Adaptation in Northern Illinois. In *Mounds, Modoc, and Mesoamerica: Papers in Honor of Melvin L. Fowler*, edited by S. R. Ahler, pp. 265-293. Illinois State Museum Scientific Papers, Vol. XXVIII. Springfield.
2003 Langford and Fisher Ceramic Traditions: Moiety, Ethnicity or Power Relations in the Upper Midwest? *The Wisconsin Archeologist* 84 (1&2): 165-180.

Jochim, Michael
1983 Optimization Models in Context. In *Archaeological Hammers and Theories,* edited by James A. Moore and Arthur S. Keene, pp. 157-172. Studies in Archaeology. Academic Press, New York.

Jones, Amanda
2014 Faunal Analysis: Reconstructing Subsistancy and Seasonality at the Tremaine Site (47LC95). *UW-L Journal of Undergraduate Research XVII.*

Jones, J. Knox Jr., Dilford C. Carter, and Hugh H. Genoways
1973 Checklist of North American Mammals North of Mexico. *Occasional Papers Museum Texas Tech University* 12: 1-14.

Jones, Malia, and Mitchell Ewald
2017 Putting Rural Wisconsin On The Map: Understanding Rural-Urban Divides Requires A Complex Spectrum Of Definitions. *WisContext* 17 May: https://www.wiscontext.org/putting-rural-wisconsin-map, accessed February 29, 2020.

Jones, William
1939 *Ethnography of the Fox Indians: 125th Annual Report to the Bureau of American Ethnography.* Government Printing Office, Washington, DC.

Karsten, Jordan K., Robert J. Jeske, Richard W. Edwards, David Strange, Kayla Kubehl, and Jeffrey A. Behm

2019 Assessing subsistence and its relationship to cultural complexity in the late prehistoric upper Midwest: A new perspective provided by dental health. *American Journal of Physical Anthropology* 168: 750-763.

Keegan, William F.

1986 The Optimal Foraging Analysis of Horticultural Production. *American Anthropologist*, New Series 88 (1): 92-107.

Keen, Katie

2018 Celebrating 100 years of wild Michigan elk. Michigan Department of Natural Resources. Electronic document, https://www.michigan.gov/dnr/0,4570,7-350-79137_79770_79873_80003-457932--,00.html, accessed November 20, 2019.

Keene, Arthur S.

1983 Biology, Behavior, and Borrowing: A Critical Examination of Optimal Foraging Theory in Archaeology. In *Archaeological Hammers and Theories,* edited by James A. Moore and Arthur S. Keene, pp. 137-156. Studies in Archaeology. Academic Press, New York.

Keesing, Felix M.

1939 The Menomini Indians of Wisconsin: A Study of Three Centuries of Cultural Contact and Change. *Memories of the American Philosophical Society* 10. Philadelphia.

Kelly, Robert L.

1995 *The Foraging Spectrum: Diversity in Hunter-Gatherer Lifeways.* Smithsonian Institution Press, Washington D.C.

Keyser, James D., and James Poetschat

2005 Another elk petroglyph from the Gateway site: some possible functional implications. *Wyoming Archaeologist* 49: 3-14.

Kinietz, W. Vernon

1940 The Indians of the Western Great Lakes, 1615-1760. *University of Michigan Museum of Anthropology, Occasional Contributions* 10. Ann Arbor.

Kirsch, J.B.

1963 Range use, relationship to logging, and food habits of the elk in the Little Belt Mountains, Montana. Master's thesis, Montana State University.

Kirtland, J.P.

1838 A catalog of the Mammalia, birds, reptiles, fishes, Testacea and Crustacea in Ohio. In *Second Annual Report of the Ohio Geological Survey*, pp. 157-200. Samuel Medary Print., Columbus, Ohio.

Kittams, W.H.

1953 Reproduction of Yellowstone elk. *Journal of Wildlife Management* 17 (2): 177-184.

Koziarski, Ralph
2004 Vertebrate Resource Utilization at the Late Prehistoric Component of the Bell Site (47WN9): An Application of Optimal Foraging Theory to Subsistence Analysis. Master's thesis, Department of Anthropology, University of Wisconsin-Milwaukee.

Kuehn, Steven R.
1997 A Model of Late Paleoindian Subsistence Behavior for the Western Great Lakes. Master's thesis, Department of Anthropology, University of Wisconsin-Milwaukee.
1998 New Evidence for Late Paleoindian-Early Archaic Subsistence Behavior in the Western Great Lakes. *American Antiquity* 63 (3): 457-476.

Kunkel, K.E., T.K. Ruth, D.H. Pletscher and M.G. Hornocker
1999 Winter prey selection by wolves and cougars in and near Glacier National Park, Montana. *Journal of Wildlife Management* 63: 901-910.

Kurowski, Ron (editor)
2019 The Monarch of Clover Valley. *The Scuppernog Journal* 24 (2): 1-2.

La Flesche, Francis
1921 *The Osage Tribe: 36th Annual Report to the Bureau of American Ethnography.* Government Printing Office, Washington, DC.

Lahontan, Louis Armand de Lom d'Arce de
1703 *Nouveaux voyages de Mr. le baron de Lahontan dans l'Amérique septentrionale.* Frères l'Honoré, The Hague.
1905 *New Voyages to North America by the Baron de Lahontan [1703]*, edited by Reuben G. Thwaites. 2 volumes. A.C. McClurg, Chicago.

LeBreck, Carol, and Julie Sarkauskas
2019 Historic 'Silver Beach Elk' skeleton comes home to the St. Croix headwaters. *St. Croix 360.* 20 September. Electronic document, https://www.stcroix360.com/2019/09/historic-silver-beach-elk-skeleton-comes-home-to-the-st-croix-headwaters/?fbclid=IwAR2AtKXI9MKwJunJtXX1vWlNjZvC5kb5SDEf_RCla880MsebfRPExXXnP9c, accessed November 27, 2019.

Leduc, Charlotte
2014 New Mesolithic Hunting Evidence from Bone Injuries at Danish Maglemosian Sites: Lundby Mose and Mullerup (Sjælland). *International Journal of Osteoarcheology* 24: 476–491.

Leszczewicz, Heather
2012 Elk herd, longtime area residents. *TribLocal Elk Grove Village.* 25 April. Electronic document, https://www.triblocal.com/elk-grove-village/2012/04/25/elk-herd-longtime-area-residents/index.html, accessed November 22, 2019.

Libby, Orin Grant
1895 Chronicle of the Helena shot-tower. In *Wisconsin Historical Collections, Volume XIII (1895)*, p. 334. State Historical Society of Wisconsin.

Linares, Olga F.
1976 "Garden Hunting" in the American Tropics. *Human Ecology* 4(4): 331-349.

Lippold, Lois Kay
1971 Aboriginal Animal Resource Utilization in Woodland Wisconsin. PhD dissertation, Department of Anthropology, University of Wisconsin-Madison.

Lorenzini, Rita, and Luisa Garofalo
2015 Insights into the evolutionary history of *Cervus* (Cervidae, tribe Cervini) based on Bayesian analysis of mitochondrial marker sequences, with first indications for a new species. *Journal of Zoological Systematics and Evolutionary Research* 53 (4): 340-349.

Ludt, Christian J., Wolf Schroeder, Oswald Rottman, and Ralph Kuehn
2003 Mitochondrial DNA phylogeography of red deer (*Cervus elaphus*). *Molecular Phylogenetics and Evolution* 31: 1064–1083

Lupardus, J. L., L. I. Muller, and J. L. Kindall.
2011 Seasonal forage availability and diet for reintroduced elk in the Cumberland Mountains, Tennessee. *Southeastern Naturalist* 10: 53-74.

Lupo, Karen D.
2006 What Explains the Carcass Field Processing and Transport Decisions of Contemporary Hunter-Gatherers? Measures of Economic Anatomy and Zooarchaeological Skeletal Part Representation. *Journal of Archaeological Method and Theory* 13 (1): 19-66.

Lurie, Nancy Oestreich
1978 Winnebago. In *Northeast*, edited by Bruce G. Trigger, pp. 690-707. *Vol. 15 of Handbook of North American Indians*, edited by William C. Sturtevant. Smithsonian Institution, Washington, DC.

Lyman, R.L.
1992 Anatomical considerations of utility curves in zooarchaeology. *Journal of Archaeological Science* 19 (1): 7-22.

Marcum, C.L.
1975 Summer-fall habitat selection and use by a western Montana elk herd. PhD dissertation, University of Montana.

Marston, Morrell
1912 Letter to Reverend Dr. Jedidiah Morse from Major Marston, U.S.A., Commanding at Fort Armstrong, Ill., November 1820. In *The Indian Tribes of the Upper Mississippi Valley and Region of the Great Lakes, Vol. 2*, edited by Emma H. Blair, pp. 137-182. Arthur H. Clark, Cleveland, Ohio.

Mason, Ronald J.
1997 The Paleo-Indian Tradition. *The Wisconsin Archeologist* 78: 78-111.
2002 *Great Lakes Archaeology.* The Blackburn Press, Caldwell, New Jersey.

McCabe, Richard E.
1982 Elk and Indians: Historical Values and Perspectives. In *North American Elk: Ecology and Management*, edited by Jack Ward Thomas and Dale E. Toweill, pp. 61-123. Stackpole Books, Harrisburg, Pennsylvania.
2002 Elk and Indians: Then Again. In *North American Elk: Ecology and Management*, edited by Dale E. Toweill and Jack W. Thomas, pp. 121-198. Smithsonian Institution Press, Washington, D.C.

McCann, Nicholas P., Eric M. Walberg, James D. Forester, and Michael W. Schrage
2019 Feasibility of restoring elk to northeastern Minnesota: habitat availability and social acceptance. University of Minnesota, Minnesota Cooperative Fish and Wildlife Research Unit, Department of Fisheries, Wildlife and Conservation Biology. University of Minnesota, St. Paul, Minnesota.

McNickle, D'Arcy
1957 Indian and European: Indian-White Relations from Discovery to 1887. *The Annals of the American Academy of Political and Social Science* 311: 1-11.

McTavish, Rachel
2019 Foodways and a Violent Landscape: A Comparative Study of Oneota and Langford Human-Animal-Environmental Relationships. Unpublished doctoral dissertation, Department of Anthropology, University of Wisconsin-Milwaukee.

Meighan, Clement W.
1981 Theory and Practice in the Study of Rock Art. In *Messages from the Past: Studies in California Rock Art*, edited by Clement W. Meighan, pp. 3-20. Monograph No. 20, Institute of Archaeology, University of California, Los Angeles.

Metcalfe, Duncan, and Kevin T. Jones
1988 A Reconsideration of Animal Body-Part Utility Indices. *American Antiquity* 53 (3): 486-504

Michigan State University
2020 Department of Geography, Environment, and Spatial Sciences. Electronic document, http://geo.msu.edu/extra/geogmich/map_g_lakes.html, accessed February 27, 2020.

Miller, Gerrit S. Jr., and Remington Kellogg
1955 List of North American recent mammals. *Bulletin of the United States National Museum, 205.* U.S. National Museum, Washington, D.C.

Miller, William
2002 Elk Interactions with Other Ungulates. In *North American Elk: Ecology and Management*, edited by Dale E. Toweill and Jack W. Thomas, pp. 435-447. Smithsonian Institution Press, Washington, D.C.

Minnesota Department of Natural Resources
2019 Elk hunting. Electronic document, https://www.dnr.state.mn.us/hunting/elk/index.html, accessed November 24, 2019.

Mississippi Valley Archaeology Center
2019 Rock Art. Electronic document, https://mvac.uwlax.edu/past-cultures/specific-sites/rock-art/, accessed November 22, 2019.

Missouri Department of Conservation
2020 Elk vs. Deer. Electronic document, https://mdc.mo.gov/contact-engage/public-comment-opportunities/elk-hunting-and-management/elk-vs-deer, accessed February 14, 2020.

Mithen, Steven J.
1988 To hunt or to paint: Animals and Art in the Upper Paleolithic. *Man* 23: 671-695.
1990 *Thoughtful Foragers: A Study of Prehistoric Decision Making.* Cambridge University Press, Cambridge.

Morgan, Lewis H.
1959 *The Indian Journals 1859-1862.* Edited by Leslie A. White. University of Michigan Press, Ann Arbor.

Murie, Olaus J.
1951 *The Elk of North America*. The Stackpole Company, Harrisburg, Pennsylvania.

Murphy, J.L., D.L. Dyer, and D.A. Walker
1985 Prehistoric Elk Remains from Cranberry Prairie, Mercer County, Ohio. *Ohio Journal of Science* 85 (3): 112-115.

Murrow, Jennifer L., Joseph D. Clark, and E. Kim Delozier
2009 Demographics of an Experimentally Released Population of Elk in Great Smoky Mountains National Park. *Journal of Wildlife Management* 73 (8): 1261-1268.

Myers, W.L., B. Lyndaker, P.E. Fowler, and W. Moore
1996 *Investigations of calf elk mortalities in southeastern Washington: A progress report 1992-1996.* Washington Department of Fish and Wildlife, Olympia, Washington.

Nabokov, Peter
1999 *Native American Testimony: A Chronicle of Indian-white Relations from Prophecy to the Present, 1492-2000*. Penguin, New York.

National Park Service
2018 Elk. Electronic document, https://www.nps.gov/romo/learn/nature/elk.htm, accessed January 29, 2020.
2019a Caribou. Electronic document, https://www.nps.gov/bela/learn/nature/caribou.htm, accessed February 14, 2020.
2019b Sound Gallery—Elk bugle. https://www.nps.gov/subjects/sound/sounds-elk.htm, accessed February 24, 2020/

National Wildlife Federation
2020 Moose. Electronic document, https://www.nwf.org/Educational-Resources/Wildlife-Guide/Mammals/Moose, accessed February 14, 2020.

Noe-Nyggard, Nanna
1974 Mesolithic Hunting in Denmark Illustrated by Bone Injuries Caused by Human Weapons. *Journal of Archaeological Science* 1: 217-248.

Nowak, Ronald M.
1999 *Walker's Mammals of the World—6th Edition, Vol. II.* The John Hopkins University Press, Baltimore, Maryland.

O'Gara, Bart W.
2002 Taxonomy. In *North American Elk: Ecology and Management*, edited by Dale E. Toweill and Jack W. Thomas, pp. 3-65. Smithsonian Institution Press, Washington, D.C.

O'Gara, Bart W., and Robert G. Dundas
2002 Distribution: Past and Present. In *North American Elk: Ecology and Management*, edited by Dale E. Toweill and Jack W. Thomas, pp. 67-119. Smithsonian Institution Press, Washington, D.C.

Olivo, Rick
2006 An AP Member Exchange. *The Daily Press, Ashland* 24 May. Ashland, Wisconsin.

Ontario Ministry of Natural Resources and Forestry
2019 Elk management plan. Electronic document, https://www.ontario.ca/page/elk-management-plan, accessed November 30, 2019.

Oswalt, W.H.
1966 *This Land was Theirs: A Study of the North American Indian.* John Wiley and Sons, Inc., New York.

Parker, Stephanie
2007 What's the difference between red deer and elk? Rocky Mountain Elk Foundation. Electronic document, https://elknetwork.com/whats-the-difference-between-red-deer-and-elk/, accessed November 22, 2019.

Parmalee, Paul W.
1959 Animal Remains from the Raddatz Rockshelter, SK5, Wisconsin. *The Wisconsin Archeologist* 40 (2): 83-90.
1960a Animal Remains from the Aztalan Site, Jefferson County, Wisconsin. *The Wisconsin Archeologist* 41 (1): 1-10.
1960b Animal Remains from the Durst Rockshelter, Sauk County, Wisconsin. *The Wisconsin Archeologist* 41 (1): 11-17.
1963 Vertebrate Remains from the Bell site, Winnebago County, Wisconsin. *The Wisconsin Archeologist* 44 (1): 58-69.

Payne, Nathan
2014 Tests: Elk remains found in local lake likely extinct subspecies. Electronic document, https://www.record-eagle.com/news/local_news/tests-elk-remains-found-in-local-lake-likely-extinct-subspecies/article_ddc1935f-2b32-55d3-8069-e4b8efabcd41.html, accessed September 16, 2019.

Peet, Stephen Denison
1890 *Emblematic Mounds and Animal Effigies.* Prehistoric America. Vol. 2. American Antiquities Office, Chicago, Illinois.

Penicaut, Andre Joseph
1902 Le Seur's voyage up the Mississippi. *Wisconsin Historical Collections* 16.

Perrot, Nicolas
1864 *Mémoire sur les moeurs, coustumes et religion des sauvages de l'Amerique septentrionale [1717].* A. Franck, Paris.

Peters, Gordon R.
1978a Archaeological inventory of the proposed Menomonee Falls—Brookfield interceptor sewer, Waukesha County, Wisconsin. *Great Lakes Archaeological Research Center, Inc.* Report of Investigation No. 47.
1978b Archaeological survey of three proposed construction areas and evaluation of the Horicon site (47 Do 131) in the Horicon National Wildlife Refuge. *Great Lakes Archaeological Research Center, Inc.* Report of Investigation No. 44.

Pfeiffer, J.
1982 *The Creative Explosion: An Inquiry into the Origins of Art and Religion*. Harper and Row, New York.

Pillaert, E. Elizabeth
1969 Faunal remains from the Milleville Site (47-Gt-53), Grant County, Wisconsin. *The Wisconsin Archeologist* 50 (2): 93-108.

Pitra, C., J. Fickel, E. Meijaard, P.C. Groves
2004 Evolution and phylogeny of old world deer. *Molecular Phylogenetics and Evolution* 33 (3): 880-895.

Polziehn, Renee O., and Curtis Strobeck
2002 A Phylogenetic Comparison of Red Deer and Wapiti Using Mitochondrial DNA. *Molecular Phylogenetics and Evolution* 22 (3): 342-356.

Preston, David L.
2009 *The Texture of Contact: European and Indian Settler Communities on the Frontiers of Iroquoia, 1667-1783.* University of Nebraska Press, Lincoln.

Radin, Paul
1923 *The Winnebago Tribe: 37th Annual Report of the Bureau of American Ethnology.* Smithsonian Institution, Washington DC.

Radisson, Pierre
1883 Fourth voyage, 1661-62. *Wisconsin Historical Collections* 11.
1885 *Voyages of Pierre Esprit Radisson, Being an Account of His Travels and Experiences among the North American Indians, from 1652-1684.* Prince Society, Boston.

Raedeke, K.J., J.J. Millspaugh, and P.E. Clark
2002 Population Characteristics. In *North American Elk: Ecology and Management*, edited by Dale E. Toweill and Jack W. Thomas, pp. 449-491. Smithsonian Institution Press, Washington, D.C.

Rajnovich, Grace
1994 *Reading Rock Art.* National Heritage/National History Inc., Toronto, Canada.

Randi, Ettore, Nadia Mucci, Françoise Claro-Hergueta, Amélie Bonnet, and Emmanuel J. P. Douzery
2001 A mitochondrial DNA control region phylogeny of the Cervinae: speciation in *Cervus* and implications for conservation. *Animal Conservation* (4): 1-11.

Rasmussen, Charlie Otto
2019 Elk hunters experience ceremony, success in northern Wisconsin. *Mazina'igan* Winter 2019/2020: 7. Electronic document, https://www.glifwc.org/Mazinaigan/Winter2019.pdf, accessed November 24, 2019.

Reynolds, H.G.
1962 Use of natural openings in a ponderosa pine forest of Arizona by deer, elk, and cattle. *Res. Note RM-78.* USDA Forest Service, Fort Collins, Colorado.
1966 Use of openings in spruce-fir forests of Arizona by elk, deer, and cattle. *Res. Note RM-66.* USDA Forest Service, Fort Collins, Colorado.

Richards, John D. and Robert J. Jeske
2002 Location, Location, Location: The Temporal and Culture Context of Late Prehistoric Settlement in Southeast Wisconsin. *The Wisconsin Archeologist* 83 (2): 32-54

Ritzenthaler, Robert E.
1978 Southwestern Chippewa. In *Northeast*, edited by Bruce G. Trigger, pp. 743-759. *Vol. 15 of Handbook of North American Indians*, edited by William C. Sturtevant. Smithsonian Institution, Washington, DC.

Ritzenthaler, Robert E., and Frederick A. Peterson
1956 The Mexican Kickapoo Indians. *Milwaukee Public Museum Publications in Anthropology* 2. Milwaukee.

Ritzenthaler, Robert E., Neil Ostberg, Kirk Whaley, Martin Greenwald, Penny Foust, Ernest Schug, Warren Wittry, Heinz Meyer, and Edward Lundsted
1957 Reigh Site Report—Number 3. *The Wisconsin Archeologist* 38 (4): 278-310.

Robb, Tom
2018 4 New Elk Could Join Busse Woods Herd By Year End. *Journal & Topics.* 6 December. Electronic document, https://www.journal-topics.com/articles/4-new-elk-could-join-busse-woods-herd-by-year-end/, accessed November 22, 2019.

Rocky Mountain Elk Foundation
2019 Elk Range and Habitat. Electronic document, https://elknetwork.com/elkfacts/, accessed November 22, 2019.

Rogers, Edward S.
1978 Southeastern Ojibwa. In *Northeast*, edited by Bruce G. Trigger, pp. 760-771. *Vol. 15 of Handbook of North American Indians*, edited by William C. Sturtevant. Smithsonian Institution, Washington, DC.

Romans, Ben
2015 Colorado Elk Herd Found Dead After Falling through Ice. Electronic document, https://www.fieldandstream.com/blogs/field-notes/colorado-elk-herd-found-dead-after-falling-through-ice/, accessed November 7, 2019.

Roosevelt, Theodore R.
1905 *Outdoor Pastimes of an American Hunter.* Charles Scribner's Sons, New York.

Rostlund, Erhard
1952 Freshwater Fish and Fishing in Native North America. *University of California Publications in Geography* 9.

Russell, Nerissa
2010 *Social Zooarchaeology: Humans and Animals in Prehistory*. Cambridge University Press, New York, New York.

Salzer, Robert J.
1987a Introduction to Wisconsin Rock Art. *The Wisconsin Archeologist* 68 (4): 277-286.
1987b Preliminary Report on the Gottschall Site (47 IA 80). *The Wisconsin Archeologist* 68 (4): 419-472.
1997 Wisconsin Rock Art. *The Wisconsin Archeologist* 78: 48-77.
2005 The Gottschall Site: 3,500 years of Ideological Continuity and Change. *Ontario Archaeology* 79/80: 109-114.

Sasso, Robert F.
1993 La Crosse region Oneota adaptations: changing late prehistoric subsistence. *The Wisconsin Archeologist* 74: 324–369.
2014 Review of Bison Remains at Wisconsin Oneota Sites. *The Wisconsin Archeologist* 95: 173-184.

Savage, Howard
1978 Armstrong: Faunal Analysis. *The Wisconsin Archeologist* 59 (1): 118-145.

Schneider, Jennifer, David S. Maehr, Karen J. Alexy, John J. Cox, Jeffery L. Larkin, and Brian C. Reeder
2006 Food habits of reintroduced elk in southeastern Kentucky. *Southeastern Naturalist* 5: 535-546.

Schonewald, Christine
1994 *Cervus canadensis* and *C. elaphus*: North American subspecies and evaluation of clinal extremes. *Acta Theriologica* 39 (4): 431-452.

Schoolcraft, Henry Rowe
1851 *Personal Memoirs of a Residence of Thirty Years with the Indian Tribes on the American Frontiers*. Lippincott, Grambo and Co., Philadelphia.

Schorger, Arlie William
1982 *Wildlife in Early Wisconsin*. Student Chapter of The Wildlife Society, Stevens Point, Wisconsin.

Schrab, Geri, and Robert F. Boszhardt
2016 *Hidden Thunder: Rock Art of the Upper Midwest*. Wisconsin Historical Society Press, Madison, Wisconsin.

Schutkowski, Holger
2006 *Human Ecology: Biocultural Adaptations in Human Communities.* Springer, Heidelberg, Germany.

Seton, E.T.
1927 *Lives of Game Animals.* Vol. 3, part 1. Doubleday, Page and Co., Garden City, New York.

Shay, C. Thomas
1978 Late Prehistoric Bison and Deer Use in the Eastern Prairie-Forest Border. *Plains Anthropologist* 23 (82): 194–212.

Simonson, Mike
2006 Prehistoric elk discovery had Bayfield County buzzing. Electronic document, https://www.rivertowns.net/news/947632-prehistoric-elk-discovery-has-bayfield-county-buzzing, accessed November 21, 2019.

Singer, F.J., A. Harting, K.K. Symonds, and M.B. Coughenour
1997 Density dependence, compensation and environmental effects on elk calf mortality in Yellowstone National Park. *Journal of Wildlife Management* 61: 12-25.

Singer, F.J., and J.E. Norland
1994 Niche relationships within a guild of ungulate species in Yellowstone National Park, Wyoming, following release from artificial controls. *Canadian Journal of Zoology* 72: 1383-1394.

Skinner, Alanson
1923 Observations of the Ethnology of the Sauk Indians. *Bulletin of the Public Museum of Milwaukee* 5(1).
1926 Ethnology of the Ioway Indians. *Bulletin of the Public Museum of Milwaukee* 5(4).

Skovlin, Jon M., Peter Zager, and Bruce K. Johnson
1982 Habitats. In *Elk of North America: Ecology and Management*, edited by Jack Ward Thomas and Dale E. Toweill, pp. 369-413. Stackpole Books, Harrisburg, Pennsylvania.
2002 Elk Habitat Selection and Evaluation. In *North American Elk: Ecology and Management*, edited by Dale E. Toweill and Jack W. Thomas, pp. 531-556. Smithsonian Institution Press, Washington, D.C.

Smith, E.A., and B. Winterhalder (editors)
1992 *Evolutionary Ecology and Human Behavior.* De Gruyter, New York.

Spindler, Louise S.
1978 Menominee. In *Northeast*, edited by Bruce G. Trigger, pp. 708-724. *Vol. 15 of Handbook of North American Indians*, edited by William C. Sturtevant. Smithsonian Institution, Washington, DC.

Spurrell, J.A.
1917 An annotated list of the mammals of Sac County, Iowa. *Proceedings of the Iowa Academy of Science* 24: 273-285.

State Cartographer's Office, University of Wisconsin-Madison
2018 Wisconsin Outline Maps. Electronic document, https://www.sco.wisc.edu/maps/wisconsin-outline/, accessed January 31, 2020.

Stencil, Zachary R.
2015 Vertebrate Evidence for Diet and Food-processing at the Multicomponent Finch Site (47 JE-0902) in Jefferson County, Southeastern Wisconsin. Master's thesis, Department of Anthropology, University of Wisconsin-Milwaukee.

Stevenson, Katherine Phyllis
1985 Oneota Subsistence-Related Behavior on the Driftless Area: A Study of the Valley View Site near La Crosse, Wisconsin. PhD dissertation, Department of Anthropology, University of Wisconsin-Madison.

Storck, Peter L., and Arhur E. Spiess
1994 The Significance of New Faunal Identifications Attributed to an Early Paleoindian (Gainey Complex) Occupation at the Udora Site, Ontario, Canada. *American Antiquity* 59(1): 121-142.

Strong, Moses
1883 List of the mammals of Wisconsin. Geology of Wisconsin, survey of 1873-1879, vol. 1: 437-440.

Tanner, Helen Hornbeck (editor)
1987 *Atlas of Great Lakes Indian History.* University of Oklahoma Press, Norman, Oklahoma.

Theler, James L.
1989 The Pammel Creek Site Faunal Remains. *The Wisconsin Archeologist* 70 (1-2): 157-241.

Theler, James L. and Robert F. Boszhardt
2006 Collapse of Crucial Resources and Culture Change: A Model for the Woodland to Oneota Transformation in the Upper Midwest. *American Antiquity* 71 (3): 433-472.

Theler, James L., Sarah Chalkley-Hubbell, Holmes A. Semken, Jr., and Katherine P. Stevenson
2016 Faunal Remains from Preston Rockshelter (47GT157), Grant County, Wisconsin. *The Wisconsin Archeologist* 97 (1): 5-46.

Thorson, Dave
2008 Silver Beach Elk update. Electronic document, http://www.barnes-wi.com/page.cfm/250, accessed November 21, 2019.

Thomas, Jack Ward, and Dale E. Toweill, ed.
1982 *Elk of North America: Ecology and Management*. Stackpole Books, Harrisburg, Pennsylvania.

Thwaites, Reuben G., ed.
1896-1901 *The Jesuit Relations and Allied Documents: Travel and Explorations of the Jesuit Missionaries in New France 1601-1791; the Original French, Latin, and Italian Texts, with English Translations and Notes.* 73 volumes. Burrows Brothers, Cleveland, Ohio.

Toweill, Dale E., and Jack Ward Thomas, ed.
2002 *North American Elk: Ecology and Management.* Smithsonian Institution Press, Washington DC.

Trigger, Bruce G.
1978 *Northeast*. *Vol. 15 of Handbook of North American Indians*, edited by William C. Sturtevant. Smithsonian Institution, Washington, DC.

Trowbridge, Charles C.
1938 Meeārmeer Traditions. Vernon Kinietz, ed. *University of Michigan Museum of Anthropology, Occasional Contributions 7.* Ann Arbor.

United States Department of Agriculture
1999 American Elk (*Cervus elaphus*). Fish and Wildlife Habitat Management Leaflet, Number 11.
2012 Driftless Area Initiative Boundary. Electronic document, https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcs142p2_020980, accessed February 6, 2020.

University of Minnesota
2019 Northeastern Minnesota Elk. Electronic document, http://elk.umn.edu/, accessed November 22, 2019.

University of Wisconsin-Stevens Point
2020 Caribou—Distribution and History in Wisconsin. Electronic document, https://www.uwsp.edu/wildlife/Ungulates/Pages/Caribou/Caribou-Distribution.aspx, accessed January 10, 2020.

Viatour, Luc
2011 *Cervus elaphus.* Electronic document, https://commons.wikimedia.org/wiki/File:Cervus_elaphus_Luc_Viatour_6.jpg, accessed November 22, 2019.

Wackman, John F., and David F. Overstreet
1978 Archaeological inventory and evaluation of the proposed wastewater treatment facilities at Campbellsport, Fond du Lac County, Wisconsin. *Great Lakes Archaeological Research Center, Inc.* Report of Investigation No. 36.

Warren, William W.
1885 History of the Ojibways, Based Upon Traditions and Oral Statements. *Collections of the Minnesota Historical Society* 5: 29-394. St. Paul.

Warwick, Matthew C.
2002 A diachronic study of animal exploitation at Aztalan: a late prehistoric village in southeast Wisconsin. Master's thesis, Department of Anthropology, University of Wisconsin-Milwaukee.

Washburn, Wilcomb E. (editor)
1988 *History of Indian-White Relations. Vol. 4 of Handbook of North American Indians*, edited by William C. Sturtevant. Smithsonian Institution, Washington, DC.

Wedel, Mildred Mott
2001 Iowa. In *Plains Part 1*, edited by Raymond J. DeMallie, pp. 432-446. *Vol. 13 of Handbook of North American Indians*, edited by William C. Sturtevant. Smithsonian Institution, Washington, DC.

Wedel, Waldo R.
1970 "Antler tine scraper handles in the Central Plains." *Plains Anthropologist* 15 (47): 36-45.

White, Richard
1991 *The Middle Ground: Indians, empires, and republics in the Great Lakes region, 1650-1815.* Cambridge University Press, New York.

White, Theodore E.
1953 A Method of Calculating the Dietary Percentage of Various Food Animals Utilized by Aboriginal Peoples. *American Antiquity* 19 (3): 254-264.

Whitewater Register [Whitewater, Wisconsin]
1919 "Ditchers Unearth Bones of Prehistoric Mammal." 22 May: 1. Whitewater, Wisconsin.

Wilson, Don E., and DeeAnn M. Reeder (editors)
2005 *Mammal Species of the World: A Taxonomic and Geographic Reference, Third Edition, Vol. 1.* The John Hopkins University Press, Baltimore, Maryland.

Wilson, Stephen Wayne
2016 Late Prehistoric Lithic Economies in the Prairie Peninsula: a Comparison of Oneota and Langford in Southern Wisconsin and Northern Illinois. Master's thesis, Department of Anthropology, University of Wisconsin-Milwaukee.

Winn, D.S.
1976 Terrestrial vertebrate fauna and selected coniferous habitat types on the north slope of the Uinta Mountains. *Wasatch National Forest Special Report.* USDA Forest Service, Salt Lake City, Utah.

Wisconsin Archeological Society
2019 The Wisconsin Archeologist. Electronic document, http://wiarcheologicalsociety.org/wisconsin-archeologist, accessed February 28, 2020.

Wisconsin Department of Natural Resources
2015 Comparison of ecological landscapes. In *The ecological landscapes of Wisconsin: An assessment of ecological resources and a guide to planning sustainable management*. Wisconsin Department of Natural Resources, Madison.
2019 Elk in Wisconsin. Electronic document, https://dnr.wi.gov/topic/wildlifehabitat/elk.html, accessed September 9, 2019.

Wisconsin Geological and Natural History Survey
1965 Early Vegetation of Wisconsin. Electronic document, https://wgnhs.wisc.edu/pubs/000360/, accessed February 5, 2020.

Wittry, Warren L.
1959 Archeological Studies of Four Wisconsin Rockshelters. *The Wisconsin Archeologist* 40 (4): 137-267.
1963 The Bell Site, Wn9, an Early Historic Fox Village. *The Wisconsin Archeologist* 44 (1): 1-57.

Wright, A., and Vlietstra, A.
1975 The Development of Selective Attention: From Perceptual Explanation to Logical Search. In *Infant Perception: From Sensation to Cognition*, edited by L.B. Cohen and P. Salapatek, pp. 169-189. Academic Press, New York.

Xu, David
2014 Michigan Girl Uncovers 160-year-old Skeleton of Extinct Elk. Electronic document, https://www.outdoorhub.com/news/2014/08/07/michigan-girl-uncovers-160-year-old-skeleton-extinct-elk/, accessed September 16, 2019.

Yarnell, Richard A.
1964 Aboriginal Relationships Between Culture and Plant Life in the Upper Great Lakes Region. *University of Michigan Museum of Anthropology, Anthropology Papers* 23. Ann Arbor.

APPENDIX A: ELK SITES IN WISCONSIN

Type codes

Arch = archaeological

Bio = biological

RA-pet = rock art, petroglyph

RA-pict = rock art, pictograph

Site Name	Type	County	Year	Cultural Association	Source	Site Number	MNI	NISP	Elements	Taphonomy/ Modifications
47LC44	Arch	La Crosse	A.D. 1400-1950		FAUNMAP Working Group 1994	47LC44	1	2		
Armstrong	Arch	Pepin	A.D. 1100-1300	Oneota	Savage 1978	47PE12	1	6	distal limb elements	
								1	scapula	
Aztalan	Arch	Jefferson		Woodland, Late	Warwick 2002	47JE01		3	distal limb elements	1 phalanx with cut marks
								1	rib, fragment	cut
								2	limb element, shaft	
								2		
Aztalan	Arch	Jefferson		Woodland, Late; Mississippian	Warwick 2002	47JE01		1	tibia, fragment	
								1	metatarsal, fragment	gnawed
								1	vertebra, cervical, fragment	
Aztalan	Arch	Jefferson		Woodland, Late; Mississippian, Middle	Leigl 2014; Parmalee 1960a	47JE01		46		
								1	scapula	rectangular section cut out[1]
Bell	Arch	Winnebago	A.D. 1400-1950		FAUNMAP Working Group 1994	47WN9		9		
Bigelow-Hamilton-Hartz	Arch	Portage	A.D. 670-1610	Woodland, Late	Lippold 1971	47PT29-2	1	4		

[1] Used for shredding fibers

Site Name	Type	County	Year	Cultural Association	Source	Site Number	MNI	NISP	Elements	Taphonomy/ Modifications
Bluff Siding	Arch	Buffalo	2550 B.C.-A.D. 1500		FAUNMAP Working Group 1994	47BF45	1	1		
Bornick	Arch	Marquette	A.D. 1290	Oneota	Gibbon 1969; Gibbon 1971	47MQ65	1	7		
Cooper's Shore	Arch	Rock	A.D. 250-350	Woodland, Middle - Late	Lippold 1971	47RO2	2	15		
Dietz	Arch	Dane	A.D. 1250	Woodland	Dietz 1956	47DA12		5	antler, fragment	burned
Durst Rockshelter	Arch	Sauk		Archaic, Late	Parmalee 1960b; Wittry 1959	47SK2		2		
Durst Rockshelter	Arch	Sauk		Archaic, Middle	Parmalee 1960b; Wittry 1959	47SK2		5		
Durst Zone I	Arch	Sauk	2550 B.C.-A.D. 1500		FAUNMAP Working Group 1994	SK2		1		
Durst Zone II	Arch	Sauk	2550 B.C.-A.D. 1500		FAUNMAP Working Group 1994	47SK2		2		
Durst Zone III	Arch	Sauk	2550 B.C.-A.D. 1500		FAUNMAP Working Group 1994	47SK2		3		
Durst Zone IV	Arch	Sauk	2550 B.C.-A.D. 1500		FAUNMAP Working Group 1994	47SK2		1		

Site Name	Type	County	Year	Cultural Association	Source	Site Number	MNI	NISP	Elements	Taphonomy/ Modifications
Furman	Arch	Winnebago		Oneota	Kreisa 1986	47WN216	1	1	antler tine[2]	pitting and smoothing on distal end
								1	antler tine[3]	pitting and smoothing on distal end
								1	carpal[4]	
Gundersen	Arch	La Crosse		Oneota	Arzigian et al. 1993	47LC394	2	33	distal limb elements	
								25[5]		
Hahn	Arch	Dodge	A.D. 900-1000	Woodland, Late; Effigy Mound	Lippold 1971	47DG2	1	1	tooth[6]	
Highsmith	Arch	Jefferson		Woodland, Middle	Lippold 1971	47JE4	1	1		
Highsmith	Arch	Jefferson		Woodland, Middle; Effigy Mound, Early	Lippold 1971	47JE4	1	1		
								1	humerus, distal end	butchery marks on the cut surface
Lasley's Point	Arch	Winnebago	2550 B.C.-A.D. 1500		FAUNMAP Working Group 1994	47WN96				
McCauley	Arch	Winnebago	A.D. 1350-1650	Oneota, Lake Winnebago phase	Grimm 2010	47WN222	1	1		
Midway Village	Arch	La Crosse	A.D. 1420	Oneota, Orr phase	Gibbon 1970	47LC19	1	1		

[2] Possible digging tool; associated with burial of >50 year old man
[3] Possible digging tool; associated with burial of 4 individuals
[4] Associated with burial of 4 individuals
[5] Including vertebrae, innominate, femur, and mandible fragments
[6] Deciduous mandibular molar from a 5-12 month old individual

Site Name	Type	County	Year	Cultural Association	Source	Site Number	MNI	NISP	Elements	Taphonomy/ Modifications
Mill Pond	Arch	Crawford	2550 B.C.-A.D. 1500		FAUNMAP Working Group 1994	47CR186				
Millville	Arch	Grant		Woodland, Middle	Pillaert 1969	47GT53	5	1	mandible, left	
								1	axis	
								1	vertebra, cervical	
								2	vertebra, lumbar	
								1	rib	
								3	scapula, right	1 scapula, unspecified side, was worked
								5	scapula, left	1 scapula, unspecified side, was worked
								3	scapula, fragment	
								2	carpal	
								1	metatarsal	
								2	innominate, fragment	
								2	femur	
								1	astragalus	
								1	calcaneus	
								4	phalanx	
								1	sesamoid, fragment	

Site Name	Type	County	Year	Cultural Association	Source	Site Number	MNI	NISP	Elements	Taphonomy/ Modifications
Pammel Creek	Arch	La Crosse		Oneota	Theler 1989	47LC61	2	4	distal limb elements	
								2	antler, fragment	possibly modified
								2	scapula[7]	
								11	antler tine	
								3	antler, fragment[8]	
								1	antler base	groove and split technique
Pipe	Arch	Fond du Lac	2550 B.C.-A.D. 1500		FAUNMAP Working Group 1994	47FD10	3	11		
Preston Rockshelter	Arch	Grant	760 B.C.	Archaic, Late, Durst phase	Theler et al. 2016	47GT157	1	13	phalanx, whole or fragment	
Preston Rockshelter	Arch	Grant	830 B.C.	Archaic, Late, Preston phase	Theler et al. 2016	47GT157	1	15	phalanx, whole or fragment	
								1	humerus shaft	
								1	naviculo-cuboid	
								2	calcaneus	
								1	scapula, fragment[9]	shaped
Preston Rockshelter	Arch	Grant	2550 B.C.-A.D. 1500	Woodland, Late	FAUNMAP Working Group 1994	47GT157	1	21		

[7] Hoes
[8] Possible tools
[9] Awl

Site Name	Type	County	Year	Cultural Association	Source	Site Number	MNI	NISP	Elements	Taphonomy/ Modifications
Preston Rockshelter	Arch	Grant	A.D. 280	Woodland, Late Middle, Millville Phase	Theler et al. 2016	47GT157		1	tibia shaft fragment[10]	flake scars on proximal end; polish and striations on distal end
								2	phalanx, whole or fragment	
Preston Rockshelter	Arch	Grant	A.D. 730-800	Woodland, Late, Eastman phase	Theler et al. 2016	47GT157	1	12	phalanx, whole or fragment	
								3	mandible, fragment	
								3	limb element, whole or fragment	
								1	ilium, left, fragment	pierced by chert projectile point
Raddatz Rockshelter	Arch	Sauk		Archaic	Parmalee 1959	47SK5	1	34	phalanx, mandible[11]	
Raddatz Rockshelter Level 10	Arch	Sauk	6550-1550 B.C.		FAUNMAP Working Group 1994	47SK5	1			
Raddatz Rockshelter Level 11	Arch	Sauk	6550-1550 B.C.		FAUNMAP Working Group 1994	47SK5	1			
Raddatz Rockshelter Level 2	Arch	Sauk	2550 B.C.-1950 A.D.		FAUNMAP Working Group 1994	47SK5	1			

[10] Possible chisel

[11] Exact numbers of different elements were unspecified; the jaws belonged to an older individual

Site Name	Type	County	Year	Cultural Association	Source	Site Number	MNI	NISP	Elements	Taphonomy/ Modifications
Raddatz Rockshelter Level 3	Arch	Sauk	2550 B.C.-A.D. 1500		FAUNMAP Working Group 1994	47SK5	2			
Raddatz Rockshelter Level 5	Arch	Sauk	2550 B.C.-A.D. 1500		FAUNMAP Working Group 1994	47SK5	2			
Raddatz Rockshelter Level 7	Arch	Sauk	2550 B.C.-A.D. 1500		FAUNMAP Working Group 1994	47SK5	4			
Raddatz Rockshelter Level 8	Arch	Sauk	6550-1550 B.C.		FAUNMAP Working Group 1994	47SK5	5			
Raddatz Rockshelter Level 9	Arch	Sauk	6550-1550 B.C.		FAUNMAP Working Group 1994	47SK5	1			
Raddatz Rockshelter Levels 13-15	Arch	Sauk			FAUNMAP Working Group 1994	47SK5	1			
Reigh	Arch	Winnebago	2000 B.C.	Archaic, Late	Ritzenthaler et al. 1957	47WN1		3	antler fragments[12]	
Sand Lake	Arch	La Crosse	A.D. 1400-1950		FAUNMAP Working Group 1994	47LC44	2	2		
Sanders I	Arch	Waupaca	A.D. 630-1010	Woodland, Late; Effigy Mound	Lippold 1971	47WP26	1	1		

[12] Associated with human burials; possible ax handles

Site Name	Type	County	Year	Cultural Association	Source	Site Number	MNI	NISP	Elements	Taphonomy/ Modifications
State Road Coulee	Arch	La Crosse	A.D. 1500-1600	Oneota, Valley View phase	Anderson et al. 1995	47LC176	7	86[13]		
								1	scapula[14]	removal of posterior ridge and scapular spine; use wear
Stonefield	Arch	Grant	A.D. 170-430	Woodland, Middle	Lippold 1971	47GT1	1	1		
Tremaine	Arch	La Crosse		Oneota	Jones 2014	47LC95	1	5	distal limb elements	
Trempealeau Bay	Arch	Trempealeau		Mississippian, Upper	Lippold 1971	47TR34	1	2		
Valley View	Arch	La Crosse	A.D. 1450-1600	Oneota	Stevenson 1985	47LC34	4	54	distal limb elements	
								1	antler	
								2	scapula	
								2	humerus	
								1	ulna	
								15[15]		
								1	scapula[16]	broken
								1	cranium, fragment	cut; stained with red ocher
Walker-Hooper	Arch	Green Lake	A.D. 1200-1240	Oneota	Gibbon 1969; Gibbon 1971	47GL65	2	20		

[13] Including cranial elements, vertebrae, ribs, and long bones
[14] Hoe
[15] Including cranial, mandibular, and dental fragments
[16] Possible hoe

Site Name	Type	County	Year	Cultural Association	Source	Site Number	MNI	NISP	Elements	Taphonomy/ Modifications
Clover Valley	Bio	Walworth			Kurowski 2019; Delavan Republican 1876		1		antlers	
Moeller Pond	Bio	Waukesha			Hudson 2007a		7[17]			
Gullickson's Glen	RA-pet	Jackson	A.D. 1300-1400	Woodland; Oneota	Schrab and Bozshardt 2016		1		head and neck[18]	
							2		full body[19]	
Gottschall	RA-pict	Iowa	A.D. 900	Mississippian	Salzer 1987a; Salzer 1987b		1		head and neck[20]	
Tainter Cave	RA-pict	Crawford	A.D. 900-1050	Effigy Mound	Schrab and Bozshardt 2016		7		full body[21]	
Tainter Cave	RA-pict	Crawford	A.D. 700	Effigy Mound	Schrab and Bozshardt 2016		1		full body[22]	

[17] 2 large adult males, 2 adult females, 2 young adult males, 1 very young individual
[18] Antlerless, shaggy neck, possible heartline
[19] Slashing "rib lines" across the body; based on antler branching, one may be a deer and the other an elk
[20] Antlered male with heartline
[21] Likely deer; antlerless, three are pregnant; surrounded by bow hunters
[22] Body filled in with black pigment

APPENDIX B: KNOWN REPOSITORIES

The lists of repositories and sources in Appendices B and C combine information from the original FAUNMAP records, additional research I conducted using the journal The Wisconsin Archeologist and a selection of relevant thesis and dissertations, and consultation with Dr. John Richards of the University of Wisconsin-Milwaukee. Dr. Richards provided information about where some of these collections are currently curated (Appendix B) and what other documentary sources might be relevant for future research (Appendix C). It should be kept in mind that the publication sources listed here attempt to be more comprehensive than the sources I used to tally the elk details of element, NISP, and site location discussed in my thesis. Information provided or updated by Dr. Richards is marked with an asterisk (*) in Appendix B.

Repository Codes

MPM	Milwaukee Public Museum
MVAC	Mississippi Valley Archaeology Center at the University of Wisconsin-La Crosse
OPM	Oshkosh Public Museum
UW	University of Wisconsin-Madison
UWM	University of Wisconsin-Milwaukee
UWO	University of Wisconsin-Oshkosh
UWP	University of Wisconsin-Platteville
WHS	Wisconsin Historical Society

Site Name	Site Number	Repository	Source(s)
Armstrong	47PE12	MVAC*	Savage 1978
Aztalan	47JE01	MPM; UW; UWM	FAUNMAP Working Group 1994; Parmalee 1960a; Warwick 2002
Bell	47WN9	UWO	FAUNMAP Working Group 1994; Koziarski 2004; Parmalee 1963; Wittry 1963
Bigelow-Hamilton-Hartz	47PT29-2	UW	FAUNMAP Working Group 1994; Lippold 1971
Bluff Siding	47BF45	WHS*	FAUNMAP Working Group 1994
Bornick	47MQ65	UW*	FAUNMAP Working Group 1994; Gibbon 1969, 1971; Lippold 1971
Cooper's Shore	47RO2	UW; WHS*	FAUNMAP Working Group 1994; Lippold 1971
Dietz	47DA12	UW*	Dietz 1956
Durst Rockshelter	47SK2	WHS	Wittry 1959
Furman	47WN216	UWO; WHS	Kreisa 1986
Gundersen	47LC394	MVAC	Arzigian et al. 1993
Hahn	47DG2	UW	Lippold 1971
Highsmith	47JE4	UW	Lippold 1971
Lasley's Point	47WN96*	OPM; UW; UWM*	FAUNMAP Working Group 1994; Lippold 1971
McCauley	47WN222	MPM	Grimm 2010
Midway Village	47LC19	MPM; MVAC; UW; WHS*	FAUNMAP Working Group 1994; Gibbon 1970
Mill Pond	47CR186	UW*	FAUNMAP Working Group 1994
Millville	47GT53	WHS	FAUNMAP Working Group 1994; Pillaert 1969
Pammel Creek	47LC61	MVAC	FAUNMAP Working Group 1994; Theler 1989
Pipe	47FD10	UWO; UWM*	FAUNMAP Working Group 1994
Preston Rockshelter	47GT157	UWP*	FAUNMAP Working Group 1994; Theler at al. 2016
Raddatz Rockshelter	47SK5	WHS	Parmalee 1959
Reigh	47WN1	MPM (accession #s 17707 & 17750); OPM; UWO; WHS*	Ritzenthaler et al. 1957
Sand Lake	47LC44*	MVAC*	FAUNMAP Working Group 1994
Sanders I	47WP26	UW	Lippold 1971

Site Name	Site Number	Repository	Source(s)
State Road Coulee	47LC176	MVAC	Anderson et al. 1995
Stonefield	47GT1	UW	Lippold 1971
Tremaine	47LC95	MVAC	Jones 2014
Trempealeau Bay	47TR34	MVAC; WHS*	Lippold 1971
Valley View	47LC34	MVAC	Stevenson 1985
Walker-Hooper	47GL65	MPM; UW*	FAUNMAP Working Group 1994; Gibbon 1969; Lippold 1971

APPENDIX C: ADDITIONAL PUBLICATIONS

Site Name	Site Number	Additional Publications
Bigelow-Hamilton-Hartz	47PT29-2	Hurley, William—1975—An Analysis of Effigy Mound Complexes in Wisconsin. *University of Michigan Museum of Anthropology Papers* 59. Ann Arbor.
Bluff Siding	47BF45	Theler, James L.—1981—Faunal Remains (47-Bf-45). *The Wisconsin Archeologist* 62 (1): 34-44.
Cooper's Shore	47RO2	Wiersum, Wayne Edward—1968—The Cooper Shore Site, RO2: A Late Havana Hopewell Village Site in Southcentral Wisconsin. Master's thesis, Department of Anthropology, University of Wisconsin-Madison.
Dietz	47DA12	Baerreis, David A. and R. Nero—1956—The storage pits of the Dietz site (Da 12) and their contents. *The Wisconsin Archeologist* 37 (1): 5-18.
Hahn	47DG2	Keslin, R. O.—1958—A Preliminary Report of the Hahn and Horicon Sites, Dodge County, Wisconsin. *The Wisconsin Archeologist* 39 (4): 191-258.
Highsmith	47JE4	Salzer, Robert—1964—The Waukesha Focus: Hopewell in Southeastern Wisconsin. Master's thesis, Department of Anthropology, University of Wisconsin-Madison.
Lasley's Point	47WN96	Bullock, Harold R.—1942—Lasley Point Mound Excavations. *The Wisconsin Archeologist* 23 (2): 37-44.
		Pekse, G. Richard—1966—Oneota Settlement Patterns and Agricultural Patterns in Winnebago County. *The Wisconsin Archeologist* 47 (4):189-193.
Midway Village	47LC19	McKern, W.C.—1945—*Bulletin of the Public Museum of the City of Milwaukee* 16 (3): 109-285
Mill Pond	47CR186	Arzigian, Constance—1982—Preliminary Report of Floral and Faunal Remains Recovered from Flotation of Soil Samples from Four Sites: CR-100, CR-0186, CR-0348, and CR-0339. In *Archaeological Survey and Testing in the Prairie du Chien Region: The 1980 Season*, ed. Stoltman et al., pp. 362-367. University of Wisconsin-Madison, Madison.
		Theler, James L.—1987—Woodland Tradition Economic Strategies: Animal Resource Utilization in Southwestern Wisconsin and Northeastern Iowa. University of Iowa, Office of the State Archaeologist, Report 17. Iowa City.
Pammel Creek	47LC61	Arzigian, Constance M., et al.—1990—The Pammel Creek Site: An Oneota Occupation in La Crosse, Wisconsin. MVAC. Report of Investigations No. 112.
Pipe	47FD10	Overstreet, David F.—1981—Investigations at the Pipe Site (47-Fd-10) and some perspectives on eastern Wisconsin Oneota prehistory. *The Wisconsin Archeologist* 62: 365-525.

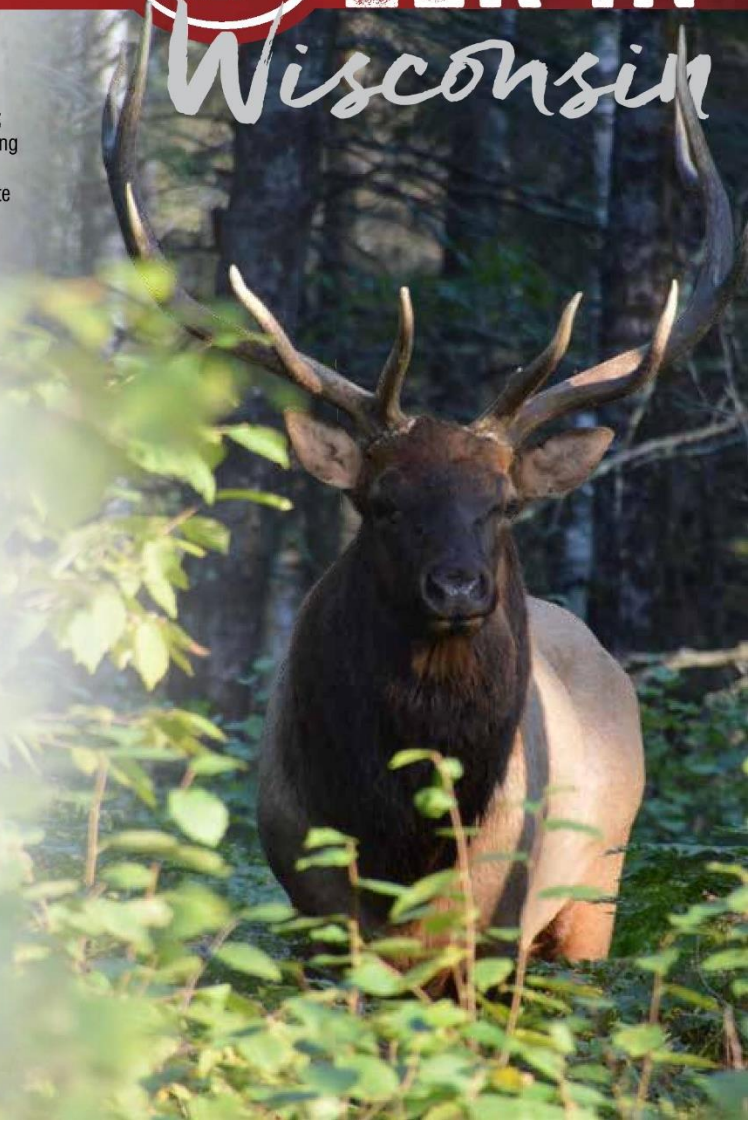
Site Name	Site Number	Additional Publications
Sand Lake	47LC44	Boszhardt, Robert, Thomas Bailey, and James Gallagher—1985—Oneota Ridged Fields at the Sand Lake Site (47LC44), La Crosse County, Wisconsin. *The Wisconsin Archeologist* 66 (1): 47-67.
Sanders I	47WP26	Hurley, William—1975—An Analysis of Effigy Mound Complexes in Wisconsin. *University of Michigan Museum of Anthropology Monographs* 59. University of Michigan Press, Ann Arbor.
Trempealeau Bay	47TR34	Boszhardt, Robert F. et al.—1996—Public Archaeology at Trempealeau. MVAC. Report of Investigations No. 257.
Walker-Hooper	47GL65	Gibbon, Guy—1972—The Walker-Hooper Site, A Grand River Phase Oneota Site in Green Lake County. *The Wisconsin Archeologist* 53 (4): 149-290.

APPENDIX D: RMEF "ELK IN WISCONSIN" BROCHURE

ROCKY MOUNTAIN ELK FOUNDATION

The mission of the Rocky Mountain Elk Foundation is to ensure the future of elk, other wildlife, their habitat and our hunting heritage.

ELK IN Wisconsin



In support of this mission, the RMEF is committed to:

- Conserving, restoring and enhancing natural habitats;
- Promoting the sound management of wild, free-ranging elk, which may be hunted or otherwise enjoyed;
- Fostering cooperation among federal, state and private organizations and individuals in wildlife management and habitat conservation; and
- Educating members and the public about habitat conservation, the value of hunting, hunting ethics and wildlife management.

Rocky Mountain Elk Foundation
5705 Grant Creek Road
Missoula, MT 59808
1-800-CALL ELK
www.rmef.org

HUNTING IS CONSERVATION

WISCONSIN DEPT. OF NATURAL RESOURCES

Thanks to the many partner organizations, agencies, volunteers and donors who made the elk reintroduction to Wisconsin possible.

COVER PHOTO: JEFF MORDEN

PUB WM-669-2018

201-0618-002

HISTORY OF ELK IN WISCONSIN

Elk were once common throughout Wisconsin prior to European settlement, but the last native elk were reportedly killed in 1886 in northwestern Wisconsin. An effort was made to reintroduce elk in 1914. Elk from Yellowstone National Park were released into a Vilas County enclosure and subsequently released into the wild in 1932. Survival was poor due to unregulated hunting and the last four elk were reportedly killed in 1954.

In 1990, the Department of Natural Resources (DNR) was directed by state legislators to explore the feasibility of restoring elk, caribou and/or moose, all of which were once native in Wisconsin. An assessment of each species suggested that elk would be the most successful.

A lack of local support initially prevented a reintroduction from occurring. But public support grew between 1992-1994. Funding from both state and non-governmental agencies was secured to allow an experimental release in the Clam Lake area of Ashland County.

In 1994, the DNR approved a four-year study under the direction of Dr. Ray Anderson of the University of Wisconsin-Stevens Point. If the experimental study found that the elk were detrimental to the environment or humans, they would be removed and the project would end. Financial support came primarily from the Rocky Mountain Elk Foundation.

During the winter of 1994-95, 25 elk were captured from Michigan's lower peninsula. After extensive health testing and a three-month quarantine, the elk were brought to Wisconsin in May. They spent two weeks in an acclimation pen and on May 17, 1995 were released into the Chequamegon-Nicolet National Forest. After an absence of 110 years, wild elk once again roamed the Northwoods of Wisconsin!

CURRENT ELK MANAGEMENT

The Clam Lake elk range consists of approximately 1,620 square miles of mixed conifer, upland hardwoods and cedar swamps. A significant portion lies within the Great Divide Ranger District of the Chequamegon-Nicolet National Forest, as well as in the Flambeau River State Forest. The elk range contains several hundred acres of openings maintained specifically for wildlife as well as an abundance of industrial forest lands, where young forests provide a perfect mix of habitat for elk. Federal, state, and county forest, and private lands are mixed throughout the elk range. The long-term population goal for the Clam Lake herd is 1,400 elk.

Elk reintroduction efforts were revived in 2012 when the DNR began working with the Kentucky Department of Fish and Wildlife Resources to transport up to 150 elk to Wisconsin over a period of up to 5 years. From this effort, a new elk herd was established in 2015 and 2016 with the release of 73 elk into the Black River State Forest of Jackson County, while remaining animals were released in the Flambeau River State Forest to augment the population of the original Clam Lake herd. The long-term population goal for the Black River herd is approximately 400 elk.

PUBLIC VIEWING OPPORTUNITIES

Elk can be seen in many habitats throughout both the Clam Lake and Black River elk ranges. Best viewing times are dawn and dusk. The most popular viewing period is September and October during the mating season, when elk are often feeding in openings. However, keep in mind that elk hunting may occur during this time. If you choose to head into the woods on foot, wear a highly visible outer garment of hunter orange or similar color. Summer observations are possible, but heavy leaf cover makes viewing more difficult.

When searching for elk, use your ears! In the fall, bull elk emit a long, high whistling sound (referred to as a "bugle") that can be heard for miles under good conditions. Bugling can often tip you off on where to start your viewing adventure.

Wildlife openings and viewing areas have been established through a cooperative effort between several partner groups and organizations in both the Clam Lake and Black River elk ranges, and are regularly used by elk. Elk can also sometimes be seen feeding along roadways or private crop fields. While searching for elk, always respect private landowners' rights and privacy.

Do not approach elk too closely. Elk should always be viewed and appreciated from a distance. This will ensure that elk maintain their natural behavior. Remember, elk are wild animals and should be respected.

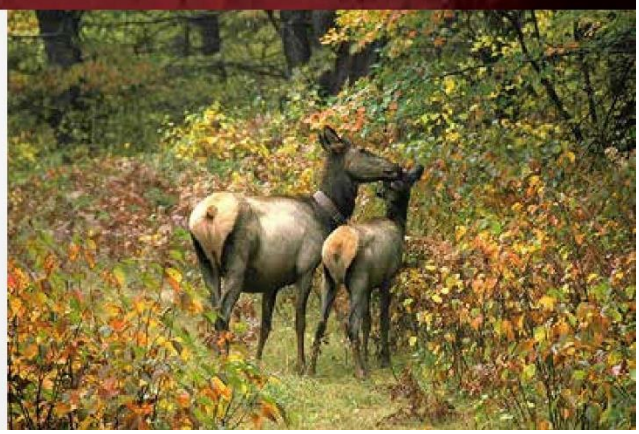
Before heading out to view elk, we suggest contacting DNR staff or local area businesses for tips on the best places to find them. Your search may take some time. Elk are highly mobile animals, so they could be miles from where they were seen just days before.

CAUTION: While driving in the elk ranges, be alert for logging truck activity and other motorists. Only stop on wide road shoulders and pull completely off the road. Be careful if leaving your vehicle.

ELK VS. DEER

ELK MAY WEIGH UP TO FIVE TIMES MORE THAN DEER

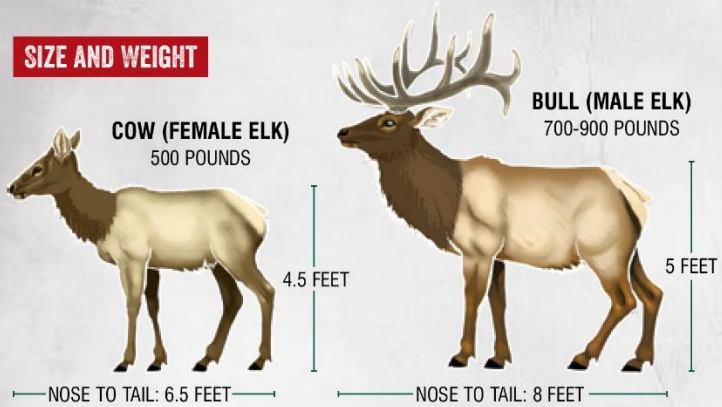
DEER		ELK
3-3½ feet at shoulders	HEIGHT	4-5 feet at shoulders
long tail with a white underside	TAILS	short tail
legs and bodies the same color, white throat patch	COLOR	tan rump patch, black legs, dark brown furry neck
antlers curve forward	ANTLERS	antlers sweep back
less frequently marked	JEWELRY	many elk have been marked with collars and ear tags



ELK FACTS

Elk or Wapiti ("white rump" in the Shawnee language) - members of the deer family, closely related to moose and white-tailed deer

SIZE AND WEIGHT



DIET

Herbivores

Eat a variety of shrubs and seedling leaves, woody browse, grasses and forbs

Natural meadows, forest openings and clear-cuts provide good foraging areas for elk

COLOR

Summer: Copper Brown

Fall, Winter & Spring: Light Tan

Rump Patch: Light Beige

Legs and neck often darker than body

ANTLERS

Only bulls (males) have antlers

Bulls shed and grow a new set of antlers each year

Antlers on a mature bull can weigh up to 40 pounds

LIFE CYCLE

Calves are born in late May through early June

Calves are born spotted and scentless as camouflage

Cows remain isolated with their calves for a few weeks and then join a nursery group with other cows and calves

Mature bulls spend the summer in small bachelor groups

The rut (breeding season) begins in September. One bull may mate with several cows and defend them from other bulls. Bulls bugle during the rut to challenge other bulls, maintain their harem and identify their territory.

After the rut large groups of elk may form and remain loosely associated all winter near good feeding grounds.