A zooarchaeological analysis of the Skadeland site (13CK402): a Mill Creek culture occupation in northwest Iowa

by

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ABSTRACT

The late prehistoric entity of the Mill Creek cultures underwent extensive research during the 1960s and 1970s to address the effects of climate change on Mill Creek populations in northwest Iowa. Through this research numerous sites have been excavated including the currently unanalyzed site of Skadeland, which is the focus of my research. Previous Mill Creek faunal analyses have examined faunal remains to record abundance and focused on the exploitation of bison as a food resource, which neglects the numerous small mammals, avian and aquatic resources found at these sites. Therefore, the objective of my research is to address Mill Creek people's exploitation of all faunal resources at the Skadeland site (13CK402) using a taphonomically informed approach to zooarchaeological analysis. This method provides new details about late prehistoric faunal exploitation and creates a data set that can be used to draw comparisons with other late prehistoric faunal assemblages. To determine the economic and symbolic value of faunal resources, my research examines ethnographic and ethno-historic records of animal exploitation on the northern plains for evidence of cultural and subsistence values placed on species.

CHAPTER 1
INTRODUCTION

Research Problem & Goal

Archaeological research on the Mill Creek culture of northwest Iowa has provided a wealth of information about late prehistoric lifeways. The pristine preservation of Mill Creek sites has enabled the archaeological manifestation of this culture to become the focus of numerous paleoenvironmental studies. Information generated from these studies has made Mill Creek one of best understood prehistoric cultures in Iowa (Alex 2000). Research on the Mill Creek culture has generated in-depth knowledge about ceramic styles (Ives 1962; Anderson 1981; Tiffany 1982), settlement patterns (Anderson 1987; Tiffany 1982; Bryson and Baerreis 1968), farming practices (Asch 1992; Jones 1993; Wegner 1979), subsistence (Dallman 1983; Lensink 1993; 1998; Jans-Langel and Fishel 1995) and exchange networks (Little 1987; Tiffany 1991; Alex 1993), but some questions still remain. One area of uncertainty resides in diet and subsistence behaviors, which have not received the attention necessary to achieve a detailed understanding of Mill Creek faunal exploitation. Thus far, faunal analyses have focused on recording taxonomic abundance and have neglected to produce data that facilitates intersite comparison of taxon-specific carcass utilization.

The traditional method of faunal analysis fails to address the complex history of cultural (i.e. transport, butchery) and non-cultural processes (i.e. carnivore and rodent modification) creating the assemblage that we see today. In order to more accurately determine the cultural behaviors influencing the assemblage, we must also record the non-human-related processes affecting the condition and frequencies of the remains. Taphonomy, coined by the Russian paleontologist Ivan A. Efremov (1940) from the Greek words *taphos* (burial) and *nomos* (laws), has gained recognition as the science of identifying postmortem, pre-, and post-burial histories of faunal remains. Archaeologists need to be especially concerned with taphonomy, as it is often a major part of the archaeological record. For example, a bone may be broken, buried, exposed, gnawed, reburied, re-exposed, transported, broken and reburied prior to recovery by archaeologists (Lyman 1994). By generating the taphonomic history, the agents and processes affecting the archaeological remains, we can begin making human behavioral inferences from the remains.

In the past 20 to 30 years, archaeologists have begun to recognize the importance of taphonomy, and it has made a major contribution to zooarchaeology. One contribution the role of taphonomy has made is exhibited in archaeologists' adoption of optimal foraging theory from ecology (Binford 1981; Blumenschine 1986; Bunn and Kroll 1986; Shipman 1986). Optimal foraging theory's examination of the exploited niche requires that archaeologists determine from the faunal remains which taxa were exploited and those that are of an intrusive nature (Lyman 1994). This entails examining the remains for indicators that humans accumulated and deposited certain remains. For example, if some of the bones have butchery marks, a sign of human agent, then it is reasonable to suppose that the taxon represented was accumulated and butchered by people. If a nearly complete and partially articulated skeleton of burrowing animals such as a pocket gopher is found in a krotovina, it is likely that this individual was naturally deposited and did not form a part of the human occupants' diet (Lyman 1994).

In past analyses of Mill Creek faunal exploitation at the site level, most workers have simply measured the taxonomic richness (number of species) represented by the sample of animal remains (Tiffany 1982; Dallman 1983). To measure dietary breadth of this prehistoric group, analysis must distinguish between the culturally and naturally deposited animal remains. "Inferences that humans broadened their dietary niche, or narrowed it, or did not alter it through time will surely be inaccurate without such taphonomic analyses," (Lyman 1994:8). We must record the processes that formed the assemblage. Former analyses reflect this deficiency, as they are unable to make sound conclusions about resource selection, transport decisions and carcass utilization decisions, leaving us uncertain of the diet breadth and dietary preferences of the Mill Creek people (Frankforter 1969; Dallman 1977; Jans-Langel 1999; Lensink and Tiffany 2005).

The objective of my research is to address Mill Creek people's exploitation of faunal resources at the Skadeland site (13CK402) using a taphonomically informed approach to zooarchaeological analysis. This method will provide new details about late prehistoric faunal exploitation and will create a data set that can be used to draw comparisons with other late prehistoric faunal assemblages. To determine the economic and symbolic value of faunal resources, my research will examine ethnographic and ethno-historic records of animal exploitation on the northern plains for evidence of cultural and subsistence values placed on species. The existing studies of Mill Creek animal procurement focus mainly on large mammal procurement, while only briefly mentioning the abundance of small mammals and birds recovered (Frankfort 1969; Tiffany 1982; Dallman 1983). The small mammal and bird contribution to the diet would have been minimal; instead, these numerous species may have been exploited for inclusion in cultural paraphernalia and hunted in order to gain prestige within the society (Fishel 1997; Holt 1996; McGuire and Hildebrant 2005). For the purpose of this paper, foraging events, in which the exploitation of a species is done for its cultural significance, will be referred to as prestige or ritual foraging.

To accomplish my research goal, it is first necessary to use current zooarchaeological methods to extract information on element abundance, species representations and taphonomic influences from the Skadeland faunal remains. This new information will be used to evaluate predictions generated from ethnographic data and mythological inferences therefore, creating a more complete picture of faunal exploitation that facilitates an understanding of the cultural context influencing the assemblage. The combination of these methods in the analysis of Mill Creek faunal exploitation will reconstruct subsistence while considering the cultural system influencing resource selection, which will allow for more conclusive distinction between foraging done for subsistence and foraging for prestige.

Current Mill Creek Zooarchaeology

The sedentary lifestyle of late prehistoric cultures in North America has resulted in the remnants of village middens with large amounts of material remains. One would think that large amounts of well preserved data are an archaeologist's dream, but it appears that the massive amounts of material remains have become a nightmare. The overwhelming amount of data has resulted in poor records, shoddy analysis and numerous collections locked away without proper documentation (Tiffany 1982). In cases where entire sites are analyzed, the extensiveness of the collection has often resulted in laundry lists of what was recovered from the site, creating descriptions of these cultures that are reflective of this broad approach. To gain a better understanding of late prehistoric diet and subsistence strategies, we must commit to analyzing faunal assemblages using a comprehensive taphonomic approach.

Prior researchers depict the Mill Creek people as successful generalized farmers who cultivated maize, beans, and a variety of other crops (Alex 2000), while utilizing meat only as a supplementary dietary resource (Dallman 1983). It is clear that these prehistoric groups exploited large prey such as bison (*Bison bison*), deer (*Odocoileus sp*.) and elk (*Cervus canadensis*), but faunal representation at sites varies through space and time. In addition to large mammals, a variety of small mammals, birds, fish, reptiles, and freshwater mussels have been suggested as secondary subsistence items. However, these analyses seem to raise more questions than answers. What species were included in the diet of late prehistoric hunters? What is the extent of their diet breadth? Is there variability in exploitation among late prehistoric cultures?

Questions regarding the dietary breadth and variability in prehistoric diets of the Mill Creek people have not been addressed, as data have not been analyzed using techniques that lend themselves to the evaluation of such questions. As we develop our analytical methods to understand the taphonomic history of faunal remains, the use of new methods for data analysis provide information that can be used to test previously untested hypotheses and begin answering these complex questions. In recent years, archaeologists have acknowledged that deposits are the result of both cultural and natural site formation processes, and the effects of these processes must be considered in our analyses. In addition to natural and cultural processes, the archaeologists' methods for collection and documentation can greatly influence the subsequent knowledge that is gained from the assemblage. Acknowledging the factors affecting assemblages, we must analyze these remains using a taphonomic approach. When this approach is taken, we can determine the life history of the remains, which will allow for an understanding of cultural behavior.

In an effort to diverge from previous analysis of faunal remains, which have provided only lists of the species represented at each site, this study will provide the results of a comprehensive taphonomic approach used to analyze the Skadeland site. The analysis will provide us with a more detailed knowledge of prehistoric subsistence, since we now have the methodology needed to address the issue of late prehistoric diet breadth. My analysis focuses on the diet breadth of the late prehistoric Mill Creek culture of northwestern Iowa and the variability in diet and subsistence behaviors. To determine this, mythological, ethnographic, and ethno-historic records are combined to identify species that were hunted as a result of motivation from the ritualistic significance and prestige associated with capture of these animals.

Theoretical Approach

Current research on late prehistoric diet uses a behavioral ecology, or evolutionary ecology, framework to review the motivating factors enticing hunters to exploit different resources. This framework has been increasingly used to address the foraging strategies of human hunters by using mathematical and graphical models (Bayman 1979, Broughton 1999, Charnov 1976, Earle 1980, Grayson and Cannon 1999, Grayson and Delpech 1998, Hames and Vickers 1982, Hamilton and Watt 1970, Nagaoka 2002, Schmitt and Lupo 1995, Speth 1983, Wolverton 2001). The basic principle behind evolutionary ecology models is that people always seek to maximize their returns while minimizing the cost, which ultimately increases fitness. However, according to Bamforth (2002:439), “Foraging theorists have simply made this common sense observation and then asserted that the variation they document in caloric intake or foraging efficiency predicts comparable variation in genetic fitness, without ever looking to see if this is actually the case. The (limited) available evidence suggests that it is not.”

The use of optimal foraging and central place behavioral ecology frameworks to examine the exploitation of mobile prey is certainly of great value, as humans are known optimizers. Behavioral ecology based foraging models have been used to understand variability in archaeofaunal assemblages and have been especially useful in illustrating transitions in subsistence strategies, whereby many hunter-gatherers intensified resource use and began to exploit a wider array of prey than their predecessors (Clark 1952; Willey and Phillips 1958). However, some problems with such foraging models have been identified, as not all populations conform to the expectations of these models (Bird and O'Connell 2006). As researchers have begun to recognize the variation in resource exploitation, the question has arisen as to how more reliable measures of resource rank can be established (Bettinger 1991; Bird and O'Connel 2006; Broughton and Grayson 1993; Lupo 2007, Bird et al 2009). Satisfactory ranks for sessile prey ranks have been achieved through ethnographic, ethno-historic and actualistic studies, but ranking mobile prey has proven to be much more complicated. Mobile prey present much more variability in pursuit and capture costs and are only loosely related to prey size (O'Connel et al. 1988). Further complicating the cost of mobile resources is the technology used to procure various prey (Grayson and Cannon 1999; Schmitt et al. 2004), as specialized technologies can substantially decrease these costs.

Most recently, Bird et al. (2009) assert that behavioral ecology based foraging models do not differentiate subsistence foraging from foraging for prestige. These different foraging strategies would significantly affect the kinds of prey being pursued, as prestige foraging would be less confined by an immediate need, resulting in the increased energy cost to pursue a resource that would otherwise be considered a negative return. However, when cultural significance is included, the status received in the form of increased social attention, improved access to alliance networks and, ultimately, expanded mating opportunities would be a benefit not included in traditional prey rank models (McGuire and Hilderbrandt 2005). To test this, we need archaeologically relevant predictions that can differentiate between prestige and subsistence foraging and make broader links between animal exploitation and group dynamics, cooperation and competition (Bird et al. 2009, e.g. Hildebrandt and McGuire 2002, McGuire and Hildebrandt 2005). Bird et al. (2009) suggest incorporating secondary measures of prey abundance and estimating the effects of prey mobility on return rates as future steps to more clearly identify violations of foraging models.

In this thesis, I propose a novel approach: to include the cultural significance or prestige value associated with the acquisition of various faunal resources. This criterion is especially useful for examining the foraging strategies of late prehistoric cultures that have known living relatives to provide analogues. Luckily, the late prehistoric Mill Creek culture has living relatives in the Mandan and Hidatsa tribes of the northern plains from which we can begin examining the cultural significance of various faunal resources (Wood 1967). A review of the ethnographic and ethno-historic documentation of ritual and subsistence behaviors of the Hidatsa and Mandan Indians will be presented in the next chapter to elucidate the cultural dimension of resource exploitation. To gauge prestige value, animals will be assigned a rank value based on their frequency in myths and their context in ethnographic accounts.

The archaeological record poses analytical problems, as we struggle to construct subsistence models that can accurately portray the complex interplay between biological needs and culturally constructed worth. My research will produce a more complete view of Mill Creek faunal exploitation by using ethnographic and mythological accounts of animals to create testable hypotheses for what we should expect to see in the archaeological remains. The inclusion of mythological representations of animals will help decipher prestige foraging events that have been previously overlooked by behavioral ecology based frameworks. These hypotheses will be tested using the Skadeland faunal assemblage. In addition to producing a more comprehensive view of Mill Creek faunal exploitation, the analysis will focus specifically on the activities occurring at the Skadeland site. The goal in constructing a culturally centered prey rank is to provide a tool for generating more reliable zooarchaeolgical measures of prey diversity and rank.

Mill Creek Culture

The Mill Creek culture of northwest Iowa was named and defined by Charles R. Keyes after a tributary of the Little Sioux River (Keyes 1927, 1951; Vis and Henning 1969; Van Voorhis 1978), and cross-dating ceramics with radiocarbon dates has suggested an A.D. 1100-1250 time span for the entire Mill Creek occupation (Lensink 1998). The Mill Creek culture is currently known through the exploration of thirty-five sites representing two phases, the Little Sioux and Big Sioux phases, which were named for the rivers where these sites reside (Keyes 1927). The Little Sioux locality is the larger of the two phases containing 28 sites, while the Big Sioux phase contains only seven sites (Figure 1.1). These residential village sites occur in rich bottom lands, which would have been ideal for agriculture. These village areas are usually about an acre (0.40 hectares) in extent and show evidence of community planning through the presence of houses arranged in rows and the development of fortification. The houses in the villages were semi-subterranean and constructed of vertical timbers interwoven with branches and rushes (Tiffany 1975, 1982; Fishel 1995). They were rectangular in shape reaching sizes up to 30x40 feet (9x12 meters) in dimensions. Fortification by a rectangular arrangement of posts around the periphery of the village is present at a number of later Mill Creek sites and is considered a sign of increased conflict with neighboring tribes (Bozell and Ludwickson 1994). As would be expected with extensive planning toward community development, the villages were inhabited year round and have been called mini "tells" because of the raised surface created by the collection of village debris (Anderson 1985, 1986; Fishel 1996). A final characteristic of these villages is the cache pits, which were dug both inside and outside of houses, creating bell-shaped pits of varying sizes for storage and disposal (Alex 2000).

The majority of research on Mill Creek Culture has been conducted to determine if the culture was affected by the Pacific climate episode and verify the origin of the Mill Creek culture. The Pacific climate episode is a shift from the mild conditions of the Neo-Atlantic Episode to more sever drier conditions around A.D. 1200. To reconstruct climate, a large number of Mill Creek sites were excavated and described during a large paleo-environmental study conducted by the University of Wisconsin in the 1960s and early 1970s (Henning 1968, 1969). This wealth of data has not been thoroughly analyzed, but efforts that were expended focused on studying ceramic technology in order to track trade, origins and create ceramic seriations used for dating. According to Ives (1962:10), the ceramic complex "consists largely of crushed granite and sand tempered vessels, which often contain varying amounts of limestone in the paste." The vessels commonly have constricted necks, pronounced shoulders, and flared rims, all of which are often decorated with incising. These analyses provided evidence for a Mississippian connection and placed Mill Creek into the Initial Middle Missouri Variant of the Northern Plains (Little 1987; Tiffany 1991). In addition to ceramic artifacts, stone tools have been commonly recovered, becoming characterized by small triangular points with one or more sets of side-notches. The presence of these projectile points is further evidence for a strong Middle Mississippian influence, potentially coming from the large ceremonial center of Cahokia (Tiffany 1991). Mill Creek sites have also been characterized by a wealth of other lithic artifacts include scrapers, knives, hammer stones, metates, manos, celts and grooved axes (Fugle 1962). The material record does not end there, as Mill Creek utilized bone for a number of tools including bison scapula hoes, rib bone scrapers, awls, fleshers, spatulas and ornamentation such as bone beads (Frankforter 1969). This wealth of material culture provides us insight into life on the Plains nearly a thousand years ago, and there is still much to be learned from this data.

Mill Creek Subsistence

The Mill Creek subsistence strategy has been generally described as hunter-gatherer-horticulturalist. This description is based on the quantities of faunal and floral remains recovered from the Chan-ya-ta (13BV1), Brewster (13CK15) and Phipps (13CK21) sites (Frankforter 1969; James and Nichols 1969; Stains 1972; Dallman 1977; Tiffany 1982; Dallman 1983; Nepstad-Thornberry 1998). These sites have led to the interpretation of agriculture as the primary contributor to the Mill Creek subsistence economy with the hunting of bison and deer and the gathering of wild plants supplementing the diet. Focusing on the contribution of meat to the diet, Tiffany (1982) conducted a study of Mill Creek subsistence based on the excavation of storage pits at the Chan-ya-ta site. Three storage pits were excavated, and the "faunal material recovered suggested the exclusive hunting of bison because all of the identifiable bone, except one beaver incisor, was bison" (Tiffany 1982:6). This is a logical conclusion, but one of very elementary implications, as this interpretation

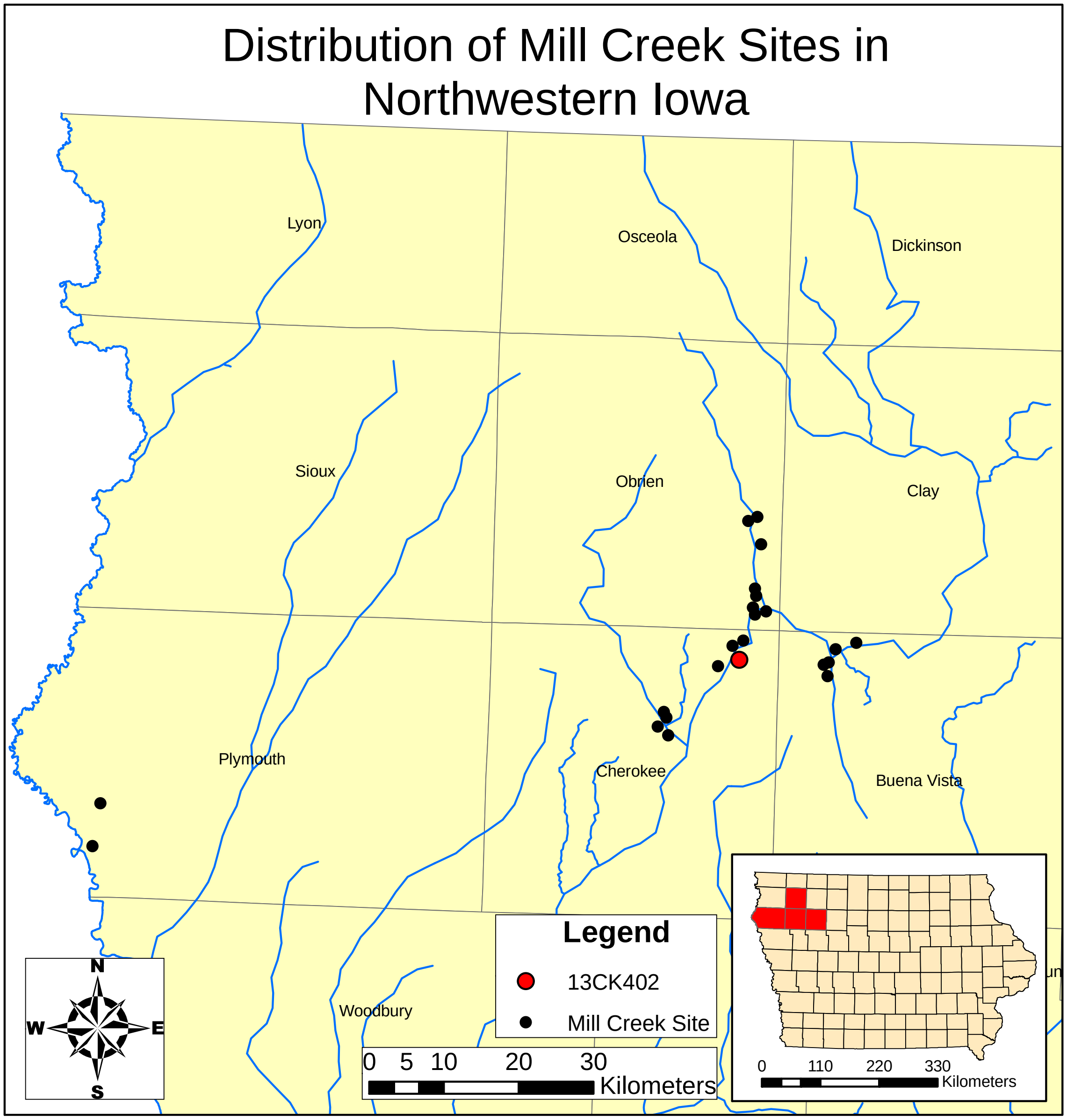

Figure 1.1 Mill Creek manifestation in Northwest Iowa.

provides no inferences about butchery and processing decisions. A slightly more comprehensive study was published by Dallman (1983) on his analysis of the Brewster and Phipps sites. In his review of the archaeological evidence, he aimed to test the hypothesis that a climate change forced Mill Creek subsistence to shift, resulting in a change visible in the archaeological record. However, the evidence did not strongly support his proposed hypothesis, and he concluded that inhabitants were dependent on bison for a food resource. It was further noted that “meat was a supplementary rather than a basic dietary resource” (Dallman 1983:57), since agriculture was considered the primary source of Mill Creek subsistence. In addition to bison, Dallman identified a number of other species exploited at these sites, concluding, that Mill Creek people hunted elk, deer, and beaver and used pocket gopher meat to supplement these other resources. The “other rodents, mustelids (otter, badger, mink, skunk), miscellaneous animals (lynx, bear, rabbit), fish, turtle, and birds provided at best a supplemental variety in the diet.” However, “these latter animals may not have been the objects of intensive hunting, but rather the fortuitous discovery of the village boys” (Dallman 1983:28).

The examples given above are representative of the faunal analysis that has been produced thus far on Mill Creek subsistence, clearly indicating the need for a more intensive study. The conclusion that bison, deer and elk are the most common large game, but vary in their representation from site to site is typical of late prehistoric sites. However, such conclusions based on the number of bones identified as belonging to these animals are incapable of answering more complex questions. From this data, these studies have only provided estimated meat weights that could be provided given the number of individual animals identified at the site (Dallman 1983). The location of hunting has also been suggested from the remains saying that although a kill site has never been identified "the nature of the butchered bone found in some villages suggests that occasionally hunts took place at distant locations" (Alex 2000: 161). Again, this interpretation reveals little about the lives of prehistoric people.

The current lack of knowledge about Mill Creek subsistence organization is often defended by citing their dependence on agriculture, domesticating maize and common beans, as well as a variety of other plants (Alex 2000; Asch 1992). However, we are now in a position to introduce a new body of data to current discussion of late prehistoric diet and subsistence that will allow us to investigate transport and butchery decisions and the motivation for exploiting various faunal resources. Tiffany has reminded us that, "there is enough information available to make Mill Creek one of the best understood pre-historic cultures in Iowa" (Tiffany 1982:5). Therefore, a reanalysis of Mill Creek diet and subsistence using new methodology and a direct historic approach will aid in making Mill Creek the best understood pre-historic culture in Iowa. My analysis employs a taphonomic approach to analyze the Skadeland site, while also using ethnographic and mythological account from the Plains to create testable prediction in an attempt to better understand Mill Creek subsistence and prestige foraging. Though there is a substantial amount of information presently recorded on Mill Creek culture, Anderson (1987: 532) argues that, "a better understanding of the subsistence and settlement systems is needed." I agree with Anderson's concerns regarding the current state of knowledge about the Mill Creek culture. Therefore, this study aims to build on the work of previous zooarchaeological analyses to increase the current understanding of Mill Creek subsistence through a comprehensive taphonomic analysis of the Skadeland faunal assemblage.

Skadeland Site

The Skadeland site (13CK402) (Figure 1.2) provides a unique opportunity to study Mill Creek faunal exploitation, as this previously unanalyzed site contains a wealth of well-preserved faunal remains. The site is part of the Little Sioux Phase as it is located on a floodplain east of the Little Sioux River about nine miles upstream from Cherokee, Iowa. The Skadeland site was excavated in July 1968 as a salvage project under the direction of Larry Zimmerman. The Northwest Chapter of the Iowa Archeological Society aided with excavations by digging two contiguous five by five feet (1.5x1.5 meters) units, running along a north-south axis (Zimmerman 1971). Later, two more test units were excavated to determine an “ideal” location to place the main excavation units. Upon determining the “ideal” location, a grid was laid out for five feet (1.5 meter) square units, and an arbitrary elevation of five feet (1.5 meters) was assigned. The units were excavated in six-inch levels until sterile soil was reached. Items recovered were recorded with number-letter coordinate of the unit, relative elevation, and the number of six inch levels below the surface. Trowels were used to excavate all units, but only the cache pits were dry screened through quarter inch mesh. A plan map of the excated units can be seen in figure 1.2.

After excavations were completed, materials were inventoried and stored at the Office of the State Archaeologist in Iowa City, IA (Zimmerman 1971). The Skadeland site contains material remains typical of Mill Creek village sites. A list of these artifacts can be found in Table 1.1. Since radiocarbon dates were not acquired, a brief analysis of the ceramics recovered was conducted to determine the temporal relation of Skadeland site to the Mill Creek sequence using Vis and Henning’s (1969) pottery seriation. Zimmerman (1971) calculated percents of the most prevalent ceramic types, Mitchell modified lip, Kimball modified lip and Chamberlain incised, and determined that Skadeland was occupied during the middle of the Mill Creek sequence, placing its occupation at approximately A.D. 1150-1250. Following this analysis, the collection was stored and remained untouched until now. The unanalyzed faunal remains from Skadeland present a valuable opportunity to provide new data that can be used to assess Mill Creek subsistence strategies and determine taphonomic factors influencing the assemblage.

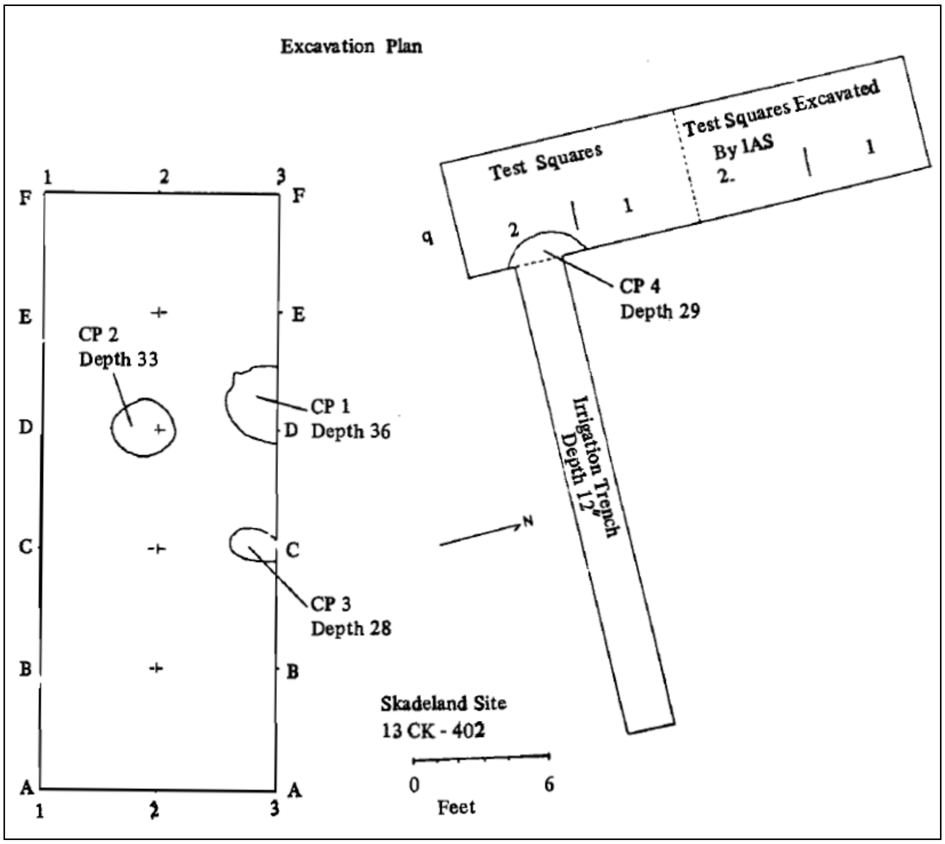

Figure 1.2 Excavation Layout at the Skadeland Site (Zimmerman 1971)

Table 1.1 Inventory of Artifacts from the Skadeland Site

Category	Artifact	n
Stone Tools	side-notched triangular point	9
	plain triangular point	2
	thumbnail scraper	4
	plano-convex scraper	1
	flake scraper	8
	graver	1
	lozenge-shaped knife	1
	triangular knife	1
Worked Bone	awl	6
	bone tube	1
	gaming object	1
	flesher	1
	spatula	1
Worked Shell	marine shell bead	1
	scored mussel shell	18
Ceramics	sanford ware rim sherd	117
	chamberlain ware rim sherd	63
	foreman ware rim sherd	7
	mill creek ware rim sherd	45
	miscellaneous rim sherd	22
	body shertd	3,474

Thesis Organization

Chapter 2 is a summary of the ethnographic and ethno-historic literature on animal procurement and the significance of animals in mythology and ritual activities of tribes on the Northern Plains. The documentation of subsistence and ritual meaning of various taxa is used to establish a culturally defined resource ranking from which inferences can be drawn concerning the diet breath and patterns of faunal exploitation observed at the Skadeland site. In chapter 3, the zooarchaeological methods aimed at extracting the taphonomic history and quantity of the remains are explained along with a description of the terminology used.

Chapter 4 provides detailed results of this research. Specifically, the faunal remains are quantified to present taxonomic abundance in a way that facilitates evaluation of diet breadth through the interpretation of carcass processing and transport decisions. The cultural and non-cultural processes creating the assemblage are incorporated in the taphonomic reconstruction of the remains. Chapter 5 discusses the findings of the research with attention paid to a more comprehensive understanding of Mill Creek faunal exploitation to test the hypotheses derived from mythology and ethnographic records. In addition, the results of quantification and basic documentation of the Skadeland assemblage will be compared with data from other Mill Creek sites, such as the Brewster and Phipps sites, to establish a regional pattern of Mill Creek subsistence. Chapter 6 provides the summary and conclusions of the research, along with a prospectus for future research.

CHAPTER 2
RESEARCH BACKGROUND

"We are the god-making species. Our genius lies in our capacity to make meaning through the creation of narratives (gods) that give point to our labors, exalt our history, elucidate the present and give direction to our future." (Postman 1995:7)

The words of Neil Postman describe the uniqueness of our ability to search for the meaning of life, as we struggle to reason our existence without purpose. In constructing stories or mythologies, we give purpose to our lives, as our belief systems construct ideals, prescribe rules of conduct, provide a source of authority, and a sense of continuity. Therefore, many behaviors are grounded in our beliefs about our role on earth. Like people today, people of the past utilized this unique ability to explain the world around them and provide meaning to their lives. As we try to understand the lives of prehistoric people, we must consider the dynamic belief systems that motivated them and structured their interactions with the world around them.

Interactions with the natural surroundings influenced Native North Americans to create oral histories rich with tales of animal deities, who protected and provided for them. Goodbird, a member of the Hidatsa Indian tribe of the Northern Plains, depicts the belief system of the Plains Indians, stating, "We believed that this world and everything in it was alive and had spirits; and our faith in these spirits and our worship of them made our religion" (Wilson 1985: 21). This belief system obviously stems from a close connection to the natural world, and we would expect such a belief system to have a profound influence on how animals were viewed and which animals would be included into the diet. Unfortunately, previous efforts to understand prehistoric faunal exploitation have been skewed by the western philosophy of utilitarianism that assigns value based on the economic utility of a resource. While utility certainly was considered during prehistoric faunal exploitation, the utility value could be based on prestige in ceremonial activities rather than the subsistence utility normally considered. Therefore, archaeological analyses have focused solely on the utility of various taxa to sustain biological needs and have neglected the cultural framework assigning value to faunal resources.

Given that nothing is done outside the influence of culture, we must examine the cultural significance of faunal resources to understand how various resources were utilized by prehistoric cultures. The belief systems of prehistoric people should be reflected in the archaeological record, since such systems are so engrained into every aspect of life, and archaeological data does often provides us with hints about religious influences on a people's way of life (e.g. bird bone beads, bear claw pendants, marine shell beads, etc.). How then can we interpret archaeological faunal assemblages without considering the belief system motivating the exploitation of the taxa now left for us to find? How did the Mill Creek narrative influence their exploitation of resources? Can mythology be used to explain the presence of non-dietary faunal remains? A review of the Mandan and Hidatsa mythology and ceremonies will help gain insight into this cultural system and its potential influence on faunal exploitation.

Mandan & Hidatsa Origins

The Mandan and Hidatsa Indians provide valuable analogy to the Mill Creek people. The Mandan and Hidatsa are the famous agricultural tribes of the Missouri River in North Dakota. The Mandan were the first to migrate to the area in the fourteenth century, arriving from the southeast along the Missouri River (Wedel 1961; Meyer 1925). Archaeological remains, such as ceramics, iconography, and bone and stone technologies, can be used to track the migration of the Mandan (Tiffany 2007; Scullin 2007; Warren 2007). Using the material record, archaeologists believe that the Mandan are descendants of members of the Mill Creek culture of northwest Iowa.

Mill Creek people and their ancestors the Mandan and Hidatsa are members of the Middle Missouri tradition, which is characterized by a lifestyle of horticulture and big game hunting (Ahler and Kay 2007). The tool assemblage of this tradition consists of side-notched and unnotched arrow points, stone knives, drills and shaft abraders (Lehmer 1971), and bone tools in the form of scapula hoes and knives, bone fleshers and bone awls. The Mill Creek culture is part of the Initial Middle Missouri variant (IMMV) dating from A.D. 969 to 1297 (Eighmy and LaBelle 1996). The IMMV was displaced by populations migrating from the Central Plains forcing IMMV groups to move north, where they were absorbed into the Extended Middle Missouri variant (EMMV) (A.D. 1075 to 1443) (Johnson 2007; Eighmy and LaBelle 1996). The EMMV populations continued to experience conflict with aggressive neighbors, as evident in village fortifications. These pressures required them to conjugate in more heavily populated compact villages that were highly fortified with banks, ditches and palisades (Mitchell 2003), which has been named the Terminal Middle Missouri variant (TMMV) (A.D. 1300-1675) (Lehmer 1971). The historical tribes of the Mandan, Hidatsa and Arikara resided in the area at the contact period and have been termed the Post-Contact Coalescent variant (A.D. 1600 to the historic period) (Johnson 1998). These tribes show some influence from the Central Plains in the form of ceramics with thicker vessel walls and simpler exterior design (Lehmer 1971), but the cultural ties spanning from the Mill Creek to the historic Hidatsa and Mandan are still present.

While there is still doubt about why the Mill Creek people left northwest Iowa, the data connecting the Mandan ancestry to Mill Creek is reliable (Wood 1967). Once settled along the Missouri, the Mandan faced encounters with other tribes, some of which resulted in warfare. However, they maintained a friendly relationship with the Hidatsa tribe. In fact, they became so integrated that early records of these tribes were often combined, and it was not until 1797, in the work of David Thompson, that we see reference to the Hidatsa as a separate tribal group (Bowers 1950). These interactions clearly involved culture sharing and adaption of shared rituals, but the informants from the Hidatsa and Mandan indicate that the two tribes had many shared beliefs and ritual practices even before sharing of some other aspects of their culture began. Given the archaeological data connecting the Mandan and Mill Creek cultures, a review of the ethnographic literature for animal rituals and the general uses of animal products will provide baseline data from which we can approach archaeological assemblages.

Mythology, Bundles & Ceremonies

The Mandan and Hidatsa, like many Native American tribes, viewed themselves as subject to the will of the gods, who were responsible for giving them everything (e.g. food, weather, health, success in battle, etc.) (Beckwith 1937; Will and Spinden 1906). They relied on supernatural beings for their livelihood and aimed to please them through the performance of rituals, dedication of goods and occasional fasting and self-mutilation. If a member of the tribe had bad luck, it was a sign that they had displeased the spirits. Therefore, it was necessary to go through the proper rituals, which would please the gods and provide them successful hunts, rain for the crops and victory in war.

The Mandan and Hidatsa mythology and ceremonies articulate their cultural view of animals, providing a glimpse into the significance of various species to these ancestors of Mill Creek people (Bowers 1950). Ceremonies were created to replicate significant encounters with spiritual beings that were depicted in mythology. After conducting the proper ritual, the gods would be pleased with the people and help them (Wilson 1985). Along with the use of ceremonies to commemorate the mythology and honor the spirits, sacred bundle containing elements representative of the characters and incidents in the myth were constructed so individuals who owned the bundle would always have some of the deity’s power with them (Examples of bundles can be found in Appendix A) (Bowers 1950; Beckwith 1937). Therefore, the myths were the real focus of ceremonies and sacred bundles, as the Plains Indian informants, who shared these myths, always referred back to them when discussing ceremonies and bundles. The importance of their mythology and ceremonies is depicted in the continued performance of these ceremonies even after European contact and the smallpox epidemic. Mandan and Hidatsa mythology did evolve to incorporate other aspects learned from new places and people they encountered, but the message and main characters/deities in the myths remained consistent over a period of at least two hundred years (Wilson 1985; Beckwith 1937).

Mythology, sacred bundles and ceremonies all arose from experiences with supernatural creatures, which came to them embodied in an animal form, such as a bird, bear or buffalo. The deities they worshiped were not the flesh and blood animals they encountered on a daily basis, but the gods were actually anthropomorphic versions of these animals, whose spirit could be incarnate in flesh and blood animals to carry messages to the people (Martin 1978). When spirits visited members of the tribe with a message, the enlightenment would occur though a dream, hallucination or visit by an animal. These occurred fairly often, as all visions and dreams were considered to be from the spirits, especially those that came by fasting or suffering. Anyone in a tribe could have a supernatural encounter, but the medicine or mystery men, who were highly regarded in the society, were thought to have a more powerful connection with the gods and received greater enlightenment. Therefore, the visions of the medicine men were more highly regarded and could transpire into popular myths that would be accompanied by a ceremony and sacred bundle rites (Bowers 1950; Harrod 2000; Beckwith 1937).

The Hidatsa and Mandan had a number of ceremonies, stemming from their mythology that were performed at various times during the year in order to please the gods, so they would provide what the people needed (Harrod 1995). The tribe members who owned the sacred bundles were placed in charge of the ceremony. There were ceremonies to promote needs such as buffalo calling and fertility, trapping of fish and eagles, rain and growth for the crops, success in warfare and medicinal for good health. Some of these ceremonies were seasonal. For example, the Corn Fertility ceremony was usually performed in May, since the purpose of this ceremony was to insure that conditions for growing crops in the gardens would be ample to produce a good crop. A comprehensive list of the major, principal ceremonies and the time and purpose for their performance is given in Table 3. The number of ceremonies dedicated to particular deities begins to give us an idea of the association between the spirits and the practices they were called upon to aid with. We can also begin to identify which deities (and animal incarnations) were most significant to the Hidatsa and Mandan (Beckwith 1937; Bowers 1950).

Table 2.1 Approximate Time and Purpose of Principal Tribal Ceremonies

Approximate Month	Ceremony	Purpose of Ceremony
June to August	Okipa	General tribal welfare, Buffalo fertility rites
May	Corn Fertility	To insure good gardens
March to October	Goose Society	Rain and good growing conditions for crops
August to October	Harvest festival	Thanksgiving rites for crops
March to October	Old Woman Who Never Dies	Rain and good growing conditions to insure good gardens
Year round	Old Woman Who Never Dies	Doctoring and warfare
March to October	Corn Pipe	Fertility
September to November	Eagle-trapping rites	To capture eagles
July to September	Eagle-trapping rites	To trap fish
Year round	Eagle-trapping rites	To corral buffaloes
April	Eagle-trapping rites	Success in hunting or warfare
April to November	Big Bird	Warfare, Rain
Year round	Small Hawk	Warfare
June to August	Small Hawk	To call buffaloes
December to March	Snow Owl	To call winter buffaloes
Year round	Snow Owl	Warfare
March to October	Snow Owl	Rain
Year round	Shell Robe	Warfare, Doctoring
December to March	Red Stick	To call winter buffaloes
December to March	White Buffalo Cow	To call winter buffaloes
Year round	Bear	Doctoring and warfare
March to November	Snake	Rain, Doctoring, Warfare

(Bowers 1950:108)

Eagle-Trapping Ceremony

One of the most significant deities for the Plains Indians was the Thunderbird, who was thought to be closely related to other large birds of prey such as eagles, hawks, ravens and owls and had the power to provide success in a variety of hunting activities and rain for the crops to grow (Bowers 1965). The close relation to large birds of prey meant that these birds were a link to the gods and their feathers were a means of transmitting power to the people. This relationship was established through mythology, enacted through ceremonies and glorified by the exclusion of those who did not own sacred bundle rites. The following account of eagle-trapping is given to illustrate the connection between a myth, ceremony and sacred bundle rites and provide an example of the emphasis placed on prestige foraging.

The supernatural knowledge of eagle trapping was introduced to the secular world through a hero, who had contact with the spirits through a hallucination or vision in which the hero would interact with the supernatural world (Bowers 1950). According to Bowers (1950) recording of the myth, a young man named Black Wolf became lost while on a hunting expedition. Fortunately, he was saved from starvation by black bears, which took the boy to live with them and taught him the art of eagle trapping. Black Wolf went with the little bears and caught eagles from pits, in which they would wait with bait in one hand and when the eagle came down, they would seize the eagle with the other hand. The boy had nearly forgotten how long he had been gone from his village and decided it was time to return. Before leaving, big bear instructed him to take a bag filled with beautiful eagle feathers back to his village, so the tribe would see that Black Wolf was befriended by the gods.

When the boy returned to the village, the tribe’s chief was so impressed by the eagle feathers that Black Wolf was given the chief’s two daughters as his wives. Black Wolf and the older of his two wives went to visit the bears in the spiritual world. The bears instructed them to return home and build a sweat lodge, but before they left, they were to remove little bears skin to be stuffed as an effigy. While big bear was asleep, they carefully removed his skin as not to cut any of the bones which would allow him to continue to live. Once they returned to the village, the snakes, eagles, coyotes and Old Black Bear from the supernatural world came to visit Black Wolf and his wives in the village. The party presented Black Wolf with a buffalo skull, and his oldest wife was made the daughter-in-law of the buffaloes by walking toward the lodge with the skull, while the others walked behind her. She also had the stuffed animal that represented little boy bear. Then, Old Bear gave them two green poles representing the Snakes, which always went with the birds, and they went into the sweat lodge and sang of Black Medicine and prayed to the animals. The animals came out of the sweat lodge and instructed Black Wolf in catching eagles, using snares and using fish traps.

This myth structured the way in which relatives of Thunderbird were captured to obtain their power. Over time, some additions made to the myth because of new visions and interaction with other tribes. For example, a supplement to the eagle trapping myth tells of a bird taking a man's son: as punishment for taking his son, the father goes to capture the birds. The father captured eagles by spitting on his hand or using his holy snare, and the locations where he captured these birds became good places to catch eagles. One day, the leader of the birds was captured by the father, and the bird leaders promised to help the people and provide them with more eagles in the future if they prayed to him. The bird leader and tribe's people made a deal that if the birds agreed not to scratch them, the tribes men would not kill the birds but let them go. Such additions to the myth did not change the key characters in the myth but simply added an element to the ceremony and rules surrounding the capture of eagles.

Once a myth was established, a ceremony and sacred bundle were constructed to complement and act out the myth. The sacred bundle contained the power of the deities mentioned in the myth, while the ceremony outlined the tasks necessary to please the gods, who would then grant the trappers a successful hunt (Hanson 1980; Wood and Irwin 2001). Therefore, the mythology, sacred bundle rites and ceremonies had a direct influence on the actions of the Mandan and Hidatsa. Their belief in the power of the Thunderbird deity motivated them to capture eagles in the same manner that the bears had taught Black Wolf. They used pits dug near the top of hills to capture the large birds of prey, sometimes killing the birds in the same fashion that Black Wolf had captured the eagles, but in other instances, the birds were just plucked of their tail feathers and released, following the contract laid out with the bird leader in the second myth. Obtaining these feathers carried significant religious and economic value; this was further heightened by the restriction on who could capture the birds and the religious taboos associated with unauthorized hunting of them (Beckwith 1937).

If a member of the tribe wanted to become an eagle trapper, they would have to purchase an eagle-trapping sacred bundle that came with the trapping rites. The purchase of a sacred bundle was very expensive and would have taken years to build up enough wealth to purchase such a bundle. Additionally, the number of eagle trappers was limited by the number of bundles in a community, as the owner of the original bundle could only duplicate the bundle three times before he was required to pass along the original bundle. Once bundle rites had been acquired, the trapper’s participation in the experience would be limited depending on their knowledge of the eagle ceremony. Only trappers with the greatest knowledge were allowed to dig new pits, make offerings to the holy women and perform other simple rites associate with eagle-trapping expeditions (Meyers 1925; Bowers 1950).

Ranking Animal Significance Using Mythology

The eagle-trapping mythology, ceremony and sacred bundle organization is representative of how the Plains Indians religious system functioned and influenced their lives (Meyers 1925; Martin 1978; Harrod 1995). The myth was created through a heroic experience with the spiritual world. Then, a ceremony to honor the gods and a sacred bundle containing elements of the myth were established. Finally, the people followed the code of conduct associated with the myth in order to please the animal gods of the supernatural world. The mythology provided a way for the Plains Indians to channel power from the supernatural world, and they provide us an indication of the importance placed of various creatures. In order to evaluate the focus placed on specific animal resources and deities, I have quantified animal occurrences within the mythology of the Mandan and Hidatsa tribes. Table 2.2 summarizes ritual significance of various animals to the plains tribes. This has been done by reviewing the key Mandan and Hidatsa mythologies and recording all animals mentioned in the myths, then assigning each animal a rank depending on the extent of their role in the myth. These were assigned on a scale of 1 (only mentioned once) to 3 (mentioned consistently throughout the myth). For example, in the Okipa myth, the bison is referenced throughout the myth (3), the deer was mentioned several times in one section of the myth (2) and an elk was mentioned once in the myth (1). This was done for all the major myths to produce a general ranking of importance, as indicated by involvement in ritual practices.

Based on this rank, the bison is by far the most represented animal in Mandan and Hidatsa traditions receiving more than twice the recognition of any other animal. The bison (n=32) is mentioned in twelve of the thirteen mythologies examined taking a lead role in almost all of them. Following the bison, the elk (n=18), birds (n=13) and eagles (n=13) are all recognized in eight myths. The snake (n=10) is in five myths, the deer (n=9) is in six myths and the bear (n=8) is in three myths. These appear to be the main animals represented in principal ceremonies, as the remaining animals are all only referenced a couple of times in the myths.

To further delineate the context in which each animal is discussed in the mythology, the role of the animal in each myth was categorized within four general classes including character, subsistence, animal product or sighting/description. Animals were assigned to the character class when the animal took on an anthropomorphic role. For example, in the eagle-trapping myth (described previously), the bear is considered a character, because they talk and interact with the young man who has transported into the spirit world, teaching him how to hunt eagles. Animals were defined as subsistence accounts if they were referred to as being eaten or hunted for food. The animals that were mentioned during a description of animal by-products such as clothing (e.g. deer skin shirt, bison robe, fox skin cap) or household utensils (e.g. bison horn spoon, bison scapula hoe) were assigned to the animal product class. Finally, animal accounts were allocated to the sighting/description class if they were depicted as being seen and/ or a description of their appearance given. In one such account, waterbirds were described noting, when the waterbirds fly north there will be plenty of rain and crops (Bowers 1950).

The aforementioned classes are intended to further identify the ritual or subsistence role of animals. For example, the bison is the most frequently mentioned animal in mythology, but is the bison represented as a character or deity figure in the mythology or more frequently mentioned as a subsistence resource? According to my classification, the bison is only depicted as a mythological character in the Big Bird myth: thus the remaining accounts describe bison products (n=14) and their subsistence value (n=8). One may conclude that the bison, while highly important to the Mandan and Hidatsa, is significant for its dietary contribution rather than ritual power and can therefore be considered the focus of subsistence foraging. The depiction of the bison is very different from other animals such as the bear, snake, mouse, pocket gopher, toad, turtle, badger, blackbird, coyote, fox, prairie dog and mole, which are only represented as a character in mythology, highlighting them as ritually significant.

The majority of the animals are characters in the mythology with the exception of six animals, including the otter, mussels, skunk, goose, waterbirds and antelope. Products procured from the otter, skunk, goose, antelope and mussels are referenced, while waterbirds are described, and the antelope is also recognized as a subsistence resource. The remaining animals, while all characters in the mythology, are also mentioned in other contexts. Birds, bison, deer, eagle, elk, magpie, meadowlark, owl, porcupine, and rabbit are referred to for their products. A sighting or description of beaver, birds, bison, crow, deer, dog, eagle, elk, fish, hawk, raven and wolf is given in mythology. The antelope, bison, deer, elk, fish and rabbit are all mentioned in the context of subsistence. By reading the mythology, we get a glimpse into how these animals were viewed and their role in Mandan and Hidatsa society. The animals occur in varying contexts, which aid in the formation of hypotheses about why these animals may have been exploited by prehistoric cultures.

Table 2.2 Representation of Animals in Principle Tribal Ceremonies (Bowers 1950)

Animals	Ceremony													Total
	Okipa	Corn Ceremony	Skull Bundle	Old Woman	Eagle-trapping	Catfish-trapping	Big Bird	Small Hawk	Snow Owl	People Above	Shell Robe	Red Stick	White Buffalo	
Bison	3	1	3	3	3		2	3	2	3	3	3	3	32
Elk	1	1	2	2			2		3		3	1		15
Birds	1	2		1	1		3	3	2	1		1		15
Eagle	1			1	3		3	2	1		1		1	13
Snake	1			3	1		3		2					10
Deer	2		1	2			2		1		1			9
Bear				2	3							3		8
Beaver	2						2	2						6
Owl									2			3	1	6
Rabbit	2						2	2						6
Fish				1		3		1						5
Magpie	1									1	2		1	5
Dog			1	2									1	4
Mouse				1				1		2				4
Pocket Gopher							2			2				4
Porcupine				2	1		1							4
Crow				2			1							3
Goose	1	2												3
Meadowlark	2										1			3
Raven							1	2						3
Toad				2				1						3
Turtle	3													3
Wolf				1				2						3
Antelope			1				1							2
Badger	2													2
Blackbird				2										2
Coyote					1			1						2
Fox		1						1						2
Hawk							1	1						2
Prairie Dog	2													2
Skunk				1									1	2
Mussels											1			1
Otter												1		1

Personal Bundles

In addition to the mythology shared by the entire Mandan/Hidatsa tribe, personal experiences with the spirit world also resulted in one's own personal medicine (Hanson 1980). The experience of spiritual enlightenment was not limited to heroes and medicine men, so anyone in a tribe could have a hallucination or vision. In such cases, these spiritual enlightenments were commemorated by the construction of a personal bundle. After having a vision, one would proceed by setting out to kill an animal like the one they had seen in their vision. For example, if an otter came to someone in a vision, the individual would go out and kill an otter. Then, a portion of the animal would be kept such as the skin, and that item would become the sacred object that the god dwelt in. Using the example of the otter, the otter skin would become that person's medicine bundle, and they would pray to it and take it into war for protection (Wilson 1985:23-24).

The combination of mythology and personal bundles reported in Hidatsa and Mandan religious system illuminates the cultural relevance placed on animals and the deities who provided for the people. The ritual significance is only one part of the picture, as they also relied on these animals for subsistence. This intersection between ritual and dietary significance is where archaeologists attempt to reconstruct prehistoric lifeways. Therefore, a more complete understanding of the Mandan and Hidatsa subsistence strategies is needed to begin teasing apart foraging for subsistence and foraging for prestige.

Ethnographic Animal Exploitation

The Mandan and Hidatsa religious systems provide much insight into their cultural views of animals, but to further appreciate the role of animals in the Mandan and Hidatsa cultures, an understanding of the dietary, decorative and functional uses of animals is needed.

Combining the religious system with ethnographic accounts of daily life, we can obtain a more comprehensive understanding of the inclusion of animals into the cultural system. Already in the ceremonies and mythology, we gather that hunting bison, trapping fish and growing corn in the gardens are three major subsistence activities. However, the plains environment would have provided numerous other resources that could serve as potential subsistence resources. The environment would have provided access to deer (*Odocoileus sp*.), elk (*Cervus Canadensis*), wolves (*Canis lupus*), fox (*Vulpus sp*.), beaver (*Castor canadensis*), rabbits (*Lepus sp*.), pocket gophers (*Geomys bursarius*) and others, which could be added to the diet. However, given the strong preference for bison, is it possible that these less frequently mentioned resources played a role in the Mandan and Hidatsa diets?

European Trade Records

European trade logs provide the first written records of contacts with the Plains Indians and the types of animals that were pursued for subsistence and other byproducts. As Europeans made contact with the Indians, they began to trade with the natives to acquire furs of which they were particularly interested in beaver pelts. The journals written by the Europeans to record trade encounters and exchange rates were not always consistent, as varying amounts of materials were traded at any given occasion. However, these accounts do provides some interesting observations about the quantity and types of furs that were traded that may have implications for the value placed on these resources by the Hidatsa and Mandan. According to the 1738-1818 journals of European traders Thompson, Larocque, McKenzie and Henry, the primary trade items were buffalo robes, wolf (coyote and wolf) pelts, beaver pelts, otter pelts (rare), fox pelts, bear skins, horses, dogs, corn, bladders of fat and slave women. The beaver, buffalo, bear and otter furs were received in lesser quantity.

Skunk and rabbit were mentioned by Pierre-Antonie Tabeau, but no records confirm the trade of these furs (Wood and Thiessen 1985).

The pelt that Europeans were most interested in was that of the beaver. However, the journals of Lewis and Clark mention the scarcity of beaver pelts from the Mandan and Hidatsa. They wrote, “They have as yet furnished scarcely any beaver, although the country they hunt abounds with them; the lodges of these animals are to be seen within a mile of their village (Wood and Thiessen 1985:56).” Pierre-Antonie Tabeau also noted the lack of beaver and otter pelts, stating “I believe that it is necessary to add that the beaver and the otter cannot become objects of trade with the hunters.” In an 1806 account, McKenzie notes the words of Hidatsa chief Le Borgne who said, “We have many good things but we have no beaver” and asked why white men valued the beaver skins. These comments from traders are insightful about the types of animals the Mandan and Hidatsa must have procured. Although it does not resolve any questions regarding the procurement of these animals for subsistence or solely for their furs, the scarcity of beaver and otter which should have been readily accessible for the Mandan and Hidatsa is notable.

The trade expeditions of the Europeans along the Missouri provide the earliest records of Hidatsa and Mandan village life and trade organization (Harrod 1995; Meyers 1925). Unfortunately, many of these accounts fail to describe details about hunting and the subsistence strategies of these tribes. Regardless, the journals and ethnographies of the early explorers provide a valuable resource for archaeologists and historians who wish to study the livelihood of the Plains Indians culture. As we examine the ethnographic record in an attempt to make analogies with prehistoric diet, the new technology of guns and horses must be acknowledged. These technologies have potential to cause a shift in diet to rely more heavily on bison, since they would make it easier to hunt these large animals (Flores1991, Cooper 2009). However, the retention of the use of corrals and accounts of hunting without horses and/or guns, provide more appropriate analogies to prehistoric people.

In this research, ethnographer's documentation of Native American animal procurement and use will be reviewed to gain a tangible measure of the ritual and subsistence foraging done by prehistoric people on the Plains. To gain an accurate picture of animal procurement, I reviewed only ethnographies that provided detailed accounts of animal utilization and included information such as geographic area, year, seasonality, month, tribe name and description of the event. Many of the journals kept by the early explorers focus on the activities of their daily lives and survival on the Plains with only occasional reference to the livelihood of the Indians, so it was a challenge to find documentation at such high resolution.

After reviewing a number of such journals, four explorers were found to provide the detailed accounts I was searching for, including the journals of Boller (1886), Bradley (1986) and Lewis and Clark (1959). Henry A. Boller traveled to the upper Missouri in 1858 with the fur trade. He was only 22 years old at the time, but he remained in the area for eight years, keeping a detailed record of his time among the Indians. John Bradley produced a detailed account of his summer living along the Missouri in 1810, and the journals of Lewis and Clark from their winters (1804 and 1805) at Fort Mandan were also reviewed. All these explorers kept documentation that was extremely detailed and yielded a total of 152 accounts of animal uses (Table 2.3).

Table 2.3 Animals Procured According to Ethnographic Records (From Boller 1886; Bradley 1986; Lewis & Clark, 1959)

Animal	n	% of animal accounts
Bison	77	50.7
Deer	15	9.9
Eagle	11	7.2
Antelope	6	3.9
Dog	6	3.9
Elk	6	3.9
Wolf	4	2.6
Fox	3	2.0
Porcupine	3	2.0
Bear	2	1.3
Bird	2	1.3
Prairie Chicken	2	1.3
Water Fowl	2	1.3
Bighorn Sheep	1	0.7
Fetal Bison	1	0.7
Frog	1	0.7
Geese	1	0.7
Hawk	1	0.7
Mountain Goat	1	0.7
River Otter	1	0.7
Rabbit	1	0.7
Rattle Snake	1	0.7
Raven	1	0.7
Mussels	1	0.7
Turtle	1	0.7
White Weasel	1	0.7
Total	152	

Animal procurement accounts were categorized into class (entertainment, functional, functional/ritual, ritual, subsistence) and context (personal adornment, hunting, bulk hunting, encounter hunting, household, weaponry, medicinal, burial, mythological), animal, element, and use. The number of times each species is mentioned in ethnographic accounts is summarized in Table 2.4.

Table 2.4 Summary of Class and Context of Ethnographic Animal Uses

Class	Context	Animal	n
Entertainment	Hunting	White Weasel	1
n=2, 1.3%		Wolf	1
Subsistence	Bulk Hunting	Bison	11
n=63, 41.4%	Consumption	Bison	3
	Encounter Hunting	Antelope	1
		Bison	7
		Deer	5
		Dog	1
		Elk	2
		Porcupine	1
		Wolf	1
	Feast	Bison	1
		Prairie Chicken	1
		Rabbit	1
	Hunting	Antelope	2
		Bison	15
		Fetal Bison	1
		Deer	4
		Elk	1
		Prairie Chicken	1
		Water Fowl	2
	Scavenging	Bison	2
Functional/Ritual	Household	Bear	1
n=7, 4.6%		Bighorn Sheep	1
	Personal Adornment	Bison	3
		Deer	1
		Wolf	1
	Total Accounts		152

Table 2.4 Summary of Class and Context of Ethnographic Animal Uses

Class	Context	Animal	n
Functional	Household	Bird	1
n=32, 21.1%		Bison	14
		Deer	1
		Dog	5
		Elk	2
	Personal Adornment	Antelope	1
		Bison	5
		Fox	1
		Mountain Goat	1
	Weaponry	Bison	1
Ritual		Raven	1
n=48, 31.6%	Burial	Bison	1
	Hunting	Eagle	1
	Medicinal	Deer	1
		Rattle Snake	1
	Mythology	Antelope	1
		Bison	10
		Eagle	4
		Frog	1
		Geese	1
		Hawk	1
		Turtle	1
	Personal Adornment	Antelope	1
		Bear	1
		Bird	1
		Bison	3
		Deer	3
		Elk	1
		Eagle	6
		Fox	2
		Otter	1
		Porcupine	2
		Mussels	1
		White Bison	1
		Wolf	1
	Total Accounts		152

The ethnographic accounts of animals were recorded systematically using class and context categories for easy comparison between resources used. Each animal mentioned was first categorized into one of five classes including entertainment, functional, functional/ritual, ritual, and subsistence. The entertainment category was created to encompass accounts of animal hunting for enjoyment. The subsistence class includes all accounts in which animals were included in the diet. The functional class describes animal products with a functional purpose, the ritual class describes animal products that were used in ritual, and the functional/ritual class designation was given to animal products with both functional and ritual uses. In addition to class descriptions, each account's context was recorded for further description. The majority of these contexts are fairly straight forward, as animals were described for their use as personal adornment, household items, weaponry, medicine, burial goods or included in mythology. The most common occurrence of animal accounts was that of hunting, so these occurrences were divided into more descriptive classes including: bulk hunting (a group of hunters searching to pursue multiple animals), encounter hunting (an animal is seen, so it is procured) and general descriptions of hunting.

Foraging Behavior

The ethnographic and mythological accounts of subsistence indicate bison to be the most important faunal resource on the plains, as over 50% of the ethnographic animal encounters were bison. Included in these observations are a number of accounts citing the Plains tribes hunting strategies, including the use of corrals, pursuit of selected animals on foot or horseback and even scavenging dead bison floating down the river (Boller 1868; Bradley 1986; Lewis and Clark 1959), making bison the focus of 62% of subsistence accounts. Unfortunately, the butchery and transport techniques used to procure these large animals are not thoroughly recorded within these accounts. However, one detailed description of bison hunting, processing and butchery was provided to ethnographers by Buffalo Bird Woman of the Hidatsa tribe (Brink 2004). The record of this hunt, said to have taken place around 1870, is one of the most comprehensive stories of bison hunting on the Plains done without the aid of horses. These hunters did have guns, but the lack of horse and subsequent use of dogs for transporting meat back to the village provides an opportunity for closer analogy of transport costs faced by prehistoric hunters.

Buffalo Bird Woman reports that the party left the village to camp and hunt some distance from the village, where they could locate large herds of bison. On the first night of the hunt, they had not yet found the herd, so the men killed an elk and removed the ribs and the two hams, which were roasted over the fire at camp. After the first night, they located the bison herds and were able to feast on bison the remainder of the trip. The group was very successful in their hunt allowing them to be highly selective, taking only choice parts of the bison and packaging the rest into a meat cache that could be returned to when the meat was needed and ready to be dried. After killing a bison, only select parts could be immediately transported from the kill to the camp. Buffalo Bird Woman reported that the tongue, kidneys, the ham bones for the marrow and sometimes the ribs were taken; the rest of the meat was left behind in the meat pile. The bison was butchered in the field to create a meat pile that could be covered for protection by the bison's hide and transported later. To create the meat pile, "the head was skinned, the tongue taken, and the rest of the head discarded; the flesh on the neck was also rejected because of its toughness. If fat, the entrails were saved; otherwise, they were thrown away" (Wilson 1924:251). The legs were skinned to the hoof, and the four legs up to the joints were cut off and thrown away. An illustration of the meat pile and discarded elements was constructed by Goodbird, as described in Table 2.5 (Wilson 1924).

Table 2.5 Bison Carcass Portions Selected and Rejected by Hidatsa Hunting Party According to Contents of Meat and Discard Pile (Wilson 1924)

Carcass Portion Selected	Skeletal Element Association
Ribs	Ribs
Leg Bones	Femur, Tibia, Humerus, Radius
Sinew	Thoracic, Lumbar
Carcass Portions Rejected	
Head	Skull
Neck	Cervical
Backbone	Lumbar & Sacrum
Pelvis	Pelvis
Lower legs	Carpals, tarsals, metapodials, phlanges, sesamoids
Lungs, Windpipe, Stomach, Liver	none
Heart (sometimes)	none
Guts (sometimes)	none

Once the meat was transported back to camp, they immediately began preparing the meat for the drying process, so the meat would be preserved for later consumption. The greater number of bison that were killed decreased the number of hunts necessary for subsistence, and if enough was stored, they would not have to rely on opportunistic hunting of elk and deer for additional meat. The ethnographic literature mentions the occasional exploitation of antelope, deer and elk, as described in 23% of subsistence accounts. Wilson (1985) reports that the Indians prefer bison, but since winter was a difficult time for subsistence, villagers were forced to pursue elk and deer in addition bison. However, Wilson's generalization does not appear to be correct, as in my review of ethnographer's journals, I found an equal number of accounts describing summer and winter hunts of antelope, elk and deer. The winter months did provide access to another resource in the form of decaying bison found floating down the river after breaking through the ice on the river and falling in to meet their fate. These bison would float for miles with their skin raising and becoming a greenish hue. Nevertheless, the Mandan enjoyed the scavenged decaying flesh, and they would make a stew using the putrid meat of bison. One ethnographer reported, the meat "is so ripe, so tender, that very little boiling is required – the stench is absolutely intolerable – yet the soup made from it which is bottle green is reckoned delicious" (Wood and Thiessen 1985:239).

Beyond the use of bison, elk and deer, the ethnographic record does not contain a thorough record mentioning the use of smaller game, birds or fish as part of the diet (Table 2.4). There are a number of ethnologists who report that the hunting of nearly all other animals, fish and birds occurred (Wilson 1985; Dodge 1959), but there are only a few accounts of eating these resources in the literature I reviewed. The porcupine, wolf, dog and rabbit are the only small mammals eaten in the accounts I observed, representing a slim 6% of subsistence accounts. Further noting the context in which these animals were procured, each was consumed during food shortage with the exception of rabbit, which was served at a feast alongside prairie chicken and bison meat (Boller 1868). Besides the serving of prairie chicken at a tribal feast, the subsistence related use of birds is minimal with only four accounts, representing 6% of subsistence descriptions, indicated the hunting of waterfowl and prairie chicken for food.

Goodbird, a member of the Hidatsa tribe, said they did not eat prairie dogs often, but he remembers a hunting trip when they saw a large prairie dog village and decided to have a dinner roasting prairie dogs on skewers over a fire (Wilson 1985). This example is rare, as the recorded exploitation of smaller mammals seems to revolve around the use of their furs. In fact, it is described that some of animals were killed only for their hide, including wolves, foxes, ermine, bobcats, raccoons, coyotes and mountain lions (Davidson and Gregg 1986). If these animals are hunted only for their hides, the exploitation of these species would be characteristic of prestige foraging and should not be included in discussions of subsistence activity.

Animal Use Beyond Subsistence

The use of some species as subsistence resources has already been questioned, but what other uses are there if not for subsistence? The major use of non-dietary animal resources appears to be for clothing and ritual paraphernalia. The dress of the Hidatsa and Mandan is described as clothes made of leather and furs from various animals. The majority of their clothes were made from buffalo skins and furs, but children's, women's and ritual clothing was often made from wolf, deer and other skins of a finer quality, which they dress as white and pliable as chamois. The men also wore caps made of fox skins (Boller 1868). Furthermore, the use of porcupine quills as decoration on robes and bedding is also recorded. The use of animals for clothing was extremely important, as one would not make it through the winter without a good bison robe.

The ritual dress was more extravagant than the everyday apparel typically made of bison, elk and deer hides. Ceremonial clothes were further decorated with porcupine quills, slips of wolf or skunk skin and fox tails around the ankle (Boller 1868; Bradley 1986), and elk teeth ornaments with bear claws threaded and tied around the neck. Feathers of the eagle, hawk and goose were worn around in the hair or around the head, often supplemented by pieces of otter skin and shells woven into the hair (Boller 1868). In their ears, they wore shells and beads (Wilson 1985:216).

In addition to clothing, animal parts were employed for household uses. Farming required the use of scapula hoes and antler rakes. The men sometimes made their bows and projectile points or spears out of antler stuck in arrows fletched with bird feathers. Mussel shells were used to scrap hides (Will and Hyde 1917:123), and could also serve as paint dishes, scoops, pendants and beads (Davidson and Gregg 1986:39). Now, these are just a few examples of the non-dietary uses of resources that have become associated with the diet. A more extensive list of non-dietary animal uses is given in Table 2.6. Given the variety of uses, a reanalysis of prehistoric diets on the northern plains is needed, one in which consideration is given to the religious significance of animals and the domestic function of products they provide.

Table 2.6 Non-dietary Animal Uses on the Northern Plains

Animal	**Part**	**Use**	**Citation**
Bear	claw	bead	(Albers & Medicine 1983)
	hide	blanket/clothes	(Bowers 1950)
Bison	horn	spoon	(Albers & Medicine 1983)
	hide	robe, rope, drum, shield	(Albers & Medicine 1983)
	skull	bundle	(Bowers 1950)
Bird	feathers	head dress	(Bowers 1950)
	feathers	arrow quiver	(Wilson 1924)
	bone	beads	(Davidson & Gregg 1986)
Deer	hide	robe, rope, drum, shield	(Albers & Medicine 1983)
	antler	spear, bow	(Wilson 1924)
	antler	rake	(Meyer 1925)
	antler	wristlets	(Albers & Medicine 1983)
Elk	hide	robe, rope, drum, shield	(Albers & Medicine 1983)
	antler	spear	(Wilson 1924)
	antler	scraper	(Albers & Medicine 1983)
	teeth	charms	(Albers & Medicine 1983)
Fox	fur	clothing	(Davidson & Gregg 1986)
Beaver	fur	clothing	(Davidson & Gregg 1986)
Coyote	fur	clothing	(Davidson & Gregg 1986)
Raccoon	fur	clothing	(Davidson & Gregg 1986)
Wolf	fur	clothing	(Davidson & Gregg 1986)
Porcupine	Quills	robe decoration and bedding	(Bowers 1950)
Freshwater Mussel	shell	scraper, container, beads, gaming pieces	(Davidson & Gregg 1986)

Through archaeological exploration, prehistoric exploitation of animals on the plains appears to be similar to that of the Mandan and Hidatsa tribes. Is it possible that prehistoric plains Indians shared the same cultural view and respect for the animal deities of the supernatural world? We cannot be certain of how prehistoric populations viewed the natural world, but the archaeological remains left behind provide the opportunity to investigate culture continuity and change on the northern plains. By creating testable hypotheses from the mythological and ethnographic data and properly documenting archaeological remains, we can begin hone in on the truth about past cultural systems.

Hypothesis 1: Bison are mentioned most frequently in both myths and ethnographic records as being primarily used for subsistence. In the archaeological record, bison remains should therefore reflect their utility as a food resource. I predict that the bison elements that are preserved at Skadeland will be those that have the highest meat value (e.g. ribs, femora etc.), marrow, and grease values. Transported elements should exhibit a positive correlation with bison utility indices (Emerson 1990) that have calculated the nutritional utility of each skeletal element.

Hypothesis 2: Small mammals are suggested to primarily be non-food resources (e.g. personal adornment, trade goods, etc.), exploited for their furs. If hunted for their furs, the cranial, metapodial and caudal bones may be left attached to the end pelt, especially if a 'trophy' skin is desired and butchery marks would be expected at the foot-limb articulations and around the cranium, maxilla and mandible (Charles 1997; Strid 2000). The presence of other cutmarks is more likely to be the cause of dismemberment for filleting, such as marks around the acetabulum or proximal limb bones (Strid 2000).

Hypothesis 3: Rodent remains have high potential to be intrusive, but ethnographic and mythological inference suggests that rodents may be used as food, fur or bait for capturing raptors. If used for food, the whole carcass would be present displaying burning from cooking over a fire and cutmarks around the acetabulum and proximal limb bones from filleting. Similar to the small mammal remains, rodent remains from fur removal and decoy construction should be dominated by cranial, foot and caudal elements, which may exhibit cutmarks from disarticulation.

Hypothesis 4: According to ethnographic accounts, raptors were being captured for feathers and bone beads used for personal adornment indicating status. If feathers, rather than subsistence, are the basis for avian exploitation, there will be more wings, leg and talon bones than high utility axial elements preserved at Skadeland.

CHAPTER 3
METHODS OF FAUNAL ANALYSIS

"The results of history lie strewn around us, but we cannot, in principle, directly observe the processes that produce them. How then can we be scientific about the past? As a general answer, we must develop criteria for inferring the processes we cannot see from the results that have been preserved." Stephen Jay Gould (1982:16)

Our current knowledge of Mill Creek subsistence is based on the use of a normative approach to interpreting faunal remains, which identifies the species found within the archaeological context but does not account for the non-cultural processes that may be responsible for their presence. By neglecting to record descriptive attributes, researchers have continued to assume that the remains are the result of human behavior and ignore non-cultural processes that may account for the presence of a diverse faunal assemblage. We now know that an essential part of examining faunal remains is a comprehensive taphonomic approach, which is an analysis of everything a bone goes through from the time the animal dies to the time of excavation and post recovery handling. In other words, "taphonomy is the study of those factors that cause a fossil assemblage to differ from the deposited, death, and life assemblages that underlie it" (Klein and Cruz-Uribe 1984:8). This approach incorporates a review of both cultural and non-cultural agents, which alter the appearance of the bone, therefore achieving a comprehensive interpretation of the faunal remains.

Late prehistoric cultures have been recognized as having an expanding diet breadth, indicated by the presence of various small mammals, birds and aquatic resources, but we must look further than simply recognizing the presence of these species. The archaeologists' methods for collection and documentation can greatly influence the subsequent knowledge that is gained from the assemblage. As we acknowledge the variety of factors effecting assemblages, we can determine the life history of the remains, which will allow for an understanding of cultural behavior. This chapter will describe the methodology used to extract essential zooarchaeological data to determine the cultural and non-cultural variables influencing the Skadeland assemblage. The goal in such a detailed documentation is ultimately to eliminate any doubt about the cultural affiliation of a number of potentially intrusive species, validating their cultural significance. In addition to establishing cultural association, the methods described below were used to quantify the number and type of species to gain an understanding of their relative significance to the diet or other cultural activities.

Documentation

The faunal remains from the Skadeland site have not yet been documented with the exception of the worked remains, which were described by Zimmerman (1971). The remains were excavated during the summer of 1968 by the Northwest Chapter of the Iowa Archaeological Society under the direction of Larry Zimmerman. These artifacts are curated in the Office of the State Archaeologists; I borrowed the collection (Loan #385) and analyzed it at Iowa State University.

The skeletal remains were documented using a tripartite hierarchy of codes, which was derived from codes presented by the Society of Vertebrate Paleontology (1973) and revised for analysis at the Horner site, bison kill-butchery bone bed by Todd (1983). The technique has since been further modified and revised to perfect its use for documentation and analysis (Hill 2008; Rapson 1990). Through modifications, descriptive codes have been added to the tripartite codes in an effort to account for extensively fragmented assemblages. Consequently, there are six levels of description included in the coding system. The first level is a general class (CL) of specimen, which classifies the faunal remains into their appropriate animal class such as bison (BI), elk (ELK) or deer (OV). The second level is coding the bone to skeletal element. For example, a femur would be coded as FM; similar abbreviated codes exist for every skeletal element (Appendix B). The third level of description refers to the portion of the element that is present, since specimens can range in completeness. The fourth level describes the segment present for each specific portion. For example, a fragmented proximal (portion) metacarpal (element) may only be represented by the medial segment of the proximal metacarpal; therefore this segment must be specified. Furthermore, the elements side of the body is recorded. These codes include right, left, axial, or not sided. Finally, the degree of epiphyseal union, for both proximal (cranial) and distal (caudal) ends is recorded. A numbering system is used to describe the degree of fusion, and it ranges from zero (unfused) to three (completely fused). For those elements that are broken, the number four is assigned, and those elements that do not fuse or fuse in-vitro are assigned the number code of five. This code aids in determining the age frequencies of the animals represented. The coding system is quite extensive but is ideal for intersite comparisons that require detailed information about the analysis.

Bone Modification

A number of cultural and non-cultural bone modifications were recorded systematically on each specimen to reconstruct the depositional history of the bones. Cultural modifications recorded include the frequency of cut marks that resulted from stone tools, impact fractures from hammerstone breakage, burning and working of bone into tools or ornaments. Non-cultural modifications recorded included rodent gnawing and carnivore modification. Additionally, breakage was recorded on the bones and required analysis on a case by case basis to determine if this attribute was the result of human behavior or non-cultural processes. Weathering and root etching are also important modifications to record when reconstructing the taphonomic history of an assemblage (Lyman and Fox 1989), however the exquisite preservation of Skadeland fauna eliminated the need to record these attributes.

Cutmark Frequency

The identification of cutmarks provides us with direct evidence for cultural modification and can be used to identify butchery and disarticulation patterns. Cutmarks were recorded systematically, first by identifying the presence or absence of such modification, then if cutmarks were located on a specimen, the number of persisting cutmarks were recorded. As such, for each specimen, the number of individual striae (not clusters like Lyman (1994) advocates) assumed to represent a single arm stroke was tallied using the NISP fragment count method employed by Abe et al. (2002) and Bunn and Kroll (1986). Recording cutmarks in this fashion allows for further interpretation of processing intensity (Egeland 2003).

Burning

A common cultural modification is burning, which results from the exposure of bone to varying degrees of heat and time. This modification was recorded following the protocols outlined by Stiner et al. (1995) to record the color change that stem from duration and intensity of exposure to heat. An unburned specimen appears cream or tan colored, but as an element is exposed to heat the oxidation process begins, which can be observed in a color change. Therefore, this method of classification tracks the intensity of burning from lowest expose, carbonized (blackening) to an extended exposure, calcined (complete oxidation, white or blue-gray). An additional code was added to account for the initial browning stage that often occurs from light heating. Recording the various stages of burning can provide evidence for various burning episodes associated with cooking or cleanup within residential areas and can distinguish cultural fauna from the intrusive.

Breakage

Breakage is a complex attribute, as there are a number of processes that can account for bone breakage. Breakage was documented by acknowledging presence or absence and recording the type of breakage, which could fall into categories that included green breakage or dry/recent breakage. The distinction between green and dry/recent breakage can be difficult to document, as multiple fracture morphologies can occur on a single specimen (Pickering and Egeland 2006) and the transformation from fully nutritive to fully nonnutritive is problematic. Generally, green (nutritive) breakage is identified by the presence of spiral fracture outlines and oblique angles to the long axis of the element (Shipman 1981). This breakage pattern is often seen in combination with percussion-generated impact fractures that form when bone is struck by a hammerstone or anvil. This modification can be identified by the damage created on the cortical surface appearing in the form of microcracking, crushing, inner-conchoidal (negative) scars, percussion pits (Hill 2008, White 1992) and in some cases discoloration to the impact area. The presence of impact fractures was recorded on specimens, as it is often associated with the extraction of marrow, and therefore has implications for processing and resource intensification. Recording impact fractures can also help distinguish between green breakage caused by human and those caused by carnivore, as carnivores are known to create breakage patterns that mimic human butchery patterns. The breakage/spiral fracturing of long bones has been ethnographically (Ingstad 1954; Lee 1979; Yellen 1977) and historically (Branch 1962) documented as behavior done to facilitate marrow removal. Beyond marrow extraction, bones may also be broken to segment an animal carcass into portions, break bones into fragments for boiling to extract bone grease or to obtain bone for manufacturing tools.

The dry/recent (non-nutritive) bone breakage usually displays transverse or longitudinal fracture outlines and right angle breakage. In addition to fracture outlines and angles, the fracture edge coloration can also aid in distinguishing between these two breakage patterns. Recently fractured edges will often appear chalky with a white to yellow coloration, while bone broken during the nutritive stage are typically mottled to match the coloration of other remains in the accumulation. This documentation will aid in identifying the degree of percussion damage to which the assemblage was submitted and determine the damage caused by non-cultural processes such as rodent and carnivore gnawing and damage done to the assemblage during excavation and storage.

Carnivore and Rodent Modification

Carnivore modification has posed a problem for researchers, as misidentifications have occurred when carnivore damage has gone unrecognized. In recent years, extensive experimental ethnoarchaeological and archaeological data have been collected to establish the taphonomic signature created by this non-cultural entity (Brain 1969; Marean and Kim 1998; Marean and Spencer 1991). From this research four primary types of carnivore damage have been identified including tooth punctures (v-shaped furrows), furrows, pitting and scoring (Binford 1981; Haynes 1980). Rodent modification was identified on the basis of smaller U-shaped, parallel furrows.

Carnivores are capable of producing spiral fractures typical of green breakage, as they chew on various elements to extract nutrients which can eliminate the presence of certain elements from assemblages. If this modification goes unnoticed, it may be confused with human-caused breakage, so to account for the degree of carnivore damage at the site, Blumeschine and Marean's (1993:275) end to shaft ratio will be used. Differentiating from carnivores, rodents are unconcerned with the nutritional value of bones, but instead chew on bones to wear down their continuously growing incisors (Brain 1981). The presence of rodent modification is a valuable indicator of the amount of time that lapsed between disposal and burial of the assemblage, as rodents prefer to gnaw on bone that is dry and slightly weathered (Lyman 1994: 195). These modifications were recorded for presence or absence and will become useful in the further interpretation of patterning and determination of the taphonomic history of the deposit.

Once I have quantified the frequency of cutmarks, breakage, burning and carnivore/rodent modification to the skeletal elements, the carnivore/ rodent modifications will be used to determine the extent to which these agents have altered the assemblage, transforming the patterns created by the Mill Creek inhabitants of Skadeland. After considering the non-cultural modifications, fragmentation will be examined to establish the processing intensity and how it may be affecting the ability to identify the remains. Finally, cutmark location and breakage abundance will be used to look at butchery patterns.

Quantification of Faunal Remains

A quantification system was employed to document the faunal remains present at the site, a summary was created depicting the number of identifiable specimens (NISP), minimum number of elements (MNE), minimum number of individuals (MNI) and minimum number of animal units (MAU). These quantifications units are defined below to avoid terminological confusion. First of all, 'skeletal element' and 'specimen' must be defined to distinguish between the two. Lyman's definition will be used for 'skeletal element,' as "skeletal elements are anatomical units that may be represented by fragments or whole bones and are represented, partially or completely, respectively, by specimens" (Lyman 1994: 100-101). Whereas, the term 'specimen' can be interchangeable with the terms 'piece' or 'item.'

Number of Identifiable Specimens

The number of identified specimens (NISP) was employed as a basic count of the number of specimens that could be identifiable to a taxon (Klein and Cruz-Uribe 1984). In previous analyses of Mill Creek faunal assemblages, the number of identified specimens (pieces) per taxon was the main analytical unit, but in this study, it will be used to quantify bone modifications and as a comparative unit. This unit is useful for quantifying bone modifications in a highly fragmented assemblage where many specimens are unidentifiable but surficial modifications are still preserved.

Minimum Number of Elements

The minimum number of elements (MNE) is an analytical unit that accounts for the frequency of skeletal element portions of individual taxa (Binford 1978). Bunn (1986:677) defines this as "the highest justifiable estimate of the minimum number of original skeletal units (elements) required to account for all of the fragmentary specimens in an assemblage that are identifiable as each skeletal category (element)." The minimum number of skeletal elements is calculated for every element in the body including both right and left sides. It is based on the presence of overlapping portion, segment and side for each element to determine the total number of that element for that species that has been identified in the assemblage. For example, the MNE for the left radius of bison would be calculated based on the most numerous overlapping portions of the left radius. If the three proximal radii and two distal radii were identified, the MNE would be three, as long as the two distal radii do not overlap with the proximal radii they could belong to the same radii as the proximal portion represents. This approach can also be called comprehensive MNE, since manual overlap is used to guarantee the highest MNE possible given the assemblage (Hill 2008). This analytical unit will be used to derive behavioral units, such as MAU, that can be used to infer butchery and transport strategies.

Minimum Number of Individuals

The minimum number of individuals (MNI) is derived from MNE to determining the number of animals that are represented at the site based on the most abundant skeletal element. For instance, an assemblage containing 2 right scapulae and 4 left scapulae, the MNI for the scapula would be 4 as that is the minimum number of individuals that can be accounted for with the scapulae. The size, ages and sex of the animal are usually not taken into consideration during this calculation, if these characteristics were taken into account, they could potentially increase the minimum number of individuals. This analytical unit has been used by other researchers to rank species importance and quantify the available meat provided by the minimum number of animals at the site.

Minimum Number of Animal Units

The minimum number of animal units (MAU) is another MNE-derived quantitative unit, which is obtained by dividing the total MNE (lefts plus rights) by the number of that skeletal element in the animal. For example, if the total MNE for the scapula is 9 (2 left + 7 right) then the MAU would be 4.5 (9 divided by 2). This analytical unit is a behavioral unit designed to reveal assemblage level patterning in the relative abundance of skeletal parts by allowing for easy identification of the most abundant elements at a site (Rapson, et al. 2007:

382). It becomes especially useful through the creation of a %MAU, where the MAU for each skeletal element is divided by the most abundant element's MAU and multiplied by 100. This percent can be used in exploratory strategies to determine factors influencing the transportation and processing decisions involved by plotting it against the food utility for the elements. For the bison assemblage, %MAU will be plotted against food utility indices for evidence of meat, marrow, grease or total package resource preference.

Fragmentation

Highly fragmented faunal assemblages such as Skadeland limit our ability to identify skeletal elements and, therefore, have an impact on the transportation and processing behavioral implications that can be made from the assemblage. Fragmentation can occur as a result of a number of processes (e.g. trampling, carnivore activity, human marrow extraction). Utilization of within-bone nutrients should be positively correlated with human intensification of carcass exploitation (Marshall and Pilgram 1991). Often skeletal elements are broken into "pot sized" portions to allegedly facilitate the grease rendering process (e.g., Binford 1978; Bunn et al. 1988; O'Connell et al. 1988; Oliver 1993; Yellen 1977). This behavior is assessed in the level of fragmentation of the Skadeland remains, measured through the abundance of green-bone breakage, percussion derived modification, and NISP:MNE ratio. This ratio compares NISP to comprehensive MNEs in order to track fragmentation intensity based on the number of identified specimens necessary to reconstruct an element (Lyman 1994; Munro 2004; Stiner 2005). Elements that are more intensively processes are represented by a higher NISP:MNE ratios.

Analysis

After a quantification summary is calculated and the taphonomic history has been addressed, the data will be assessed in conjunction with expectations derived from ethnographic and experimental data to produce inferences regarding butchery, transport and utility.

Skeletal Element Economic Utility

Utility indices have been constructed to produce inferences regarding butchery and transport decisions, since the relationship between skeletal element abundance and economic utility have proven to be useful in understanding the logic behind behavioral dynamics responsible for their patterning. Binford (1978) originally constructed economic utility indices for caribou and sheep elements, and others have expanded his work to create additional indices such as the bison (Emerson 1990) index used in this study. The premise behind the use of a utility index is to monitor what elements we would expect to see at various sites. At a residential site, one would expect to see an abundance of high utility elements (e.g. long bones, vertebra, ribs) compared to low utility elements (e.g. crania, phalages). The opposite would be expected at a kill/butchery site because theoretically all of the high utility elements would have been transported to the residential village. In addition to bison, a utility index will also be used to assess the transport of mussel remains from the Skadeland site (Parmalee and Klippel 1974; Theler 1991). This index examines the meat weight of various species to determine if the highest utility species were the focus of exploitation.

Unfortunately utility indices have not been created for small mammal and avian remains since the transport of complete carcasses could be done with relative ease, as these species can be transported by a single individual. Rather than a utility index, expectations of differential transport and butchery patterns derived from experimental and ethnographic analogy will be used to distinguish between ritual and subsistence function. For the small mammals, an abundance of long bones and axial (e.g. ribs, vertebra, acetabulum) elements if subsistence was the goal of small mammal exploitation. However, if fur was the focus, cranial, foot and caudal portions transported in the pelt would be in abundance. Whereas, the avian remains should exhibit a high abundance of wing elements compared to axial elements if the goal of exploitation is feather harvesting.

No Mill Creek site has yet been analyzed using a comprehensive taphonomic approach which has impeded our understanding of the diet and subsistence behaviors of these people. However, now that we have more refined methods, we ask further questions of the remains in order to discover more about past behavior. Through proper methods of documentation, quantifying and interpreting, we can begin to understand Mill Creek faunal exploitation in the region by analyzing the Skadeland site.

CHAPTER 4
RESULTS

"Only a small part of what once existed was buried in the ground; only a part of what was buried has escaped the destroying hand of time; of this part all has not yet come to light again; and we all know only too well how little of what has come to light has been of service for our science." O. Montelius (1888:5)

General Characteristics of the Assemblage

The Skadeland site excavation comprises a total of 3,149 faunal remains from a 350 square foot area, of which 1,879 (NISP) have been identified to skeletal element. The assemblage consists mainly of fragmented bison bone, which equates to 777 specimens for a minimum of 4 mature bison. There are also 55 fetal bison bones, which account for at least 2 immature bison. Deer and elk remains are far less frequent with 37 specimens identified as deer and 8 identified as elk; the specimens identified for both animals only account for one individual. For large ungulate elements, which could not be confidently identified as bison, elk or deer, a Class 3/4 category was created. This category is useful, as it allows for the addition of large ungulate specimens into the exploration of transport strategies. The Class 3/4 category includes 435 specimens. In addition to large ungulate remains, a plethora of small mammal, rodent, avian and aquatic remains have been recognized at the site. From these classes, there are 82 small mammal, 136 rodent, 205 avian, and 82 fish bones, which account for a variety of species. The remaining 1,279 unidentifiable specimens could not be confidently identified to class, so they were categorized generally as cancellous bone, flat bone, long bone or unspecified.

The assemblage has proven to be highly fragmented due to a number of human and non-human agents, which have been recorded thanks to the remarkable preservation the assemblage has withheld due to the favorable soil conditions in northwest Iowa. The cortical surface of the bone has maintained an assortment of identifiable modifications, allowing for significant data to be collected on the taphonomic history of the assemblage. A summary of the faunal remains and modifications identified on the bones can be viewed in Table 4.1.

Table 4.1 Summary of Faunal Remains and Surficial Modifications

Taxon	**NISP**	**MNI**	**NISPcut**	**NISPburn**	**NISP gnaw**	**NISP Green Break**
Bison	777	4	76	92	186	470
Fetal Bison	55	2	5	3	6	24
Elk	8	1	-	-	1	5
Deer	37	1	4	-	11	13
Class 3 / 4	435	-	29	50	61	407
Small Mammal	62	-	3	7	5	6
Rodent	73	-	1	2	-	3
Canine	12	1	2	1	-	2
Skunk	1	1	-	-	-	-
Beaver	3	1	2	-	1	2
Fox	1	1	-	-	-	1
River Otter	3	1	-	-	-	-
Muskrat	2	1	-	-	-	-
Turtle	1	1	-	-	-	-
Weasel	1	1	-	-	-	-
Pocket Gopher	56	11	-	-	-	-
Ground Squirrel	4	2	-	-	-	-
Squirrel	1	1	-	-	-	-
Woodrat	3	1	-	-	-	-
Avian	205	21	25	19	2	38
Fish	82	-	-	5	2	10
UN	1327	-	38	233	130	957
Total	3149	-	185	412	405	1938

The remainder of this chapter reports the findings of the taphonomically-oriented zooarchaeological analysis of all faunal remains recovered from the Skadeland site. In order to comprehend the formational history of the Skadeland faunal assemblage, I identify the possible taphonomic agents influencing the recovered sample in order to isolate and interpret the human behavior involved. Interpretations of the taphonomic history and behavioral implications are addressed briefly in this chapter providing a baseline for further discussion in Chapter 5, where bone modifications and element frequencies will be used to test hypotheses derived from mythological and ethnographic animal accounts to determine the ritual or subsistence role of various species. For organizational purposes, the results for each method employed (outlined in Chapter 3) will be reported in the following categories: large mammals, small mammals/rodents, avian and aquatic remains. These categories are used to distinguish between these resources and allow for easier comparison with other Mill Creek faunal assemblages, which have been analyzed using similar categorical distinctions. As the faunal remains are tabulated and modifications summarized, the focus will be placed on assessment of the taphonomic history, inferences of large mammal carcass utilization (meat, marrow, grease and total package) and distinction between subsistence and prestige foraging by Mill Creek hunters.

Large Mammal Remains

Skeletal Element Frequencies

Table 4.2 summarizes the large mammal skeletal element frequencies represented at the Skadeland (13CK402) site. The assemblage has a total of 1,312 specimens that have been identified as large ungulate remains, which include bison (NISP=832), elk (NISP=8), deer (NISP=37) and indeterminate large ungulate (NISP=435).

Minimum Number of Elements

The minimum number of elements is the total number of skeletal units (elements) required to account for all identifiable specimens in the assemblage combining the right and left sides. This analytical unit was achieved through a combination of element-specific landmark identification and fragment overlap, and it is summarized in Table 4.2. From the bison remains, cranial elements are represented by at least 1 cranium, 3 hyoid and 3 mandibles, 2 right side and 1 left side. Post-cranial axial elements include 1 atlas, 1 axis, 2 cervical, 8 thoracic, and 3 lumbar vertebrae. Axial elements also include a minimum of 21 ribs, 1 sacrum and 7 caudal vertebrae. Forelimb long bones include scapula (MNE=2), humerii (MNE=2), radii (MNE=6), ulnae (MNE=3), and metacarpals (MNE=3). Hindlimb long bones include femora (MNE=3), tibiae (MNE=4), and metatarsals (MNE=3). There are at least 13 carpals and 9 tarsals. Digit bones are represented by 11 first phalanges, 9 second phalanges and 7 third phalanges with a minimum of 8 sesamoid bones. Additionally, the bison remains contain 1 patella and 2 os coxae.

Deer and elk remains are far less represented than bison. The deer remains include cranial elements accounting for a minimum of 1 antler, 1 cranium and 1 mandible and post-cranial elements of 2 ribs and 1 lumbar vertebra. Forelimb long bones include scapula (MNE=1), radii (MNE=1), ulnae (MNE=1), and metacarpals (MNE=1). The remaining deer elements include 4 phalanges, 1 tarsal and 1 metatarsal. Elk is represented by a minimum of 1 mandible, 2 cervical and 1 lumbar vertebrae, 1 rib, 1 first and 1 second phalange.

There are also 435 specimens assigned to Class 3 /4 (indeterminate large ungulate). While the specimens could not contribute to the MNI because these specimens may belong to the bison, elk or deer elements already accounted for by other elements, they add to our overall understanding of the large ungulate remains. Class 3/4 remains are dominated by rib blade fragments (NISP=354), which is typical of all large ungulate remains, since the rib fragments account for slightly over 43% of the 1,312 specimens identified as bison, elk or deer. In addition to ribs, long bone flakes are also prominent, as another 10% of the total large ungulate remains have been identified as indeterminate long bone flakes. These high percentages demonstrate the fragmentary nature of this assemblage, especially when this evidence is paired with the breakage recorded on all other elements with the exception of compact elements such as phalanges, carpals and tarsals.

Minimum Number of Individuals

Minimum number of individuals was derived from MNE frequency calculations by taking side into consideration. The bison remains account for a minimum of four individuals represented at the site, derived from an MNE of 4 distal radii. The MNI is achieved through the presence of 3 left distal radii and 1 right distal radius distinguished as representing an additional individual through the use of bilateral matching. Bilateral refitting involves the matching of right and left pairs of an animal to determine the number of animals that are present at the site (Todd and Frison 1992). In the case of the distal radii, the size discrimination was such that the right distal radii clearly belonged to an additional individual, giving a MNI of four. In addition to four mature bison, a minimum of two fetal bison were identified. This number was reached through distinction in maturation of a number of fetal bison remains. Of the 55 fetal bison remains, portions of a skull and an astragalus represent a fetal bison near full development, while a second individual was distinguished by a femur and humerus belonging to a younger bison. In addition to bison, the 37 deer bones and 8 elk bones account for a minimum of one deer and one elk (Table 4.2).

Table 4.2 Detailed Quantification Summary

	Bison					Deer			Elk			Class 3/4		
ELE	**NISP**	**MNE**	**MNI**	**MAU**	**MAU%**	**NISP**	**MNE**	**MNI**	**NISP**	**MNE**	**MNI**	**NISP**	**MNE**	**MNI**
ANT	-	-	-	-	-	3	1	1	-	-	-	-	-	-
CRN	23	1	1	1	33.3	2	1	1	-	-	-	-	-	-
MR	17	3	2	1.5	50.0	2	1	1	1	1	1	4	1	1
MUN	3	-	-	-	-	-	-	-	-	-	-	-	-	-
PUN	2	-	-	-	-	-	-	-	-	-	-	-	-	-
TFR	1	-	-	-	-	-	-	-	-	-	-	-	-	-
HY	5	3	2	1.5	50.0	-	-	-	-	-	-	-	-	-
AT	1	1	1	1.0	33.3	-	-	-	-	-	-	-	-	-
AX	2	1	1	1.0	33.3	-	-	-	-	-	-	-	-	-
CE	7	2	-	0.4	13.3	-	-	-	3	2	1	1	1	1
TH	49	8	-	0.6	20.0	-	-	-	-	-	-	2	1	1
LM	17	3	1	0.6	20.0	3	1	1	1	1	1	2	1	1
VT	42	-	-	-	-	-	-	-	-	-	-	21	-	-
SA	12	1	1	1.0	33.3	-	-	-	-	-	-	1	1	1
CA	11	7	-	-	-	-	-	-	-	-	-	-	-	-
RB	199	21	-	0.75	25.0	13	2	1	1	1	1	354	1	1
SN	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SC	27	2	1	1.0	33.3	1	1	1	-	-	-	-	-	-
HM	16	2	1	1.0	33.3	-	-	-	-	-	-	-	-	-
RD	8	6	4	3.0	100.0	1	1	1	-	-	-	-	-	-
UL	10	3	2	1.5	50.0	1	1	1	-	-	-	1	1	1
CPI	4	4	2	2.0	66.7	-	-	-	-	-	-	-	-	-
CPR	1	1	1	0.5	16.7	-	-	-	-	-	-	-	-	-
CPU	2	2	1	1.0	33.3	-	-	-	-	-	-	-	-	-
CPS	1	1	1	0.5	16.7	-	-	-	-	-	-	-	-	-
CPA	4	4	2	2.0	66.7	-	-	-	-	-	-	-	-	-
CPF	2	1	1	0.5	16.7	-	-	-	-	-	-	-	-	-

Table 4.2 (Continued)

	Bison					Deer			Elk			Class 3/4		
ELE	**NISP**	**MNE**	**MNI**	**MAU**	**MAU%**	**NISP**	**MNE**	**MNI**	**NISP**	**MNE**	**MNI**	**NISP**	**MNE**	**MNI**
MC	8	3	2	1.5	50.0	1	1	1	-	-	-	-	-	-
MCF	3	3	2	1.5	50.0	-	-	-	-	-	-	-	-	-
IM	14	2	1	1.0	33.3	-	-	-	-	-	-	-	-	-
FM	17	3	2	1.5	50.0	-	-	-	-	-	-	1	1	1
TA	18	4	3	2.0	66.7	-	-	-	-	-	-	1	1	1
LTM	2	2	2	1.0	33.3	-	-	-	-	-	-	-	-	-
AS	1	1	1	0.5	16.7	-	-	-	-	-	-	-	-	-
CL	6	4	2	2.0	66.7	1	1	1	-	-	-	-	-	-
TRC	2	2	2	1.0	33.3	-	-	-	-	-	-	-	-	-
TRS	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TRF	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PT	1	1	1	0.5	16.7	-	-	-	-	-	-	-	-	-
MT	11	3	2	1.5	50.0	1	1	1	-	-	-	-	-	-
PHF	14	11	-	1.4	45.8	1	1	1	1	1	1	-	-	-
PHS	13	9	-	1.1	36.7	4	1	1	1	1	1	1	1	1
PHT	7	7	-	0.9	29.2	1	1	1	-	-	-	1	1	1
PH	-	-	-	-	-	1	1	1	-	-	-	-	-	-
SED	4	4	-	0.5	16.7	-	-	-	-	-	-	-	-	-
SEP	11	4	-	0.5	16.7	-	-	-	-	-	-	-	-	-
MP	3	-	-	-	-	1	1	1	-	-	-	-	-	-
CS	36	-	-	-	-	-	-	-	-	-	-	-	-	-
CB	27	-	-	-	-	-	-	-	-	-	-	1	1	1
FB	3	-	-	-	-	-	-	-	-	-	-	5	-	-
LB	92	-	-	-	-	-	-	-	-	-	-	39	-	-

Minimum Number of Animal Units

Figure 4.1 displays a summary of the Skadeland assemblage skeletal element abundance for bison expressed as %MAU (minimum animal units). The purpose of this analytical unit is to display the skeletal abundance of an assemblage as a proportion of what is represented. This unit is calculated by dividing the total MNE for each element by the number of times that element occurs in a species, then standardizing the skeletal element abundance into a percent by setting the highest MAU at 100 and scaling the other values accordingly. In order to simplify the plot and reduce noise, element values such as those for the carpals and tarsals, which are intuitively aggregated, are represented by their average MAU value. The profile shows a mix of element representation, but it appears that select forelimb and hind limb long bones are the most abundant. Less well- represented portions include the axial elements and phalanges, specifically the vertebrae and ribs are the least represented.

Focusing on the axial elements, the cranial (%MAU=33) and mandibular (%MAU=50%) elements have the highest representation, which is similar to many of the long bone %MAUs. However, the vertebrae and ribs are the least well-represented elements with %MAU less than 25%. Identification of axial elements is hampered by the extremely fragmentary nature of the assemblage. Of the other poorly represented phalanges, the first phalanx is of highest abundance at 45.8%, which makes it similar in abundance to the ulna, metacarpal, femur and tibia, while the other phalanges have %MAUs around 30%.

The limb elements are most abundant, as they consistently exhibit %MAUs over 30%. Some forelimb elements, including scapulae, humeri and metacarpals are found at the same frequency, however, the radius is the highest represented element in the assemblage.

Hindlimb representation consists of the femur at 50% MAU, the tibia at 67% MAU and the metatarsal also at 50% MAU. While the long bones are highly represented, the "rider" elements expected to be seen associated with the long bone transport such as the patella and tarsals are present in very low frequencies.

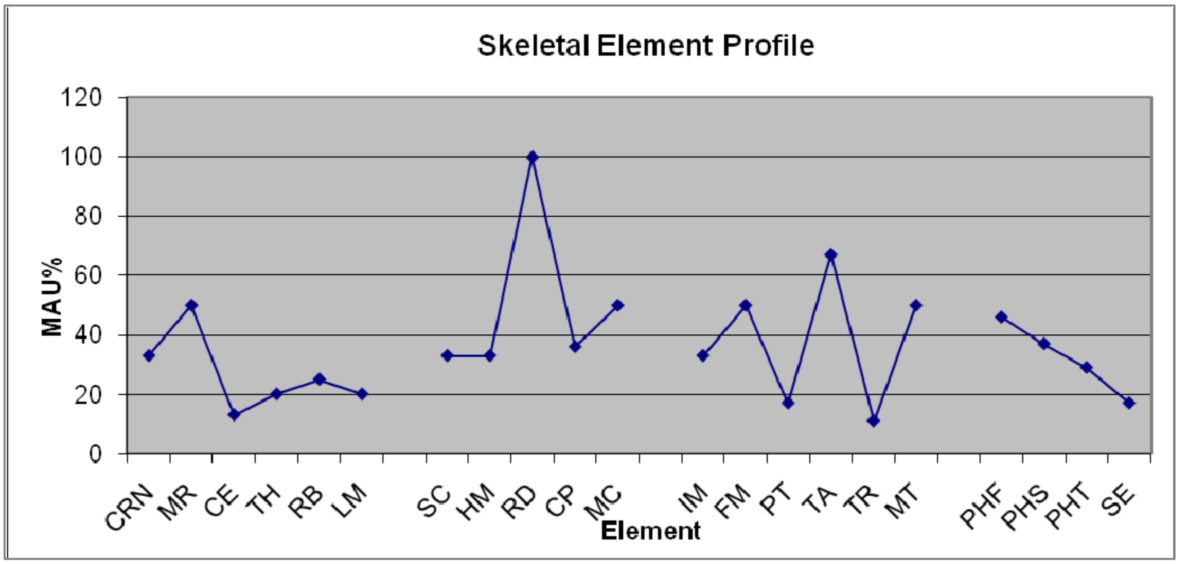

Figure 4.1 Bison Skeletal Element Profile. The graphic depiction of %MAU relative abundances in which the carpals, tarsals and sesmoids are based on collapsed MNEs for the skeletal subgroup

TAPHONOMIC HISTORY OF THE LARGE MAMMAL ASSEMBLAGE

Non-Cultural Modifications

Carnivore and rodent modifications were the only non-human surficial attributes recorded to address questions concerning the taphonomic history of the assemblage. These data are summarized in Table 4.3 (bison remains) and Table 4.4 (all Class 3/4 remains).

Carnivore Modification

Carnivore modification is exhibited in less than 8% of the identified bison specimens (NISP=73; Table 4.3). The highest incidence of carnivore modification on bison occurs on the metapodials (35%) with moderate damage also occurring on the long bones (17.3%), ribs

(13%) and phalanges (8%). When deer and elk remains are considered, antler (100%) is the only additional highly modified element. There appears to be a higher occurrence of carnivore modification on the denser low utility element (antler, phalanges, metapodials, etc.), while only moderate alterations occur on high utility elements such as long bones. Given the presence of domesticated dogs by this point in prehistory, some carnivore modification is expected from village site assemblages. However, extensive carnivore damage can alter the archaeological signature and result in misinterpretations of butchery and transport strategies. To avoid this problem, an articular end to shaft ratio based on anatomical zone was calculated.

Long bone epiphyses to shaft fragment (NISP) ratios provide an accurate and easily obtained quantitative estimate of the degree to which carnivores remodeled the assemblage (Blumenschine and Marean 1993). This quantification is possible because carnivores prefer to gnaw on softer, cancellous portions of bone to obtain nutrients, therefore, if a similar end to shaft ratio exists, carnivores likely played a minimal role in shaping the condition of an assemblage. At the same time, if an assemblage has few ends and many shafts, this ratio suggests the occurrence of significant carnivore destruction. Table 4.5 displays the end to shaft ratio results for bison in terms of anatomical zone quantification to account for intra-element fragmentation. Elements such as the radii that have more articular ends than shafts display increased rations, whereas elements such as the humerii with more shafts than ends display decreased ratios.

Table 4.3 Select cortical modifications arranged by NISP and %NISP (Bison)

Element	NISP	Cut	%	Burned	%	Breakage	%	Impact	%	Carnivore	%	Rodent	%
CRN	23	2	8.7	0	0.0	11	47.8	1	4.3	0	0	0	0
MR	17	3	17.6	1	5.9	11	64.7	1	5.9	2	11.8	4	23.5
MUN	3	0	0.0	0	0.0	0	0.0	0	0	2	66.7	0	0
PUN	2	0	0.0	1	50.0	0	0.0	0	0	0	0	0	0
TFR	1	0	0.0	0	0.0	0	0.0	0	0	0	0	0	0
HY	5	1	20.0	0	0.0	2	40.0	0	0	0	0	0	0
AT	1	1	100.0	0	0.0	1	100.0	0	0	0	0	0	0
AX	2	0	0.0	0	0.0	1	50.0	0	0	2	100	0	0
CE	7	1	14.3	0	0.0	6	85.7	2	28.6	0	0	0	0
TH	49	2	4.1	4	8.2	33	67.3	1	2	1	2	3	6.1
LM	17	2	11.8	0	0.0	14	82.4	3	17.6	1	5.9	0	0
VT	42	1	2.4	1	2.4	31	73.8	1	2.4	1	2.4	0	0
SA	12	2	16.7	1	8.3	6	50.0	2	16.7	1	8.3	2	16.7
CA	11	0	0.0	0	0.0	0	0.0	0	0	1	9.1	0	0
RB	199	39	19.6	16	8.0	150	75.4	11	5.5	26	13.1	43	21.6
SC	27	5	18.5	3	11.1	21	77.8	0	0	3	11.1	7	25.9
HM	16	2	12.5	5	31.3	14	87.5	3	18.75	2	12.5	2	12.5
RD	8	1	12.5	0	0.0	6	75.0	2	25	0	0	4	50
UL	10	3	30.0	1	10.0	4	40.0	0	0	0	0	3	30
CPI	4	0	0.0	0	0.0	0	0.0	0	0	0	0	0	0
CPR	1	0	0.0	1	100.0	0	0.0	0	0	0	0	0	0
CPU	2	1	50.0	0	0.0	0	0.0	0	0	0	0	0	0
CPS	1	0	0.0	0	0.0	0	0	0	0	0	0	0	0
CPA	4	0	0.0	0	0.0	0	0.0	0	0	0	0	0	0
CPF	2	0	0.0	0	0.0	0	0.0	0	0	1	50	0	0
MCF	3	0	0.0	0	0.0	0	0	0	0	0	0	0	0
Total	759		10%		12%		61%		7%		8%		16%

Table 4.3 (Continued)

ELE	**NISP**	**Cut**	**%**	**Burned**	**%**	**Breakage**	**%**	**Impact**	**%**	**Carnivore**	**%**	**Rodent**	**%**
MC	8	2	25.0	3	37.5	4	50.0	2	25	5	62.5	2	25
IM	14	1	7.1	2	14.3	12	85.7	2	14.9	0	0	2	14.9
FM	17	2	11.8	9	52.9	15	88.2	5	29.4	1	5.9	6	35.3
TA	18	1	5.6	3	16.7	12	66.7	6	33.3	1	5.5	6	33.3
LTM	2	0	0.0	0	0.0	0	0.0	0	0	0	0	0	0
AS	1	0	0.0	0	0.0	0	0.0	0	0	1	100	0	0
CL	6	1	16.7	0	0.0	2	33.3	0	0	2	33.3	0	0
TRC	2	0	0	0	0.0	0	0.0	0	0	0	0	0	0
TRS	-	-	-	-	-	-	-	-	-	-	-	-	-
TRF	-	-	-	-	-	-	-	-	-	-	-	-	-
PT	1	0	0	0	0.0	-	-	0	0	0	0	0	0
MT	11	0	0	0	0.0	8	72.7	2	18.1	1	9	4	36.4
PHF	14	0	0	1	7.1	1	7.1	0	0	1	7.1	5	35.7
PHS	13	0	0	1	7.1	1	7.7	0	0	2	15.4	3	23.1
PHT	7	0	0	0	0.0	0	0.0	0	0	0	0	0	0
PH	-	-	-	-	-	-	-	-	-	-	-	-	-
SED	4	0	0	0	0.0	0	0.0	0	0	1	25.0	0	0
SEP	11	0	0	0	0.0	0	0.0	0	0	0	0	2	18.1
MP	3	0	0	1	33.3	1	33.3	0	0	1	33.3	0	0
CS	36	0	0	2	5.5	0	0.0	0	0	0	0	3	8.3
CB	27	0	0	6	22.2	12	44.4	0	0	1	3.7	1	3.7
FB	3	0	0	0	0.0	2	66.7	1	33.3	0	0	1	33.3
LB	92	3	3.3	32	34.9	81	88.0	7	7.6	4	4.3	22	23.9
Total	759		10%		12%		61%		7%		8%		16%

Table 4.4 Select cortical modifications arranged by NISP and %NISP (All Class 3 / 4)

ELE	**NISP**	**Cut**	**%**	**Burned**	**%**	**Breakage**	**%**	**Impact**	**%**	**Carnivore**	**%**	**Rodent**	**%**
ANT	3	0	0.0	0	0.0	0	0.0	0	0	3	100	0	0
CRN	25	2	8.0	0	0.0	12	48.0	1	4.0	0	0	0	0
MR	19	3	15.8	1	5.3	17	89.5	3	15.8	2	10.5	4	21.1
MUN	3	0	0.0	0	0.0	0	0.0	0	0	2	66.7	0	0
PUN	2	0	0.0	1	50.0	0	0.0	0	0	0	0	0	0
TFR	1	0	0.0	0	0.0	0	0.0	0	0	0	0	0	0
HY	5	1	20.0	0	0.0	2	40.0	0	0	0	0	0	0
AT	1	1	100.0	0.0	0.0	1	100.0	0	0	0	0	0	0
AX	2	0	0.0	0.0	0.0	1	50.0	0	0	2	100	0	0
CE	11	1	9.1	0.0	0.0	10	90.9	2	18.2	0	0	0	0
TH	51	3	5.9	4.0	7.8	35	68.6	1	1.96	1	1.96	3	5.9
LM	23	3	13.0	0.0	0.0	17	73.9	3	13.0	1	4.3	0	0
VT	63	1	1.6	6	9.5	47	74.6	1	1.6	1	1.6	1	1.6
SA	13	2	15.4	1.0	7.7	6	46.2	2	15.4	1	7.7	2	15.4
CA	11	0	0.0	0.0	0.0	0	0.0	0	0	1	9.1	0	0
RB	567	66	11.6	48	8.7	494	87.1	15	2.65	28	4.9	95	16.8
SC	28	5	17.9	3.0	10.7	22	78.6	0	0	3	10.7	7	25
HM	16	2	12.5	5.0	31.3	14	87.5	3	18.75	2	12.5	2	12.5
RD	9	1	11.1	0.0	0.0	6	66.7	2	22.2	0	0	4	44.4
UL	12	3	25.0	1.0	8.3	5	41.7	0	0	0	0	4	33.3
CPI	4	0	0.0	0.0	0.0	0	0.0	0	0	0	0	0	0
CPR	1	0	0.0	1.0	100.0	0	0.0	0	0	0	0	0	0
CPU	2	1	50.0	0.0	0.0	0	0.0	0	0	0	0	0	0
CPS	1	0	0.0	0.0	0.0	0	0.0	0	0	0	0	0	0
CPA	4	0	0.0	0.0	0.0	0	0.0	0	0	0	0	0	0
CPF	2	0	0.0	0.0	0.0	0	0.0	0	0	1	50	0	0
Total	1234		9%		12%		71%		5%		6%		15%

Table 4.4 (Continued)

ELE	**NISP**	**Cut**	**%**	**Burned**	**%**	**Breakage**	**%**	**Impact**	**%**	**Carnivore**	**%**	**Rodent**	**%**
MCF	3	0	0.0	0.0	0.0	0	0.0	0	0	0	0	0	0
MC	9	2	22.2	3.0	33.3	4	44.4	2	22.2	6	66.7	2	22.2
IM	14	1	7.1	2.0	14.3	12	85.7	2	14.3	0	0	2	14.3
FM	18	2	11.1	10	55.6	15	83.3	5	27.8	1	5.6	6	33.3
TA	19	1	5.3	3	15.8	13	68.4	6	31.6	1	5.3	6	31.6
LTM	2	0	0.0	0	0.0	0	0.0	0	0	0	0	0	0
AS	1	0	0.0	0	0.0	0	0.0	0	0	1	100	0	0
CL	7	1	14.3	0	0.0	2	28.6	0	0	3	42.9	0	0
TRC	2	0	0.0	0	0.0	0	0.0	0	0	0	0	0	0
TRS	-	-	-	-	-	-	-	-	-	-	-	-	-
TRF	-	-	-	-	-	-	-	-	-	-	-	-	-
PT	1	0	0.0	0	0.0	0	0.0	0	0	0	0	0	0
MT	12	0	0.0	0	0.0	9	75.0	3	25	1	8.3	3	25
PHF	16	0	0.0	1	6.3	1	6.3	0	0	1	6.25	8	50
PHS	19	2	10.5	1	5.3	2	10.5	0	0	2	10.5	4	21.1
PHT	9	0	0.0	0	0.0	0	0.0	0	0	0	0	2	22.2
PH	1	0	0.0	0	0.0	1	100.0	0	0	0	0	0	0
SED	4	0	0.0	0	0.0	0	0.0	0	0	1	25	0	0
SEP	11	0	0.0	0	0.0	0	0.0	0	0	0	0	2	15.2
MP	4	0	0.0	1	25.0	1	25.0	0	0	2	50	0	0
CS	36	0	0.0	2	5.6	0	0.0	0	0	0	0	3	8.3
CB	28	0	0.0	6	21.4	13	46.4	0	0	1	3.57	1	3.6
FB	8	0	0.0	0	0.0	7	87.5	1	12.5	0	0	1	12.5
LB	131	5	3.8	44	33.6	108	82.4	10	7.6	5	3.8	28	21.4
Total	1234		9%		12%		71%		5%		6%		15%

The bison long bones exhibit variability in their end to shaft ratio. The humerii, femora and tibii display more shaft zones than end zones, while the radius, metacarpal and metatarsal have more epiphysis zones than shaft fragments (Figure 4.2). Overall, the Skadeland bison remains show a low percentage of teeth marks (8.4%) and a high ratio of epiphyses to shaft fragments at 0.69, demonstrating that carnivore ravening played an insignificant role in the formation or destruction of the Skadeland bison assemblage. Using Blumenschine and Marean's (1993) epiphyses/shaft fragment ratio and tooth-marked-shaft%, the Skadeland assemblage is compared with experimental assemblages and most closely resembles Blumenschine and Marean's (1993) hammerstone-only assemblage. Similar to the bison remains, the elk, deer and class 3/4 elements bear slight modification with less than six percent of the specimens being modified (Table 4.4).

Figure 4.2 Bison long bone flakes displaying carnivore modification.

Table 4.5 Skadeland bison remains % toothmarked and End:Shaft ratio

ELE	% toothmarked	End	Shafts	End:Shaft ratio
HM	12.5	3	9	0.33
RD	0.0	6	4	1.5
MC	62.5	6	4	1.5
FM	5.9	4	11	0.36
TA	5.5	5	12	0.42
MT	9.0	7	5	1.4
Assemblage Average	8.4	31	45	0.69

Rodent Modifications

Rodent damage occurs in similar frequency as carnivore modifications with approximately 15% of the assemblage being affected (Table 4.3; Table 4.4). The long bones and phalanges exhibit the most rodent damage, as these elements display a 30% modification rate, which is over 20% higher than the assemblage average. The rodent modification mimics the abundance of carnivore modification on most elements with metapodials as the one exception. The metapodials (35%) are highly modified by carnivores, whereas they display no sign of rodent modification. Some researchers suggest that rodent modification can be used as an indicator or surface exposure (Lyman 1994). Following this implication, it would appear that the Skadeland large ungulate remains were not exposed for an extended period of time.

Cultural Modifications

Once the non-cultural taphonomic processes have been determined, we can begin focusing on the interpretation of animal procurement and butchery through the identification of human created surficial modifications. In this analysis, a number of cultural modifications were recorded to address the human role in creation of the faunal assemblage. To better understand the influence of Mill Creek inhabitants on the Skadeland faunal remains, attributes such as green-bone breakage, percussion damage, cutmarks and burning were recorded.

Breakage

Percussion breakage is the highest modification observed in the Skadeland assemblage, upon visual inspection the high level of fragmentation is notable. Table 4.3 provides a summary of green-bone breakage for bison, along with a separate summary (Table

4.4) that combines bison, elk, deer and Class 3 and 4 remains for an assemblage level view of bone breakage. The average percent breakage for the bison assemblage is over 60% with long bones (70%), ribs (75%) and vertebrae (78%) exhibiting extensive evidence of fresh breakage. The long bones exhibit spiral fractures typical of green bone breakage, which is complimented by visible impact related surficial modifications such as fractures, flakes, cones, notching and crushing. These surficial modifications, often associated with marrow extraction, are created when a hammerstone or other blunt object hits the bone. This cultural modification is most prominent on the radius (25%), humerus (19%), tibia (33%), femur (30%) and metapodials (22%). As a result of impact damage, these long bone elements exhibit a 74% rate of green bone breakage, which is substantially higher than the assemblage level average of 61%.

The axial elements also exhibit a high frequency of breakage, as many of the ribs and vertebra are pulverized almost beyond recognition, resulting in a large number of indeterminate rib fragments being placed in the Class 3/4 category (large animal). From the bison remains, the vertebra and ribs display a 75% rate of green breakage and these rates only increases when elk, deer and Class 3/4 remains are considered. In fact, the rate of rib breakage increases to 87%, as a result of the large amount of broken rib fragments in Class 3/4. The crushing of ribs and vertebra may have been done to make these elements ‘pot sized’, preparing them to be boiled for maximum grease extraction (Lupo 2006; O’Connell et al. 1988; Yellen 1977). The boiling of bones to extract grease is most effective when the bone is highly fragmented to provide maximal surface area exposure (Bonnichsen and Will 1980). Currently, the interpretation of rib and vertebra crushing is based mainly on ethnographic analogy and experimental study, but a recent pioneering study by Koon, O'Connel and Collins (2009) may provide even further evidence for this method in prehistory. The method they employ is the use of chemical analysis to detect if collagen molecules in the bone have been altered by heating. In addition to the highly fragmented axial and long bone elements, the cranium and mandible maintain moderate breakage rates around 50%, while tarsals, carpals and phalanges are almost completely devoid of breakage damage.

Fragmentation

The fragmentary nature of the large mammal assemblage has already been noted during observations of breakage, but further examination is needed to determine the degree of fragmentation intensity. To assess fragmentation and processing intensity, a measure of the NISP:MNE ratio has been used. This ratio compares NISP to comprehensive MNEs in order to track fragmentation intensity based on the number of identified specimens necessary to reconstruct an element (Lyman 1994; Munro 2004; Stiner 2005) (Figure 4.3). This measure accounts for fragmentation of numerous skeletal elements, but one disadvantage is its inability to identify fine grained intra-element fragmentation patterns. Elements that are more intensively processed are represented by higher NISP:MNE ratios.

Based on the NISP:MNE ratio, a fragmentation pattern similar to that already identified using % breakage emerges. Using this measure, the cranium is the most fragmentary element with a high ratio of 23. Following the cranium, the scapula (NISP:MNE ratio=14) and ribs (10) exhibit the most fragmentation. The long bones and axial elements also display a moderate rate of fragmentation, while the carpals, tarsals and phalanges show little to no fragmentation.

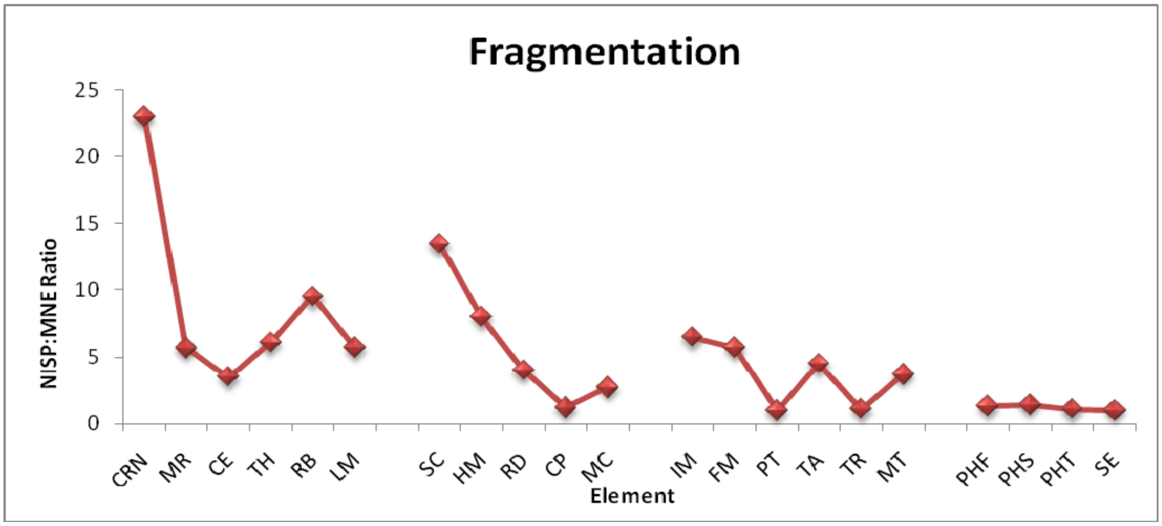

Figure 4.3 NISP:MNE ratios of bison skeletal elements

Cutmarks

The average number of cutmarks per bison skeletal element can be viewed in Table 4.6, and the percentages of cutmarks on all large mammal elements are available in Tables 4.3 (bison) and Table 4.4 (all Class 3/4). Examining the number of cutmarks per element and the location of the modification has implication for butchery behavior. The bison long bones display the highest percent of cutmark damage on the scapula, ulna, and metacarpal specimens nearly 20% show the presence of cutmarks. The axial elements also contain a high degree of cutmark damage averaging around 10% of the elements with cutmarks. Finally, the mandible (15.8%) and hyoid (20%) exhibit patterning typical of cranial disarticulation. When mean cutmarks per unit area is considered, the ulna exhibits the most cutmarks based on the surface area of the fragments identified. The cranium, mandible and hyoid also exhibit a high ratio of cutmarks per unit area, further supporting inferences of cranial disarticulation.

Table 4.6 Bison Cutmarked Remains by Portion

ELE	Portion	NISP	Mean Cutmarks	Mean Surface Area (mm)	Mean Cuts/ Unit Area
CRN	unidentified fragment	2	5	2,756	1.8
MR	border	1	2	1,571.50	1.3
	SYM	2	3	11,951.40	0.25
HY	angle	1	2	1,173.90	1.7
AT	centrum	1	1	11,620.60	0.08
CE	articular process	1	3	2,665.70	1.1
TH	dorsal spine	1	3	3,627.60	0.83
	neural arch	1	2	3,331.60	0.6
RB	blade	38	71	85,611.90	0.83
	proximal	1	1	1,757.80	0.57
LM	transverse process	2	4	5,670.20	0.71
SA	articular process	1	1	2,958.10	0.34
	centrum	1	2	2,204.20	0.91
SC	border	4	7	15,144.90	0.46
	spine	1	1	5,087.10	0.2
HM	mid shaft	2	3	9,898.30	0.3
RD	mid shaft	1	1	3,387.30	0.3
UL	proximal end	2	2	21,919	0.09
	distal end	1	2	561	3.57
CPU	complete	1	2	1,661.90	1.2
MC	proximal end	2	2	4,487.60	0.45
IM	isium	1	1	5,214.50	0.19
FM	distal end	1	1	1,898.80	0.53
	unidentified flake	1	1	4,987.50	0.2
TA	mid shaft	1	1	2,603.50	0.38
LB	unidentified fragment	3	3	5,517.90	0.54
VT	unidentified fragment	1	2	1,611.60	1.2

Burning

The final attribute for addressing the cultural modifications concerns the frequency and intensity (measured by color) of burning. Overall, the assemblage displays a relatively low frequency of burning at only 12% (Table 4.3). Table 4.3 shows that nearly 12% (NISP=51) of the identified specimens are calcined or conjunctively carbonized and calcined. Burning is known to cause increased fragmentation, rendering specimens unidentifiable (Lyman and O’Brien 1987), which may explain the abundance of burned specimens unidentifiable to skeletal element. When we take a closer look at the bison elements displaying signs of burning, there seems to be a fairly even distribution of burning of all element classes. The only slight increase in burning is exhibited in the long bones, specifically the humerii, metacarpals, and femur specimens, of which over 30% are burned. The even distribution of burning among all skeletal elements indicates that all elements are equally subjected to fragmentation that results from burning and no elements were the focus of intensive burning by human butchers. Bone burning can also be used to identify spatial distributions of burned features which are considered to be the result of clean-up episodes and can provide inferences regarding the occupational history of the site (Hall 2007). Unfortunately, the methods of excavation and inconsistencies in provenience data recording at the Skadeland site have created data that is unsuited for a fine grained spatial analysis.

Carcass Exploitation

The Skadeland faunal assemblage displays a complex history of dual-patterning as a result of non-cultural agents' destruction by carnivores and rodents and human caused modifications in the form of tool marks, fragmentation, cutmarks and burning. The effect of modifications on the assemblage may cause blurring of the human behavioral pattern, therefore analysis of human carcass transport and butchery decision making must be approached with caution. Until refined inferences can be established, the data concerning meat, marrow, grease and overall carcass utility is presented cautiously with an understanding that the results might be biased as a result of carnivore and rodent modifications and fragmentation of elements beyond identification that have damaged the original skeletal element frequencies created by the Skadeland inhabitants.

Table 4.7 provides bison skeletal element economic utility measures calculated by Emerson (1990) for meat, marrow, grease and total package (a single index combining meat, marrow and grease utility). These measures will be correlated with %MAU to isolate possible preferences of one of these resources over others and identify butchery and transport strategies, as discussed in the following chapter.

Table 4.7 Bison Skeletal Economic Utility

ELE	(S)AVGTP	Meat (kg)	Marrow (ml)	Grease (g)	%MAU
CRN-MR	14.2	1.5	-		33.3
MR	-	-	46.8	-	50
CE1-7	70.8	9.9	-	7.2	13.3
TH	84.7	8.1	-	22.7	20
LM	82.9	7.5	-	22	20
RB	100	13	-	52.2	25
SN	52.9	5.4	-	4	0
SC	31.6	5.6	3.5	13.6	33.3
HM	19.5	5.5	152.8	89.4	33.3
RDU	7.8	1.9	100.1	56	100
CP	0.5	-	-	8.6	36
MC	1	-	30.3	19.8	50
IM-SA	56.2	6.3	-	93.9	33.3
FM	69.3	22	169.1	127.8	50
TA	11.2	2.8	169.9	56.4	66.7
TR	1.6	-	-	28.8	11
MT	1.4	-	37.4	23.5	50
PH	2.4	-	5.5	19.8	37.3

(Emerson 1990)

Meat

Meat is the most accessible resource on the carcass in comparison to bone marrow and grease, which require additional processing for removal. Theoretically, if meat was the principal

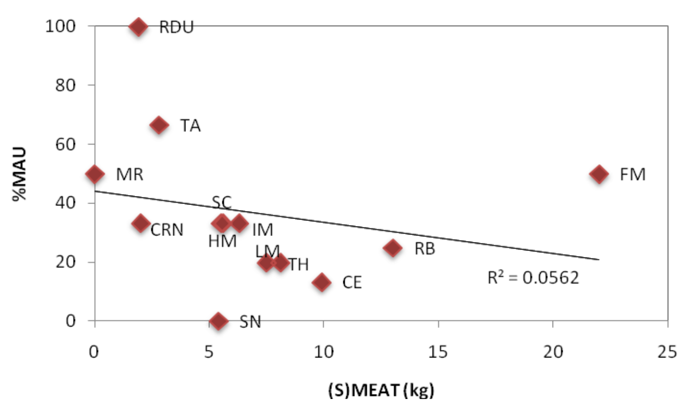

Figure 4.4 Bison Meat Utility

target of Mill Creek hunters, we would expect the meatiest elements to be procured and carried back to the residential site. Since residential sites are often representative of multiple carcass transportation events, perfect utility curves that materialize from the data are the exception rather than the rule.

The utility curve resulting from Skadeland bison element %MAU frequencies and Emerson's (1990) associated meat weights show a slightly negative correlation (Figure 4.4). If meat was the target resource of Mill Creek hunters, we would expect to see the opposite of what is expressed here (i.e., a higher %MAU of meaty elements). However, because some of the less meaty elements such as the radius-ulna, mandible and scapula are abundant, the primary goal of procurement does not appear to be meat extraction. Meat was clearly not excluded as an influencing factor in procurement, as meaty elements such as the femur and ribs are abundant at the site.

Marrow

If marrow was preferentially targeted by Mill Creek hunters, therefore transporting elements rich in marrow back to the camp site, we would expect a greater number of long bone elements as opposed to non-marrow bearing axial elements. There appears to be a slight positive correlation between the bison element frequencies and the marrow amount, which suggests marrow to be a consideration for prehistoric hunters. This is supported by the presence of spiral fractured long bones indicating marrow extraction. Upon examination of

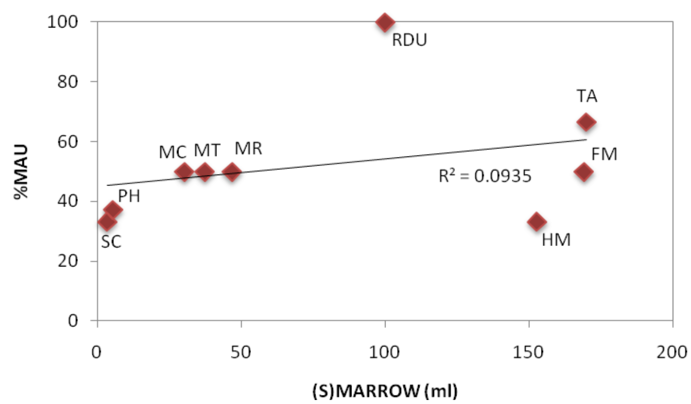

Figure 4.5 Bison Marrow Utility

figure 4.5, it appears that the long bone elements were all exploited at a similar rate, potentially indicating a strategy that considered total package utility.

Bone grease

A final resource available to prehistoric hunters is bison bone grease which is accessed through the boiling of the bones. Figure 4.6 represents Emerson's (1990) grease utility index correlated with %MAU values. The index indicates a slight positive correlation with element frequencies suggests that grease may have been a principal component of Mill Creek carcass exploitation. This suggestion is further supported by the assemblage's high rate of fragmentation, typical of 'pot sizing' for grease extraction from bones.

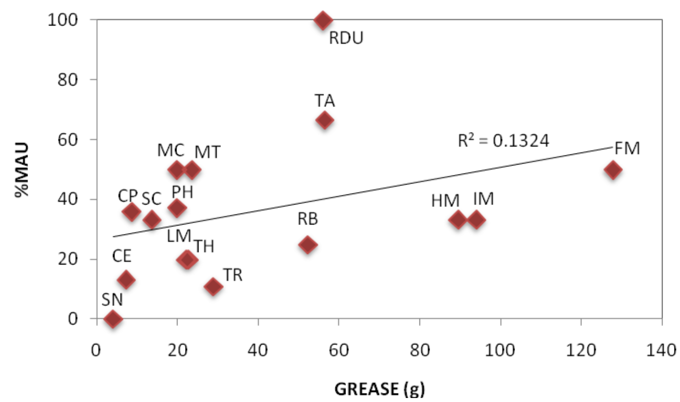

Figure 4.6 Bison Grease Utility

Total Package

Emerson's (1990) calculated total package utility refers to the combination of meat, marrow and grease values in the overall carcass. The total package utility may be the most representative in terms of how hunters perceived that value of particular skeletal parts, since hunters most likely make transport decisions by considering variables such as the distance to the camp,

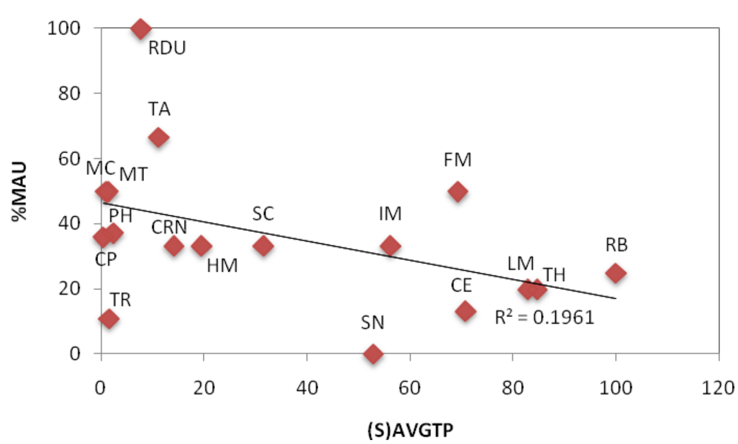

Figure 4.7 Bison Total Package Utility

the number of carriers and the overall utility of skeletal elements (total package utility). Therefore, hunters must optimize in their selection of what elements are transported to the village and what is left at the kill site.

Using Emerson's calculated total package utility, Figure 4.7 depicts a slight negative correlation. This is what many researchers refer to as a reverse utility curve (Grayson 1989; Lyman 1992), because low utility elements outnumber high utility elements that should be selected for transport to the village. Interestingly, a reverse utility curve is expected at a kill site rather than residential villages, like the Skadeland site. These results do not change the interpretation of the site's function, but rather more likely confirm the impact of fragmentation and lack of identification on the interpretation of carcass exploitation utility indices. Further implications for Mill Creek faunal exploitation are discussed in the following chapter.

Small Mammal Remains

Skeletal Element Frequencies

The Skadeland small mammal and rodent assemblage consists of 218 (NISP) identifiable elements. The presence of small mammal fauna at late prehistoric sites is not well understood, as questions remain about the cultural versus intrusive nature of various taxa. Thus, I have recorded a variety of cultural and non-cultural modifications to better understand the taphonomic processes that have influenced the deposition of the remains.

The small mammal bones from Skadeland represent 11 species including: beaver (two left femur fragments), fox (one mandible fragment), ground squirrel (two left femur fragments), muskrat (two right ulna fragments), pocket gopher (NISP=56, 23 are mandibles), river otter (one caudal vertebra and two phalanges), skunk (one axial vertebra), squirrel (one left mandible), turtle (one humerus), weasel (one tibia) and wood rat (one femur, humerus, and tibia). Each of these species is represented by only one individual with the exceptions of the pocket gopher and ground squirrel (Table 4.1). The pocket gopher remains represent a minimum of 11 individuals, while there is a minimum of two ground squirrels represented by two left femora. In addition to the species listed, other remains were unidentifiable to species including 135 small mammal elements. Also, four canine cervical vertebrae, possibly belonging to the same individual, could not be assigned to species, but their size suggests an animal between the size of a fox and coyote, potentially a domesticated dog. Full results of the small mammal remains can be found in Table 4.8.

Table 4.8 Summary of Small Mammal Remains

Animal	Element	NISP	MNE	cut	burn	green-break
Canine	AT	1	1	-	-	-
	CE	3	3	-	1	1
	CRN	1	1	1	-	1
	MR	1	1	-	-	1
	PHF	2	2	1	-	-
	PUN	1	1	-	-	-
	TA	1	1	1	-	-
	VT	3	-	-	-	-
Ground Squirrel	FM	2	2	-	-	-
	HM	1	1	-	-	-
	SC	1	1	-	-	-
Fox	MR	1	1	-	-	1
River Otter	CA	1	1	-	-	-
	PHF	2	2	-	-	-
Muskrat	UL	2	1	-	-	-
Pocket Gopher	CRN	10	9	-	-	-
	FM	4	4	-	-	-
	HM	13	11	-	-	-
	MR	23	22	-	-	-
	SC	3	3	-	-	-
	TA	3	3	-	-	-
Woodrat	FM	1	1	-	-	-
	HM	1	1	-	-	-
	TA	1	1	-	-	-
Turtle	HM	1	1	-	-	-

Table 4.8 Summary of Small Mammal Remains

Animal	Element	NISP	MNE	cut	burn	green-break
Small Mammal	CE	2	2	-	-	-
	CL	4	2	-	-	-
	CRN	8	3	-	1	1
	FM	1	1	-	-	-
	IC	1	1	-	-	-
	IM	3	1	1	-	-
	LB	6	-	1	1	3
	LM	1	1	-	-	-
	MR	4	3	-	-	-
	MUN	2	2	-	1	-
	PH	3	3	-	-	-
	PHF	4	4	-	-	-
	PHS	2	2	-	1	-
	RB	12	2	-	1	2
	RD	2	2	-	-	-
	TH	3	1	-	-	-
	TOOTH	1	2	-	-	-
	TRF	1	1	-	-	-
	UN	1	1	-	-	-
	VT	1	1	-	-	-
Rodent	CRN	3	1	-	-	-
	FM	12	9	-	-	2
	HM	6	4	-	-	-
	IC	3	2	-	-	-
	IL	1	1	-	1	-
	IM	9	9	-	1	1
	LB	4	3	-	-	-
	MR	12	9	-	-	-
	PHF	1	1	-	-	-
	PV	1	1	-	-	-
	RB	5	3	-	-	-
	RD	5	5	-	-	-
	SA1-2	1	1	-	-	-
	SC	2	2	-	-	-
	TA	5	3	-	-	-
	TH	1	1	-	-	-
	UL	2	2	-	-	-
Skunk	AX	1	1	-	-	-
Squirrel	MR	1	1	-	-	-
Weasel	TA	1	1	-	-	-
Beaver	FM	2	1	1	-	1

Bone Modification

The small mammal remains represent a variety of species that are common in the plains, so how do we know it was the behavior of the Skadeland site inhabitants that brought these animals to this location? To begin determining the agents affecting the small mammal remains, cultural (Table 4.8) and non-cultural modifications were recorded. All together, only 8% of the small mammal remains show any indication of modification.

The non-cultural modifications recorded include carnivore modification, rodent modification and recent breakage that occurred during excavation and storage. Rodent damage was recorded on a beaver femur, small mammal mandible, two ribs and an unidentifiable long bone fragment and only one small mammal mandible shows any sign of carnivore damage. The small mammal remains exhibit less damage than the large mammal remains, potentially because of their small size and reduced nutritive interest to rodents and carnivores. While pre-depositional damage is slim, the assemblage does exhibit breakage damage done during excavation and storage. This modification appears on the canine (2), fox (1), ground squirrel (1), pocket gopher (11), rodent (15), small mammal (7), and wood rat (1) elements. Therefore, 17% of the small mammal remains have been altered further fragmenting the remains and impeding identification of the remains.

Cultural modifications such as breakage, cutmarks and burning were also minor being documented on only 7.6% of the elements. In fact, the ground squirrel, muskrat, river otter, pocket gophers, skunk, squirrel, wood rat, weasel and turtle remains exhibited no cultural modifications. However, a number of small mammal, canine, beaver and fox remains did show modifications. Cutmarks were recorded on only three percent of the assemblage; these include two specimens within the small mammal class, a long bone fragment and an os coxa, a beaver femur, and three canine elements. The canine elements including a tibia, first phalanx and cranial fragment all have cutmarks remaining on their surface.

Additionally, small mammal remains display burning on four percent of elements. Burning is indicated only by slight browning color alteration, which occurs in instances of mild exposure to heat. This modification is exhibited on two rodent os coxae, one canine vertebra and several small mammal elements. The most predominate human alteration is green-bone breakage, occurring when elements are broken when still in a nutritive state. Green-bone breakage is visible on six percent of small mammal fragments including cranium, ribs and long bones. The general rodent class has breakage on two femora and one os coxa. A fox mandible also appears to be broken by the Skadeland inhabitants, as do a number of canine sized vertebrae and cranial parts. These modifications are a clear sign of human interaction with these specimens, so the question of why these animals were procured remains.

Avian Remains

Skeletal Element Frequencies

A total of 205 (NISP) bird remains were recovered from the Skadeland site. A summary of these elements can be found in Table 4.10. They were classified according to arbitrary size categories: large for turkey-size elements (29 %), medium for hawk-size elements (44 %), and small for robin-size elements (27 %) (Table 4.11). Based on the use of these size classes, humeri totals indicate the presence of at least fourteen birds at the site. However, some of the elements were identifiable to species (Table 4.9). Based on these results, a minimum of 21 individuals belonging to ten different species have been identified. The species identified include: Goose (*Branta canadensis*), Mallard (*Anas* sp.), Redhead

(*Aythya americana*), Golden Eagle (*Aquila chrysaetos*), Hawks (*Buteo* sp.), Cooper's Hawk (*Accipiter cooperii*), Prairie Chicken (*Tympanuchus cupido*), Woodpecker (*Dryocopus* sp.), Barn Owl (*Tyto alba)* and Screech Owl (*Otus asio*).

At the Skadeland site, the majority of the elements identified belong to the wing (37%) and lower limb (35%), while only 18% of the remains are from the axial skeleton. The high occurrence of elements such as the carpometacarpus and humeri-elements representing the wing (upper limb) and the tibia and tarsometatarsus of the lower limb, may indicate feather harvesting.

Table 4.9 Avian Species Identification

Taxon	Common Name	Species	NISP	Elements	MNI
Anseriformes	Goose	-	1	CRD	1
	Mallard	*Anas* sp.	2	PHF-2W	2
	Redhead	*Aythya americana*	1	CRD	1
Falconiformes	Golden Eagle	*Aquila chrysaetos*	1	CRD	-
			2	CMC	-
			6	HUX	-
			4	TMT	2
	Hawk	*Buteo* sp.	1	CMC	1
	Cooper's Hawk	*Accipiter cooperii*	1	CMC	1
	Red-tail Hawk	*Buteo Jamicensis*	12	TMT	4
	Swainson's Hawk	*Buteo Swaisoni*	1	HM	-
			1	CMC	1
Galliformes	Prairie Chicken	*Tympanuchus cupido*	1	HM	-
			2	CMC	2
Piciformes	Woodpecker	*Dryocopus* sp.	1	TMT	1
Strigiformes	Owl		1	FM	1
	Barn Owl	*Tyto alba*	1	TA	1
	Screech Owl	*Otus asio*	3	TA	3
MNI Total					21

Table 4.10 Avian Skeletal Element Frequency

Element	NISP	MNE	cut	burn	break
CA	2	2	-	-	-
CE	4	4	-	-	1
CMC	11	11	3	-	-
CRD	4	3	1	-	1
CRN	9	4	-	-	3
CUNI	1	1	-	-	-
FB	3	-	-	-	1
FIB	3	2	-	-	-
FM	3	2	2	1	3
FUR	1	1	1	-	-
HM	20	12	3	2	1
HUX	9	9	1	2	1
IM	1	1	1	1	1
LB	31	-	5	6	18
MR	2	2	-	-	-
PH	12	12	-	-	-
PHF	2	2	-	1	-
PHF2W	6	6	-	1	-
QUAD	2	2	-	-	-
RD	4	4	-	-	1
SC	9	7	1	-	-
SN	3	2	-	-	-
TA	12	8	1	-	2
TMT	17	15	4	4	4
UL	4	4	1	1	1
VT	3	-	-	-	-
WING	15	7	1	-	-
Total			13%	10%	20%

Bone Modification

The avian remains were also examined for signs of cultural and non-cultural processes that may have affected the integrity of the assemblage. The only non-cultural modifications on these remains are light rodent modification on one humerus and carnivore modification on one long bone fragment. Considering that only two of the 205 specimens retained modifications, the avian remains have been altered very little by non-cultural modification. The cultural modifications far outnumber the non-cultural effects, as cutmarks, burning and breakage are present on almost half the remains (Table 4.10). There are 25 elements that display cutmarks, all of which are long bones with the exception of one terminal phalanx also retaining evidence of butchery. Burning occurs on only 19 specimens and is confined to lower and upper limb elements such as tarsometatarsii and humeri. Breakage is more common, with 38 elements being broken, 18 of which are long bone fragments. The cranium also shows signs of breakage in the form of skull fragments and one individual (species unknown) has clearly suffered blunt force trauma to the head. Another interesting breakage pattern is that of the tarsometatarsus, which exhibits a pattern of breakage at the distal end.

Table 4.11 Avian Element Class Size

Element	NISP	Class Size		
		1	2	3
CA	2	-	2	-
CE	4	1	-	3
CMC	11	3	5	2
CRD	4	1	1	3
CRN	9	3	4	1
CUNI	1	-	-	-
FB	3	-	-	-
FIB	3	-	1	-
FM	3	-	2	1
FUR	1	-	1	-
HM	20	6	13	1
HUX	9	1	2	6
IM	1	-	-	1
LB	31	10	8	9
MR	2	1	1	5
PH	12	-	5	-
PHF	2	-	-	-
PHF2W	6	2	2	2
QUAD	2	-	2	-
RD	4	1	-	2
SC	9	3	4	-
SN	3	-	1	-
TA	12	3	6	-
TMT	17	1	12	4
UL	4	1	-	1
VT	3	-	-	2
WING	15	5	2	5
Total NISP		42	69	46

Aquatic Remains

The aquatic resources that have been identified from the Skadeland remains are those of mussels and fish (Table 4.12; Table 4.1). These remains comprise only a minor part of this analysis but are included to consider all the potential dietary and ritual faunal resources.

Mollusks

The bivalves in the assemblage were analyzed by John Lambert (Powell et al. 2008), and represent a total of 117 (NISP) mussel remains of which 85 are identifiable to species. These specimens represent 12 different species with the plain pocketbook, *Lampsilis cardium*, being the most abundant species constituting 29 percent of the total NISP for the site (Table 4.12). All taxa identified in the assemblage are locally available with the exception of a single, small marine shell bead. When % MNI (MNI for an individual species / total MNI) is plotted against average meat weight by species (Parmalee and Klippel 1974; Theler 1991), a weak positive relationship is apparent ($r = 0.44$, $p = 0.13$) (Figure 4.8). Despite the fact that this relationship is not statistically significant, it appears that high-utility bivalve species are being preferentially exploited over lower-utility species.

Cultural modifications to the assemblage include: a total of 33 percent of the valves are worked and three percent of the valves are burned. The Skadeland bivalve assemblage accounts for only 3 kg of edible meat providing a meager 0.8 kcal-days or four protein days for a single individual (Parmalee and Klippel 1974). Based on experimental studies, which indicate harvest rates can exceed 175 mussels per hour per individual, the entire Skadeland assemblage (MNI = 56) could have been collected by a single person in 40 minutes (Theler 1987, 1991). In ethnographic accounts, mussels were cooked by exposure to a fire for a brief period of time. If this is the case for the Skadeland bivalves, the lack of burned specimens may indicate that the valves were processed at an off-site location. Additionally, the high proportion of worked shell present at Skadeland may reflect processed shell transported back to the site for cultural uses. This speaks to the dual importance of freshwater mussels within the Mill Creek culture as both a subsistence resource and as raw material for the creation of artifacts.

Table 4.12 Skadeland Bivalve Remains

Scientific Name	Common Name	MNI	%MNI	Average Meat Weight (g)	Total Meat Weight (g)
Amblema plicata	threeridge	4	7.1%	36	144
Elliptio dilatata	spike	4	7.1%	12	48
Fusconaia flava	Wabash pigtoe	3	5.4%	16	48
Lampsilis cardium	plain pocketbook	16	28.6%	80	1280
Lampsilis siliquoidea	fatmucket	4	7.1%	55	220
Lasmigona complanata	white heelsplitter	2	3.6%	99	198
Leptodia fragilis	fragile papershell	3	5.4%	44	132
Ligumia recta	black sandshell	7	12.5%	76	532
Pleurobema sintoxia	round pigtoe	6	10.7%	29	174
Quadrula pustulosa	pimpleback	2	3.6%	18	36
Quadrula quadrula	mapleleaf	3	5.4%	25	75
Strophitus undulatus	creeper	2	3.6%	18	36
					Total = 2923 g

(Derived from Powell et al. 2008)

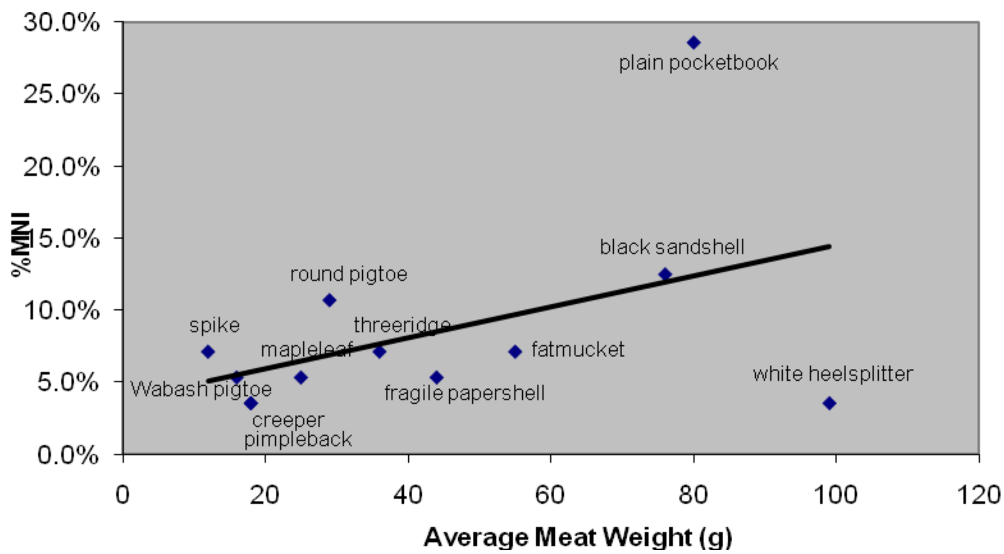

Figure 4.8 Bivalve average meat weights plotted against %MNI.
(Derived from Powell et al. 2008)

Fish

At Skadeland, fish remains number 82 identifiable specimens (Table 4.1), most of which could not be identified to specific element. The remains were dominated by vertebrae (NISP=23) and unidentifiable flat bone fragments (NISP=54). Only two remains (2.4%) exhibit any signs of non-cultural modifications in the form of mild rodent damage. Cultural modifications are also minimal: burning on five specimens (6.1%) and breakage of 10 (12.2%). The breakage occurs mainly on the spinal elements, which could have occurred during butchery. Since we are unaware of the species of fish represented at the site, we cannot be certain of the dietary significance this resource may represent. Further research is needed to verify the number of individuals and fish taxa that are represented by the remains.

CHAPTER 5
DISCUSSION AND INTERPRETATION

"When I questioned them as to what they did when they could not locate a moose, I was told that this never happened. They say that, when they want a moose they get a moose, and when asked what happens if they don't get a moose on a given day, they say they try again later, and they will get a moose." Calvin Martin (1978:126)

The previous chapters have laid the groundwork concerning the necessary data and interpretive framework needed to construct a fresh perspective on Mill Creek faunal exploitation. These tools include: 1) a taphonomically informed analysis of the Skadeland faunal assemblage, 2) ethnohistoric observations of animal exploitation and utility necessary to bolster behavioral inferences and 3) expectations of animal significance and function derived from recorded Plains Indian mythology. Additionally, faunal evidence from the Brewster and Phipps sites will be compared with the Skadeland remains for a broader picture of Mill Creek behavior. These data will facilitate distinctions between subsistence and non-subsistence based resource exploitation and more accurately determine where resources lie on the complex continuum of subsistence to ritual foraging.

In this study, prestige and subsistence foraging are described as a spectrum, because the use of a resource is not confined to a purely subsistence or ritual function. As indicated by mythological and ethnographic data, the procurement of animals has ritual significance (e.g. ritual paraphernalia, social status, etc.), while also providing for dietary needs. For example, bison hunting is labeled as subsistence foraging, since bison meat provided a major contribution to diets on the plains. However, the Mandan and Hidatsa exhibit the ritual significance of bison hunting through their mythologies, ceremonies and the prestige men received when they successfully procured these animals. Therefore, a continuum is necessary to combine these three lines of evidence for a broader assessment of the ritual and symbolic view of animals that influenced a hunter's selection of resources, while also taking precautions not to stretch interpretation beyond documentary evidence. From the archaeological remains, we can begin to understand the resources selected by prehistoric hunters and why these species were exploited.

Before discussing the Skadeland remains in light of ethnographic and mythological animal procurement, animal representation in ethnography, mythology and at the Skadeland site are compared to examine the capacity of ethnographic and mythological data to predict prehistoric faunal exploitation. Table 5.1 displays the frequency of animals in ethnographic accounts, mythological references, and at the Skadeland site showing similar patterns of animal significance among these three lines of evidence. Acknowledging the ethnographic accounts and mythology of the Mandan, bison are predicted to be the focus of Mill Creek foraging. This prediction holds true at the Skadeland site, as the bison is the most abundant animal identified amongst the remains. Ethnographic and mythological accounts mention other animals as well, but these references are few in comparison to the bison. Deer, elk, dog, and birds, specifically the eagle, are the next most abundant being mentioned in 5-10% of accounts. At the Skadeland site, deer, birds (waterfowl, hawks, owls and eagles), elk and canine/dog are also the second most abundance based on NISP. Finally, the remaining animals mentioned in ethnography and myths depict a variety of small mammal and bird species that account for <5% of animal references. The Skadeland remains continue to mimic the ethnographic and mythological accounts, as the remains contain a variety of small mammals and birds that represent only a small portion of the identified elements. Given the similarities between these data, we can confidently use the ethnographic and mythological data as predictors of Mill Creek faunal exploitation.

Table 5.1 Animals Procured According to Ethnographic Records, Mythology and Skadeland Faunal Remains

Ethnographic Accounts			Mythology			Skadeland			
Animal	n	%	Animal	n	%	Animal	NISP	MNI	%
Bison	77	50.7	Bison	32	18.2	Bison	777	4	77.2
Deer	15	9.9	Elk	15	8.5	Pocket Gopher	56	11	5.6
Eagle	11	7.2	Birds	15	8.5	Fetal Bison	55	2	5.5
Antelope	6	3.9	Eagle	13	7.4	Deer	37	1	3.7
Dog	6	3.9	Snake	10	5.7	Hawk	16	6	1.6
Elk	6	3.9	Deer	9	5.1	Eagle	13	2	1.3
Wolf	4	2.6	Bear	8	4.5	Canine/Dog	12	1	1.2
Fox	3	2.0	Owl	6	3.4	Elk	8	1	0.8
Porcupine	3	2.0	Beaver	6	3.4	Owl	5	5	0.5
Bear	2	1.3	Rabbit	6	3.4	Ground Squirrel	4	2	0.4
Bird	2	1.3	Fish	5	2.8	Prairie Chicken	3	2	0.3
Prairie Chicken	2	1.3	Magpie	5	2.8	Wood rat	3	2	0.3
Water Fowl	2	1.3	Pocket Gopher	4	2.3	Beaver	3	1	0.3
Bighorn Sheep	1	0.7	Porcupine	4	2.3	River Otter	3	1	0.3
Fetal Bison	1	0.7	Dog	4	2.3	Water fowl	2	2	0.2
Frog	1	0.7	Mouse	4	2.3	Muskrat	2	1	0.2
Geese	1	0.7	Raven	3	1.7	Turtle	1	1	0.1
Hawk	1	0.7	Turtle	3	1.7	Fox	1	1	0.1
Mountain Goat	1	0.7	Meadowlark	3	1.7	Goose	1	1	0.1
River Otter	1	0.7	Wolf	3	1.7	Skunk	1	1	0.1
Rabbit	1	0.7	Goose	3	1.7	Weasel	1	1	0.1
Rattle Snake	1	0.7	Skunk	2	1.1	Squirrel	1	1	0.1
Raven	1	0.7	Fox	2	1.1	Woodpecker	1	1	0.1
Mussels	1	0.7	Blackbird	2	1.1	Birds	205	-	
Turtle	1	0.7	Coyote	2	1.1	Mussels	117	-	
White Weasel	1	0.7	Antelope	2	1.1	Fish	82	-	
			Hawk	2	1.1	Rodent	73	-	
			Otter	1	0.6	Small Mammal	62	-	
			Mussels	1	0.6				

Therefore, this chapter will further examine the Skadeland remains in light of the ethnographic and mythological data.

The current view of Mill Creek subsistence is based on identifying faunal remains to determine the number of animals (MNI) present, which is then used to calculate an estimate of meat or calories provided by those animals. This method neglects the human decision making progress that created the assemblage (Tiffany 1982; Dallman 1983), so we must consider resource selection from a functional, social and ritual perspective rather than just explain the presence of fauna through an economic lens. What differences would we expect if resource selection is culturally driven versus subsistence driven? The Skadeland faunal assemblage contributes to a comprehensive understanding of Mill Creek faunal exploitation, and allows us to test predictions derived from ethnographic and mythological accounts.

Large Mammals

Skadeland Assemblage

The Skadeland large mammal assemblage is in excellent condition, showing only slight modification by non-cultural agents. Based on the observed modifications, the large mammal remains were procured by hunters in close proximity to the village. These remains were transported to the Skadeland site for further processing to access meat, marrow and grease, as evidenced in the high rate of fragmentation and green bone breakage. After these resources were acquired, the bones were discarded and subjected to a brief period of exposure to carnivore and rodent damage. However, based on the minimal damage to these elements and lack of surficial weathering, these remains were only exposed for a brief period of time before being buried.

Non-cultural Modifications

Although non-cultural modifications appear to be few, damage from rodents and carnivores cannot be ignored. The damage imposed by these agents can disrupt identification by destroying element landmarks, and smaller bones can be completely removed by carnivore consumption. The presence of domesticated dogs at the Skadeland site probably contributed to the destruction of the remains, as a minimum of one canine, most likely a domesticated dog, was identified from the remains. These animals were probably allotted access to the faunal remains, once humans had extracted all possible resources from the skeletal elements. The Skadeland remains exhibit the most carnivore damage on the low utility elements of the metapodials, phalanges and antler. The highest incident of carnivore modification occurring on the distal metapodials falls in line with actualistic observations in which carnivores approached the distal end of caribou metacarpals in order to consume the cartilaginous material between the phalanges (Binford 1981). Carnivores may have been given access to the metapodials because they do not contain large amounts of meat, marrow or grease resources wanted by hunters.

In addition to low utility elements, the carnivores at Skadeland were given some access to higher utility elements as indicated by modification to the long bones and ribs. The long bone and rib remains show human butchery patterns of green bone breakage and fragmentation demonstrating exploitation of meat, marrow and grease prior to granting access to carnivores. Though the remains indicate that carnivores had some access to the higher utility elements, it does not appear that they have affected the original pattern of element frequency. If carnivores had ravaged the assemblage we would expect to see a higher frequency of long bone shaft elements as compared to long bone ends preferred by carnivores (Blumenschine and Marean 1993). However, the Skadeland bison remains have a similar frequency of long bone ends and shafts, indicating that carnivores did not play a significant role in the formation of the assemblage.

Behavioral Interpretation

Carcass Transport

Due to the accumulation of multiple hunting events, questions of carcass transport are difficult to address (Binford 1982). When examining palimpsest faunal assemblages, the only way to extract inferences of carcass part preference is if redundant choices were made regarding the packages selected for transport. Ethnographic research has shown that, although there is situational variability, some body parts are transported more frequently than others. These preferences should be reflected in the archaeological record if destruction from attritional processes in not a factor (Bunn et al. 1988; O'Connell et al 1988; Lupo 2001).

Figure 5.1 Fetal bison bone from the Skadeland faunal assemblage. Image of (a) Long bone shaft, (b) Femur shaft, (c) Tibia, (d) Metatarsal, (e) Astragalus, (f) Intermediate carpal

If the faunal sample is a complete representation of the site, the amount of archaeological remains can be used to infer an extended stay at the Skadeland site. Based on the identification of two fetal bison, one mid-development and one nearing full maturity, the site was occupied from at least a January to April timeframe, probably longer based on the large accumulation of ceramic and lithic materials at the site. The varying stages of fetal bison development also suggest that the presence of bison elements can be attributed to multiple hunting trips, as opposed to a single kill event. Furthermore, the presence of fetal bison remain may represent a food fetish of the Mill Creek people. Ethnographic reports indicate that for the Mandan, unborn bison calf meat was a delicacy (Boller 1959), and this suggestion is supported by the Skadeland remains and Dallman’s (1983) identification of a minimum of 11 newborn/fetal bison at the Phipps site, a Mill Creek site just a few miles downriver from Skadeland. The Skadeland fetal bison elements have sustained cutmarks on the zygomatic arch, which probably resulted from cranial disarticulation. Additional cutmarks on femur, humerii, an unidentified long bone and rib elements are further evidence of butchery, presumably for subsistence.

During multiple hunting trips, Skadeland hunters appear to have employed an opportunistic hunting strategy, where individual bison were taken in close proximity to the village (Tiffany 1982). This strategy would have allowed for the transport of entire carcasses for further processing at the village. Representation of all bison skeletal elements provides evidence for this strategy and may indicate signs of food stress, signifying all elements were utilized to alleviate food shortage (Bayham 1979). The skeletal profile (Figure 4.1) reveals several discrepancies in element frequencies. For example, there is a lack of axial elements with the exception of mandibles. In contrast, forelimbs are well represented by high MAU values for radii and metacarpals, while high tibia and femora MAU values indicate hindlimb abundance.

According to an ethnographic account of bison transport (Table 2.5), the ribs, femur, tibia, radius, humerus, thoracic and lumbars were transported back to the residential site, while the skull, cervical vertebrae, pelvis, sacrum, metapodials, phalanges, carpals and tarsals were left behind (Wilson 1924). The small sample size makes it difficult to verify transport patterns, since only four bison hunting events can be confirmed from the Skadeland remains. However, since the presence of radii is used to establish the MNI, it appears that the fore limb was selected for transport over other skeletal elements. The femora, tibii, and metatarsals are also highly represented, which indicates selection of the hind limb for transport to the residential camp. The ribs and vertebrae exhibit low element frequencies, which is unexpected based on utility and recorded transport strategies, but the frequency may be explained by the high rate of fragmentation. Based on the high fragmentation rate, these elements may appear to be less frequent because of the difficulty in identifying small fragments.

Assuming that fragmentation accounts for the apparent lack of ribs and vertebrae, the elevated frequency of long bones, ribs and vertebrae match well with what elements we expect to be transported. It is clear that the same transport decisions were not made during every hunt, as the presence of every element suggests complete transport of at least one bison. The high frequency of crania is one discrepancy between expected and observed element frequency. The cranium exhibits the highest rate of fragmentation in the assemblage, which has prevented identification of more than one individual from the bone fragments. However, an examination of teeth age determination indicates a minimum of four individuals represented in the assemblage, three mature and one immature animal. This abundance may be a result of the small sample size, but it is noteworthy since the transport of cranial elements is not expected based on optimizing transport strategies. The cranium is one of the lowest utility elements and would be expected to be discarded at the kill site in exchange for higher utility elements selected for transport and further processing at the camp site.

The ethnographic and mythological accounts do suggest that skulls of bison were used during ritual ceremonies performed to bring bison to the area (Bowers 1950). The bison skull was worshiped (Lewis and Clark 1959), and it was attached to the body as a form of torture inflicted to cause a vision experience (Bradley 1986). The use of the skull in these activities would increase the benefit gained from transporting an element with low food utility. If this element frequency is truly representative of carcass transport, the transport of low utility crania can be considered an indication of ritual bison use. This premise can also be applied to the scapula, which is also of low meat and marrow utility. However, ethnographic reference and archaeological evidence suggests that this element was utilized as a hoe for gardening (Bradley 1986). Therefore, the presence of the skulls and scapulae, relatively low-utility elements, at Skadeland is best explained by their use in ritual (skulls) and agricultural tools (hoe).

Carcass Utility

Highly mechanistic utility indices must be used with caution, as the degree of carcass use will vary with cultural and situational contingencies, such as people and pack animals available to transport meat, distance to camp, nutritional condition and so forth (Brink 2004). The use of utility indices has been widespread, but the application of indices to faunal collections is challenged by the ambiguities of archaeological assemblages (Binford 1978; Otarola-Castillo 2006; Hall 2007). The Skadeland assemblage, like other assemblages, faces a number of uncertainties because of the salvage nature of excavation which has resulted in the loss of some remains. The entire Skadeland site was not excavated and excavation methods employed have biased the assemblage to the recovery of larger remains; therefore some bones were not recovered, which may distort the observed pattern and has likely caused an underestimate of the number of bison, elk and deer exploited. Regardless of ambiguity, the assemblage has been examined for meat, marrow, grease and total package utility and the following discussion will address the exploitation of these resources by the Skadeland inhabitants.

The meat is the first resource to be procured from the carcass, as it is the most accessible. If the focus of Skadeland bison exploitation was meat, we expect a positive correlation between meat utility and MAU% element ratios. However, the Skadeland bison assemblage shows a relatively even transport of all meaty elements with no preference toward just meat exploitation. This indicates that meat was not the only resource being considered when elements were selected for transport to the camp. Following the removal of meat, two resources remain: marrow and grease. Marrow is a resource embedded within the cavity of the long bones and therefore requires the breaking of long bones for removal. Marrow exploitation is indicated by long bone elements displaying evidence of impact fractures and green bone/nutritive spiral breaks.

Figure 5.2 Metacarpals exhibiting spiral fractures as a result of hammerstone impact

Plotting %MAU against (S)MARROW (Figure 4.5) shows the most abundant elements rank high in marrow utility, creating an unbiased utility curve (Binford 1978) and further indicating that marrow utility was an important consideration in transport strategies. The extraction of marrow from the metapodials is especially interesting, considering their marrow cavity is among the most difficult to access of any element (Figure 5.2) (Hill et. al. 2008). In ethnographic documentation, boiling meat, in addition to drying meat, was the preferred method of cooking (Boller 1868). The extracted marrow could have been added to the water to make gravy and enhance the flavor of the meat (Binford 1978; Yellen 1977).

Beyond marrow extraction, the long bones could have been boiled to extract grease and other nutrients. However, the long bones do not exhibit fracturing beyond the spiral fractures of marrow extraction, so it is not suggested that the long bones were further processed for grease. Instead, the vertebrae display butchery more typical of grease extraction, as they are highly fragmented to the ‘pot size’ needed for boiling bones in vessels to extract grease. Like marrow, bones boiled with the meat leads to the absorption of valuable nutrients such as lipids, carbohydrates, and vitamins imperative to a healthy diet (Vehik 1977). These nutrients would have been especially significant during the winter months when animals are particularly lean (Brink 1997; Lupo and Schmitt 1997). Bone would also have also been boiled separately to produce grease for use in preparing hides or making bone butter (Davidson and Gregg 1986:39). Grease is a tasty addition to meals and, according to ethnographies, grease played an additional role in the tanning of hides (Wilson 1924).

The calculated total package utility index (Figure 4.7) is negatively correlated with %MAU (a reverse utility curve). This pattern can be attributed to the lack of identifiable, high utility axial elements. The apparent lack of axial elements, frequently interpreted as a function of preferential transport, could be attributed to the fragmentary nature of vertebral and rib segments resulting from their use in bone grease manufacture (Binford 1978). These patterns of marrow extraction and grease rendering provide evidence for extensive carcass utilization supporting hypothesis 1 (outlined in Chapter 2). These high-intensity processing measures imply that Skadeland inhabitants either (a) had leisure time to exploit these resources or (b) or were experiencing food shortage and found it necessary to exploit bison carcasses in this manner. It is certain that the Skadeland group was intensively processing bison carcasses as a food resource; however, the motive for such behavior remains difficult to ascertain.

The mythological and ethnographic descriptions depict bison as a key subsistence resource, valued source of robes and hides, and the focus of ceremony performed to call the bison. “The simple fact is that the Plains culture could not have survived without the buffalo,” (Oliver 1962:15). While dependency on the bison has been questioned (Cooper 2009), Oliver’s observation holds true for Mill Creek residents of the Skadeland site, as the bison’s significance is readily supported by the archaeological remains present at the site. The bison clearly held high status in the subsistence economy and likely an elevated ritual status because of dependency on the animal for the community’s well being. The records of Mandan and Hidatsa ritual behavior and hunting strategies focused around bison provide a glimpse into the ritualized behavior surrounded bison hunting by the Mill Creek people.

While ritual behavior is difficult to extract from the bones themselves, further analysis of ritual structures and iconographic imagery may be able to add to our understanding of ritualized bison hunting. The Plains culture placed emphasis on the ability of males to call bison to the village and return successfully with provisions for the village (Beckwith 1937; Bowers 1950). For the Mill Creek people, who pursued these animals on foot, it must have been an intimidating and dangerous endeavor that brought high praise upon success. Further emphasis would also be placed on the acquisition of bison hides, as social status was achieved through becoming an owner of ceremonial bundles, which were bought using hides and other valued products.

In addition to bison, the presence of deer and elk remains in archaeological contexts is suggested to be the result of subsistence foraging (Dallman 1983). The Skadeland remains contain only a small number of elk (n=8) and deer remains (n=37), but the quantity is to be expected based on the use of these animals as supplementary resources and the small assemblage size. The elk and deer remains contain cultural modifications in the form of cutmarks and green bone breakage. Cutmarks occur on four deer elements, while breakage has been sustained by 40% of elk and deer elements. This extensive breakage is typical of bones that have been crushed for boiling, and this processing method is interred at other late prehistoric sites with elk and deer assemblages (Hall 2007). These data combined with mythological and ethnographic accounts depicting elk and deer as common dietary resources and archaeological evidence from across the plains showing signs of deer and elk butchery, suggests that subsistence is clearly the focus of exploiting elk and deer.

In the Plains Indian mythology, eight of 13 myths mention elk and six of 13 mention deer (Table 2.2). The elk and deer are described in this context as being plentiful near the river and good for food. The elk seems to have the greatest ritual significance of the two, and it is presented in mythology as a subsistence resource that was also valued for its hide, antler and teeth. Elk teeth are further mentioned as a valued embellishment for clothing. The deer takes on a role in mythology being mentioned as a subsistence resource, a source of soft hides and a helper in the fields. Aligning with mythology, the elk and deer are frequently mentioned in ethnography as the prey of choice during encounter hunting. After bison, elk (n=6) and deer (n=15) receive the second most attention in ethnographic accounts. The elk and deer are used for meat, skin for making rope, the teeth for clothing trim and antler for handles of tools (Wilson 1924; Boller 1868). Like the bison, the household items provided by the products of the elk and deer play a significant role in the lives of prehistoric people, but the focus of these resources appears to be use as dietary supplement. While the elk and deer do not take precedence over the bison, deer and elk recovered from the Skadeland site exhibit cultural modifications interpreted as exploitation for meat, marrow and grease.

Overall, large mammals, including bison, elk and deer, are frequently mentioned in Plains ethnographies and mythology as the preferred dietary staples. The bison is the most frequently referenced animal in the ethnographic literature, representing over 50% (n=77) of the animals mentioned (Table 2.3). While elk and deer take a lesser role in mythology and are secondary in ethnographic account of animal procurement, these animals are depicted as important dietary resources. Bison, elk and deer are also referenced as significant for construction of a wardrobe made from their hides. We do not have preserved hide robes, leather shields, boats or other products made from bison, deer and elk soft tissues, so it is often difficult to make conclusive inferences about the ritual significance of these resources. The mythological and ethnographic data provides some insight into how Plains tribes viewed and used these resources.

Small Mammals

The presence of small mammal remains at Mill Creek sites is one aspect of prehistoric fauna evidence that has received little attention. The Skadeland assemblage, like other late prehistoric assemblages, consists of numerous locally available small mammal species that are represented by only a few identifiable specimens. When provided with such minimal faunal evidence, assessing the utility of such scarcely represented taxa poses a challenge. What reliable interpretation can be made regarding the presence of, for example, one rabbit femur or two snake vertebrae? How can this data add to our current knowledge of prehistoric lifeways?

To overcome this challenge, small mammal data from numerous Mill Creek sites can be combined in an effort to identify broader patterns of element frequencies and cultural modifications. Unfortunately, the minimal skeletal evidence has resulted in analyses that focus solely on large mammal exploitation with the possible inclusion of a list of the small mammals identified (Frankforter 1969). These lists lack any connection between the remains and the cultural processes that brought them to rest. Therefore, we are unsure why the animal remains are at the site, their abundance or the elements that were transported. The literature is slim on suggestions for the presence of small mammal remains, providing three main suggestions including expanding diet breadth, boyish adventures (Dallman 1983) and invasive species (Semken 1971). However, there is a lack of convincing evidence for these behaviors.

The ethnographic record and animal representation in mythology were reviewed to determine motivating factors for Mill Creek people to exploit small mammal species (as outlined in Chapter 2). The mythology and ethnographic records present the use of resources such as the beaver, rabbit, dog, mouse, pocket gopher, porcupine, toad, turtle, wolf, badger, coyote, fox, prairie dog, skunk, mole and otter, many of which are the same animals procured by Mill Creek villagers. These locally available resources would have been easily accessed by the Mill Creek villagers, and according to ethnographic and mythological analogy were hunted for 1) inclusion in ritual paraphernalia, 2) their fur and 3) as a minor part of the diet. To more accurately determine the function of these species to the Mill Creek people, the Skadeland faunal remains are used to test these hypotheses created from the ethnographic data.

Ethnographies and myth indicate the use of various small mammals in Plains Indian ritual, so the Mill Creek ceremonies and rituals many also have incorporated a variety of clothing, hair pieces, rattles or others paraphernalia made from small mammals. According to Mandan and Hidatsa ideology, people were animals before they became human, and therefore, each person had their own animal protector or medicine, who gave them power and protection (Wilson 1924). The individual owned the medicine of their animal protector through a personal bundle that contained elements of that animal. The animal protector was even the protector in death, as a portion of the animal medicine would be buried with the deceased. For example, one Hidatsa man's medicine was the otter, and upon burial, an otter skin was placed under his head as a pillow. The Skadeland remains represent a variety of locally available small mammals such as the otter, which could have been procured for their ritual significance. Given the wide variety of small mammal taxa represented in similar frequencies, this hypothesis cannot be excluded. The Skadeland small mammal remains may represent numerous hunting events focused on procuring the medicine of animal protectors. In addition to faunal remains, the Mill Creek ceramics provide evidence of animal ritual/medicine focus, as several vessels have been reported with animal imagery such as deer, fox, beaver and bird head handles (Anderson 1981).

As described in Chapter 2, the ethnographic recordings of Mandan and Hidatsa animal uses and mythological representations report numerous instances of small mammals captured to acquire their fur. These accounts include procurement of weasel, wolf, coyote, fox, otter, rabbit, beaver, skunk and badger pelts. These elements were commonly used by the Mandan and Hidatsa for personal adornment, ceremonial paraphernalia, personal bundle construction and a valuable trade items. Since the furs have not been preserved in the archaeological record, an understanding of processing and technique of skinning is necessary to interpret faunal evidence produced by these activities. Experienced taxidermists report that if a freshly dead animal is skinned carefully and the carcass is not required for any other resources, there could be no elements associated with the pelt and a complete skeleton associated with the carcass. Depending on the extent of field processing, it is possible that the cranial, metapodial and caudal bones may be left attached to the end pelt, especially if a ‘trophy’ skin is desired. The treatment of the skull, feet and tail would depend on the species and since these elements have little nutritional value the remains could also be indicative of butchery waste (Fairnell and Barrett 2007). The transport of these elements with the pelt is an event mentioned in Mandan mythology, as the Red Stick myth describes a hunting expedition in which a hunter brought back “a beautiful otter skin with the skull still in it” (Bowers 1950:319). Ethnographically ‘trophy’ skins of mustelids (weasel, mink, skunk and otter) were most commonly observed (Peterson and Berg 1954), and one example, a mink pelt, was collected with part of the cranium, mandible and foot bones remaining in the stuffed skin (Ubelaker and Wedel 1975).

The skinning and butchery process is also characterized by a pattern of cutmarks that reflect anatomically sensible locations to achieve the desired end product (Olsen and Shipman 1988). In the case of small fur bearing mammals, cutmarks would be expected at the foot-limb articulations and around the cranium, maxilla and mandible (Charles 1997; Strid 2000). However, an expert skinner could conceivably leave no cutmarks and avoid unnecessary blood and guts (Fairnell and Barrett 2007). The presence of other cutmarks is more likely to be the cause of dismemberment for filleting, such as marks around the acetabulum or proximal limb bones (Strid 2000). The skinning and filleting of an animal for meat are not mutually exclusive, as an animal could be skinned and then dismembered and filleted for meat, creating dual patterning (Charles 1997; Strid 2000; Trolle-Lassen 1987). The dual use of fur bearing species is also mentioned in mythology. In the Big Bird mythology, hunters went to kill a unique red furred jackrabbit an elder had seen on the countryside. The hunters killed the animal, and the elder, who requested the pelt, skinned the animal and then ate the meat (Bowers 1950).

The Skadeland small mammal remains are represented by 85 specimens identifiable to skeletal element. An examination of these remains indicates that 44% (n=37) are elements that would be incorporated in a ‘trophy’ skin, including the cranium, phalanges and caudal bones. The fox, otter, squirrel and skunk are represented only by elements indicative of fur procurement and are therefore suggested to be remnants of prestige foraging. The fox is represented by a mandible fragment that shows signs of green bone breakage by humans, possibly during the creation of a stuffed skin. The mythology and ethnographic reference of the fox is dominated by description of fur use (especially the fox tail) for ankle wraps and head bands (Bowers 1950; Boller 1868), while there is no mention of eating fox meat. This meat could have been eaten, but fox meat has very little fat, making it tough and likely not a favorite of the Mill Creek people. The otter is represented by a caudal vertebra from the tail and two phalanges, a skunk axis is present and a squirrel is represented by a mandible; all indicating potential fur exploitation. The squirrel is not mentioned in ethnographic or mythological accounts, but the otter and skunk are both mentioned in mythology for the exploitation of their fur. Besides the breakage of the fox mandible, none of these elements exhibited signs of human modification. Nevertheless, the combination of archaeological evidence and ethnographic and mythological data lead to the interpretation that the fox, otter and skunk remains are the result of fur procurement likely associated with gaining prestige within the society to increase fitness.

The elements not associated with a 'trophy' skin including the long bones, pelvis and axial elements account for 56% of the assemblage. The ground squirrel (1 femur, 1 humerus, 1 scapula), muskrat (1 ulna), woodrat (1 femur, 1 humerus, 1 tibia), weasel (1 tibia) and beaver (1 femur) are represented by at least one long bone element. Of these animals, only the weasel and beaver are directly mentioned in ethnographic or mythological accounts. The weasel is discussed in an ethnographic account of fur procurement, but given the presence of a weasel tibia exhibiting cutmarks typical of filleting for meat, the weasel may also have been used as food. The beaver is mentioned only in mythology as a character that became angry at the villagers and threw flint knives from its tail at them, and as being plentiful in the area. The one beaver represented at Skadeland is indicated by a femur that has been cut and broken by human butchers. Like the weasel remains, this element exhibit modifications typical of processing for meat. The beaver is a likely source of food, since the meat is desirable for its high percentages of protein, minerals and fat content. The thigh (femur) is the meatiest element of the beaver, and exploitation of a mature beaver can provide 5.5 kg (12lb) of meat (Jankowska et al. 2005). The exploitation of beaver for their pelt cannot be ruled out, but the evidence available indicates the use of beaver for subsistence.

The ground squirrel, muskrat and woodrat present an interpretive challenge since no mention is made of these animals in mythology or ethnography. However, some suggestions can be made based on the use of similar animals, element representation and characteristics of these animals. The ground squirrel is also referred to as a gopher, so this animal will be examined in the following section on pocket gopher abundance. As for the muskrat and woodrat, these elements show no sign of human modification, but based on context it is assumed that human activity brought the remains to the Skadeland site. The muskrat may have been exploited for its thick fur, subsistence or used for baiting raptorial birds. The muskrat weights between 1.5 to 4 pounds and is said to taste similar to rabbit meat (Caras 1967), which was recorded ethnographically as being enjoyed as part of a celebratory feast (Boller 1868). The presence of the muskrat ulna is not substantial evidence to rule out any of these possibilities. The woodrat is much smaller than the muskrat, weighting only half a pound. This weight makes it unlikely that this animal was procured for food, but rather mention of mice in myths suggests a potential mythological significance described as being the grandmothers who gave advice. However, it is also noted that caution should be taken when making interpretations of burrowing animals such as the woodrat, because this animal may be intrusive to the site (Semken 1971).

The mythological, ethnographic and archaeological data support the differential use of various animals. Addressing hypothesis 2 (outlined in Chapter 2), animals such as the skunk, otter and fox appear to have been exploited for their furs, as predicted by the myths and ethnographic accounts. The minimal evidence available from the Skadeland site also supports the use of beaver as a food resource. Interpretations of other resources are not as well supported because of the lack of mythological or ethnographic reference and identification by only one element.

Pocket Gopher

The pocket gopher is the only species that is represented in greater abundance at the Skadeland site than is predicted based on the ethnographic and mythological accounts of its use and significance. Pocket gophers are mentioned only briefly in the ethnographic and mythological records as mythological characters and medicine of the Arikara people. The procurement of gophers is also mentioned by Wilson's (1924) informant, Wolf-chief, who tells of a means used to capture gophers, in which a snare was set in a gopher hole and when the gopher stuck its head out the noose tightened confining the animal. The gophers were then removed from the hole and killed by striking them against the ground, skewered, roasted over fire and eaten (Wilson 1985; Wilson 1924). However, pocket gophers weigh only ½ to ¾ of a pound, so these rodents would not have provided a great amount of meat (Criddle 1930). Nevertheless, such a method of capture would decrease the cost of procuring this animal, potentially to the point that benefits would outweigh the cost of exploitation.

While subsistence is one suggested hypothesis for exploitation of pocket gophers, researchers have questioned the possible use of gophers for their fur, to bait birds of prey or killed for their intrusion and destruction of village gardens (Fishel 1997; Dallman 1983). The pocket gopher could have been exploited for its fur, as it has soft, silky, dense gray fur during the months from December to middle of April, but during the rest of the year is in a perpetual state of molt giving it an odd appearance (Criddle 1930). The gophers are also common prey for owls and hawks, especially the red-tail hawk, Swainson's hawk and great horned owl (Criddle 1930), so their use to bait eagles and other large bird of prey is probable. A final suggestion is that these animals burrowed into nutrient rich areas such as cultivated fields where they have access to green vegetation and disrupted gardens. Based on typical pocket gopher densities, populations can reach numbers of 15-20 per acre (Criddle 1930), creating a great disturbance to Mill Creek gardens.

The pocket gopher has received attention in the Mill Creek literature for their abundance and questions have arisen concerning their subsistence, ritual or intrusive nature (Fishel 1997; Dallman 1983). The pocket gopher is one of the more abundant small mammals identified at Mill Creek sites, as in the Skadeland site, which is contradictory to what is expected based on mythological significance. Since, it is has been noted that caution should be taken when making interpretations of burrowing animals such as the pocket gopher (Semken 1971), the Skadeland remains were examined for evidence of human modification that would indicate human exploitation. The pocket gopher remains from the Skadeland site contain a minimum of 11 individuals, none of which show any signs of cultural modification or differential treatment of elements. However, further examination reveals that regardless of the lack of cultural modifications, the abundance of gophers can only be explained by human transport. For a typical naturally occurring gopher population, one acre (43,560 square feet) would contain a maximum of 15-20 individuals (Criddle 1930). However, at the Skadeland site where only 350 square feet were excavated there are at least 11 individuals. If the pocket gophers at the Skadeland site were an intrusive population, we would expect a maximum of one pocket gopher to have intruded the site.

The Mill Creek people were exploiting pocket gophers, so is it most likely that they were used for food, fur or bait? If the pocket gopher was being procured for subsistence and skewered over a fire, as described by Goodbird, then we would expect to see some burning of gopher remains. Since none of the published data or that from the Skadeland site shows any indication of burning, subsistence does not appear to be the goal of procurement. Even if another method of cooking was being utilized, the small size of gophers at only half a pound makes this an unlikely possibility. The use of pocket gopher for their fur during the months of December to April is possible and may be indicated by the differential treatment of the skeleton, if, as described in the previous section on fur bearing species, furs were processed by leaving skull, feet and tail with the pelt, while removing the axial skeleton and long bones. The abundance of skulls and mandibles is evidence for fur procurement.

A final possible use for the pocket gophers is to bait raptorial birds such as hawks, owls and eagles. This possibility is supported by the ethnographic record, as the Mandan would make bird bait from the skin of an animal such as a rabbit with the skull left in it for a more realistic decoy (Bowers 1950). Therefore, the plethora of pocket gopher skulls at Mill Creek sites could be the remains left from decoys made to capture large birds. This may also explain the lack of gopher significance in mythology, if the presence of gophers is focused around the exploitation of prestigious birds. Further supporting this hypothesis (hypothesis 3, outlined in Chapter 2) is the documentation of the red-tailed hawk, Swainson's hawk, golden eagle and various owl remains at the Skadeland, which are common predators of the pocket gopher. Overall, the pocket gopher remains at Mill Creek sites represent an unexpected abundance that cannot be attributed to natural occurring gopher populations and is most likely the remnant of skinning and creation of bait used in bird trapping ceremonies.

Avian

One of the trademarks of the Mill Creek culture is the abundance of bird bones and thunderbird effigies. The combination of these artifacts has drawn the attention of researchers, who have suggested bird remains to be the result of ritual foraging for feathers and trade items (Fishel 1997). Based on ethnographic and mythological accounts, the Thunderbird god granted the people success in war and hunting, provided rain for the crops and sent bison close to the village (Beckwith 1937; Bowers 1950). The Thunderbird would send his helpers including the owl, eagle, hawk, raven and crow to help the people in these tasks (Wilson 1924). For this reason, the feathers of these birds were prestigious. To acquire feathers, the birds were captured from ceremonial lodges and worn by individuals who achieved a certain status (Davidson and Gregg 1986:37). In addition to thunderbird's relatives, the feathers of the prairie-chicken, duck and owl were chosen to fletch arrows with the feather of the prairie-chicken being preferred for flying the swiftest (Wilson 1924:162). The blackbird, goose, magpie, meadowlark, and swan are also mentioned for their feathers, while ducks and other waterfowl are referred to for subsistence (Boller 1868; Wilson 1985).

The Skadeland remains are dominated by the birds identified in mythology as helpers of the Thunderbird, as 14 (67%) of the 21 individuals identified are eagles (MNI=2), hawks (MNI=7), and owls (MNI=5). The individuals are represented only by wing, lower leg and talons supporting hypothesis 4 (outlined in Chapter 2). This high occurrence of raptor wings and lower legs, coupled with the abundance of these mythological helpers, suggests a focus on bird exploitation for ritual and trade use. When this evidence is combined with the bird as a common iconographic symbol of the Plains Indians, it is hard to deny the prestige associated with the exploitation of these birds. Currently, two hypotheses stand including 1) raptors were being exploited for feathers, which is interpreted from the large number of raptor remains (Alex 1971; Hamon 1961; Scott 1979) and 2) the entire bodies of raptors excluding the distal leg were being traded as indicated by a lack of raptor elements other than the lower limb bones (Fishel 1997). Overall, the assemblage matches well with element frequencies expected of feather exploitation, as there is a high occurrence of raptor lower leg and phalanx elements with few axial elements. At the Skadeland site, only 18% of the remains are from the axial skeleton, while 37% are wing elements and 35% are leg and talon elements.

The reverence assigned to eagles and hawks appears to be a worldwide phenomenon (Clark 1989). In the United States, we even used this creature as a sign of power as our national icon, so it is not surprising that other cultures, such as the Hidatsa and Mandan, see the eagle as a figure of power. In Native American tribes, the raptor is widely regarded as a symbol for the warrior class (Brown 1976, Hall 1991, Howard 1968, LaFlesche 1921). The thunderbird and weeping-eye motif, thought to represent the feather coloration around the eye of a falcon, are common bird iconography from Middle Mississippian imagery. The Mill Creek villagers are thought to have participated in long distance trade with Mississippian tribes (Alex 1971, Henning 1967, Tiffany 1991) and could have been influenced by such iconography to create their own symbols such as the thunderbird effigies mentioned previously. One such long-distance connection is the trade of long-nosed god masks, a few of which are found at Mill Creek sites (Griffin 1967; Kelley 1982). The 'long-nose' of the mask has been interpreted as beaks of eagles providing further evidence of reverence held for these birds (MacCurdy 1913:410).

The second piece of evidence identifying the ritual significance of birds is the abundance of portable thunderbird effigies characteristic of the Middle Missouri tradition (Warren 2007). The distribution of these effigies can be traced from the Mill Creek villages of northwest Iowa along the Missouri River to the historic residence of the Mandan and Hidatsa. These pocket-sized effigies raise questions about the representational meaning of such iconographies, but it is difficult to discern such symbolic meaning of stylized art forms without clues from the artists themselves. However, given the Mandan are the likely descendents of the Middle Missouri tradition, the thunderbird figures may represent the Mandan Thunderbird deity.

In addition to prestige foraging for the feathers of thunderbird's relatives, ethnographers recorded multiple accounts of hunting and eating waterfowl and prairie chickens. The Skadeland remains coincide with ethnographic representation, as the non-raptorial birds identified at the Skadeland site are waterfowl and prairie chickens. Of the 21 individuals, two Mallards (*Anas sp*.), one Redhead duck (*Aythya americana*) duck and two Prairie Chickens (*Tympanuchus cupido*) were likely exploited as a dietary resource, while also stripped of their feathers for use in arrow manufacture and personal adornment.

Mythology and ethnographic records indicate a focus on avian exploitation mainly for their feathers, which carried indication of status. The feathers themselves have not preserved, but evidence of this prestigious resource is presented by numerous eagle, hawk and owl wing and leg elements. Additionally, effigies depicting these raptorial birds add further support to the ritual significance of these species. Subsistence was also supplemented by the capture of ducks (waterfowl) and prairie chickens, which have been identified at the Skadeland site and referenced for their dietary contribution in ethnographic records.

Aquatic

Mussels

This mussel data is difficult to situate in a relevant body of work, as the Mill Creek literature is relatively silent where exploitation of freshwater bivalves is concerned. Some archaeologists hold that freshwater bivalves were never more than a secondary, seasonal resource for late prehistoric groups, and that their main value was as a tempering agent for pottery or as material for the creation of tools (DeVore 1990; Parmalee and Klippel 1974). While shell-tempered pottery has been found at Mill Creek sites (Tiffany 1982), it is far from the norm, and constitutes a small percentage of most ceramic assemblages. In addition, there is a significant body of evidence that suggests freshwater bivalves could have played an important role as a primary subsistence resource (Theler 1987). However, the question remains: did the residents of the Skadeland site view freshwater bivalves primarily as a subsistence item or as a source of raw material for other activities?

Previous research has raised some valuable suggestions as to the use of mussels, but the ethnographic record and mythology provide little supplement to previous suggestions. There is no mention of mussel exploitation in ethnography and only one reference of mussel shells used as a decorative element in mythology. Therefore, we must rely on identification of worked shell and food utility to decipher between subsistence and non-subsistence utility. Beginning with subsistence, experimental studies indicate that harvest rates can exceed 175 mussels/hour/individual (Theler 1987), which means that the entire Skadeland assemblage (MNI = 56) could have been collected by a single person in approximately 40 minutes. These data might indicate that freshwater bivalves were only a very marginal subsistence resource for Mill Creek groups.

As previously mentioned, only 2.5% (n = 3) of the valves in the Skadeland assemblage are burned. However, ethnographic accounts of mussel processing "indicate that cooking mussels requires a very brief period of exposure to fire" (Fishel 1995:69; Waselkov 1987). This disparity, coupled with the very small size of the assemblage, strongly suggests that the Skadeland bivalves were not processed on-site. When % MNI (MNI for an individual species / total MNI) is plotted against average meat weight by species (Parmalee and Klippel 1974; Theler 1991), a weak positive relationship is quite apparent ($r = 0.44$, $p = 0.13$) (Figure 4.8). Despite the fact that this relationship is not statistically significant, it appears that high-utility bivalve species are being preferentially exploited over lower-utility species. This indicates that Mill Creek peoples did, in fact, view freshwater mussels as a subsistence resource. The high proportion of worked shell present at Skadeland (32.5% of the entire assemblage) may indicate that shell was transported back to this residential site from a specialized mussel processing/consumption site located nearby. If this interpretation is correct, the Skadeland bivalve assemblage speaks to the dual importance of freshwater mussels within the Mill Creek culture, as it appears they were utilized both as a subsistence resource and as a raw material for the creation of other artifacts.

Fish

Fish remains appear at many late prehistoric sites including all Mill Creek sites, but the extent to which fish may have contributed to the diet is undetermined. The ethnographic and mythological data indicates that fish traps, set up by family units, were a valued possession (Beckwith 1937). In such a case, the prestige achieved through ownership appears to be as valuable if not more so than the subsistence provided by the fish. In fact, a ceremony for fish trapping was established and highlighted the owners of the fish traps, who led the ceremony (Bowers 1950).

The Skadeland fish remains pose an interpretive challenge since the recovery of such elements has been diminished by the lack of screening done during the Skadeland excavations, as dry screening was only conducted on soil from the cache pits. However, we can say with confidence that the remains are the result of exploitation by the Mill Creek people, and intrusiveness can be eliminated. It is not plausible that the fish remains are intrusive, because fish bones do not travel far because of “their compact shape” (Shafer 1972:61), and bone burning indicates cultural modification. Further evidence of Mill Creek’s focus on fish is present in the form of fish hooks, fishing lures and fish effigies located at

Mill Creek sites. Of the 74 fish hooks, blanks or lures discovered in Iowa, 43% (n=33) of them are from Mill Creek culture sites (Jones 2003). This is a high percentage considering the remaining 57% of fishhooks are shared among six cultures or phases. The abundance of fishing equipment and ethnographic analogy suggest social prestige associated with fish trapping indicates the subsistence and prestige nature of this activity.

Comparison Between Three Mill Creek Villages

Intersite comparison of three Mill Creek sites, Skadeland (13CK402), Brewster (13CK15), and Phipps (13CK21), all located in Cherokee county; exhibit a similar pattern of faunal exploitation that coincides with predictions made by the ethnographic and mythological records. The Phipps site (13CK21) and Brewster site (13CK15) are located approximately nine miles downstream from the Skadeland site along Mill Creek. The Phipps site, which is considered the “type” site for Mill Creek, is located on the south side of Mill Creek in a cultivated field. Cultivation has severely altered the Phipps site, as years of cultivation have reduced the size of the village midden and obliterated all traces of the ditch once reported by local residents (Frankforter 1969). The Phipps site was excavated during three filed seasons in 1955, 1963 and 1994. Analysis of the extensive remains recovered from the site indicate it to be a village site radiocarbon dated between 960 to 1110 A.D. (Fishel 1996), classifying it within the early period of the Mill Creek culture.

The Brewster site lies in a cultivated field on a ridge on the southeast bank of Mill Creek. Excavations of the site were carried out during the summer of 1970 under the direction of David A. Baerreis and Duane C. Anderson (Anderson 1981). A 375 square feet (approximately 115 square meters) area was excavated and all the soil was screened using ¼ inch with some units also being water screened through window screen or 0.425 mm mesh to recover large seeds, rodent bones, snails and other mircomaterials. This site is also identified as a Mill Creek village with radiocarbon dates indicating an approximated 950 to 1050 A.D. occupation.

The Phipps and Brewster faunal remains are only presented in the literature using the analytical unit number of identifiable specimens (NISP), which is a count of the number of bones that could be identified. This unit does not allow for determination of the number of animals at the site or examination of element frequencies that could inform about transport strategies, so the comparison between these sites is only telling of the most abundant animal based on the %NISP. The percentage was created by dividing the NISP for each animal by the total number of bones identified at the site [e.g. Brewster bison: 1745 (NISP) / 3787(total number of bones) = 46.1%]. This percentage allowed for the resources to be ranked at each site with the preferred resources being represented by the highest percentages (Table 5.2).

Table 5.2 Faunal Remains from three Mill Creek Culture Occupations in Northwest Iowa

Taxon	Common Name	Brewster Site 13CK15		Phipps Site 13CK21		Skadeland Site 13CK402		
		NISP	%	NISP	%	NISP	MNI	%
Bison bison	bison	1745	46.1	1896	41.5	832	4	60.2
Canis sp.	dog or coyote	105	2.8	247	5.4	12	1	0.9
Mephitis sp.	skunk	p	-	2	0.0	1	1	0.1
Lynx rufus	lynx/bobcat	-	-	1	0.0	-	-	-
Vulpes sp.	fox	p	-	2	0.0	1	1	0.1
Citellus franklinii	Franklin's ground squirrel	-	-	-	-	4	2	0.3
Citellus sp.	squirrel	-	-	-	-	1	1	0.1
Geomys bursarius	plains pocket gopher	50	1.3	330	7.2	56	11	4.1
Castro candensis	beaver	172	4.5	200	4.4	2	1	0.1
Martes americana	marten	-	-	p	-	-	-	-
Ondatra ziberthicus	muskrat	p	-	1	0.0	2	1	0.1
Lepus californicus	jack rabbit	p	-	1	0.0	-	-	-
Sylvilagus floridanus	eastern cottontail	p	-	1	0.0	-	-	-
Cervus canadensis	elk	47	1.2	81	1.8	8	1	0.6
Odocoileus sp.	deer	313	8.3	699	15.3	37	1	2.7
Scalopus aquaticus	eastern mole	-	-	1	0.0	-	-	-
Procyon lotor	raccoon	p	-	1	0.0	-	-	-
Mustela vison	mink	p	-	1	0.0	-	-	-
Mustela sp.	weasel	-	-	p	-	1	1	0.1
Lutra canadensis	river otter	p	-	3	0.1	3	1	0.2
Taxidea taxus	badger	p	-	-	-	-	-	-
Neotoma floridana	woodrat	-	-	-	-	3	2	0.2
Indeterminate	other small mammals	p	-	46	1.0	135	-	-
Indeterminate	unidentified mammals	-	-	-	-	1327	-	-
Indeterminate	fish	339	8.9	428	9.4	82	-	5.9
Unspecified	birds	1018	26.9	704	15.4	201	21	14.6

Based on the %NISP of animal remain identified at each site, the most abundant resources are as follows:

1. Bison (Brewster=46.1%, Phipps=41.5%, Skadeland=60.2%)
2. Birds (Brewster=26.9%, Phipps=15.4%, Skadeland=14.6%)
3. Fish (Brewster=8.9%, Phipps=9.4%, Skadeland=5.9%)
4. Deer (Brewster=8.3%, Phipps=15.3%, Skadeland=2.7%)
5. Pocket gopher (Brewster=1.3%, Phipps=7.2%, Skadeland=4.1%)
6. Dog/canine (Brewster=2.8%, Phipps=5.4%, Skadeland=1%)
7. Beaver (Brewster=4.5%, Phipps=4.4%, Skadeland=0.1%)
8. Elk (Brewster=1.2%, Phipps=1.8%, Skadeland=0.6%)
9. A variety of small mammals

The similarity between the three assemblages is remarkable, especially considering the variation in site seasonality, resource availability, taphonomic histories and excavator bias that likely influenced exploitation and recovery of the faunal remains. At all three sites, (Table 5.2), the bison and birds have been identified as the most abundant faunal resource, fitting with their recognition in mythological and ethnographic accounts. The fish remains being of third most abundance is a little surprising considering their lack of attention in the ethnographic record. However, there is a catfish trapping myth and ceremony dedicated to fish in mythological accounts (Bowers 1950). In fact, the bison, birds and fish are the only three animals that have mythology dedicated to their procurement and capture, which signifies a correlation between the Mandan mythology and the focus of Mill Creek faunal exploitation.

The deer is the fourth most abundant animal found at Mill Creek sites, which is in line with its high ranking in ethnographic and mythological accounts for its subsistence focus. Fifth, the abundance of pocket gophers identified at the Skadeland site is supported by evidence from the Brewster and Phipps sites. Although these rodents are not frequently mentioned in mythology or ethnography, the pattern of exploitation is undeniable and cannot be attributed to an intrusive cause. Closer examination of the Phipps gopher remains identified that the majority of the remains were secluded to pit feature 8, which contained 50 post cranial remains. The lack of skulls and mandibles was peculiar, as there was an abundance of skulls elsewhere at the site. Additionally, the gopher skulls at Phipps and Brewster exhibit a pattern of breakage at the occipital. The abundance of skulls crushed at the occipital represents disarticulation from the axial skeleton, which as described in the previous section on pocket gophers, is evidence for fur procurement and creation of decoys in which the skull, feet and tail were left in the pelt. The abundance of broken cranial elements and discard of post-cranial elements in pit 8 at Phipps can be interpreted as differential treatment of body parts for non-dietary uses such as pelts, bag preparation and bait for raptorial birds (Fishel 1997).

Dogs are also prevalent at all three sites being important for their use in transporting meat packages from various hunting locals back to the village (Boller 1868; Bradley 1986). The beaver and elk are represented in similar abundance with both likely being significant for their meat and products (e.g. pelts and teeth pendants) (Bowers 1965; Matthews 1878). The beaver is not mentioned in ethnographic accounts, but does play a substantial role in three of the thirteen Mandan mythologies. The beaver’s beautiful fur and nutrient rich meat aided in making the beaver a highly ranked resource. The elk is less highly represented than we would expect based on mythological and ethnographic accounts of its procurement; however this is likely a result of elk availability. For the Mill Creek villagers in northwest Iowa, the elk would have been less prevalent than its abundance in central North Dakota where ethnographers documented its procurement. Finally, a variety of small mammals account for the remained of the faunal remains. Like the ethnographic and mythological accounts, these small mammals are minor in comparison to the exploitation of bison, birds, fish and deer.

CHAPTER 6
CONCLUSION

The Mill Creek manifestation of northwest Iowa has been both well documented and the focus of numerous research efforts. Yet, there are aspects of Mill Creek faunal exploitation that remain inadequately addressed, as previous faunal analyses may be biased by their focus on large mammal exploitation and sole use of analytical units such as NISP and MNI, which tell little about prehistoric hunting strategies. The analyses performed in the present research provide a rigorous understanding of faunal remains at the Skadeland site. Utilizing the proper tools has allowed me to take a more comprehensive approach to Mill Creek faunal analysis and examine the full breadth of species exploited.

In recent years, archaeology has adopted optimal foraging theory from ecology, which has been a valued addition to behavioral interpretations. However, the adoption has not come without its challenges, as applying such a theory to prehistoric populations is quite different from the traditional use on living populations (Bamforth 2002; Bird and O'Connell 2006). Furthermore, the use of optimal foraging theory on human populations must also take culture into consideration, as benefits of exploiting animals for prestige are not seen through an economic lens. Therefore, this study has examined subsistence and non-subsistence uses of animal identified in the Skadeland assemblage in an attempt to break from past analyses that are biased by their focus solely on the caloric returns of various taxa.

Methodological Implications

If we are to look beyond economic utility and examine social and cultural dynamics, zooarchaeological analysis must use methods and analytical units capable of such inferences. In order to extract reliable inferences, archaeologists must acknowledge the complex history of pre- and post-burial agents influencing assemblages. When these biases are not considered, datasets cannot be trusted, and behavioral inferences made will likely reflect the behaviors of non-cultural agents rather than the prehistoric culture in question. For these reasons, this study has examined the Mill Creek remains of the Skadeland site using a comprehensive taphonomic approach, which examines the full life-history of the faunal remains to determine what modifications to the assemblage may be influencing the pattern we see.

Determining the ritual or subsistence importance of animal resources is still highly problematic, as previous excavations and analytical methods did not produce data adequate for such a question. Previous Mill Creek faunal analyses focused on recording taxonomic abundance and neglected to present data that facilitates intersite comparison of taxon specific carcass utilization. To more accurately measure dietary breadth, my analysis used an approach capable of distinguishing between culturally and naturally deposited animal remains. As Lyman (1994:8) says, "Inferences that humans broadened their dietary niche, or narrowed it, or did not alter it though time will surely be inaccurate without such taphonomic analyses". This method has provided new details about late prehistoric faunal exploitation and therefore contributes to the small but growing number of databases that have used contemporary zooarchaeological analyses on late prehistoric faunal assemblages (Hall 2007; Otarola-Castillo 2006).

Resource Ranking by Mill Creek Villagers

The Skadeland site provides a glimpse into Mill Creek faunal exploitation in northwest Iowa and the variety of fauna typically identified at late prehistoric villages on the Northern Plains. Previous analyses have focused on large mammal exploitation and suggested slight dietary contributions by small mammals, birds and aquatic resources. However, these numerous species may have been exploited for inclusion in cultural paraphernalia and hunted in order to gain prestige within the society (Fishel 1996; Holt 1996; McGuire and Hildebrant 2005). To determine the economic and symbolic value of faunal resources, my research has examined ethnographic and ethno-historic records of animal exploitation on the northern plains for evidence of cultural and subsistence values placed on species. Current zooarchaeological methods were used to extract information on element abundance, species representations and taphonomic influences from the Skadeland faunal remains, and this fresh information was used to evaluate predictions posed by ethnographic data and mythological inferences, therefore creating a more complete picture of faunal exploitation that facilitates an understanding of the cultural context influencing the assemblage. The combination of these methods in the analysis of Mill Creek faunal exploitation create an outlook on subsistence that is considerate of the cultural system influencing resource selection, allowing for more conclusive distinction between subsistence and prestige foraging.

The large mammal assemblage from the Skadeland site exhibits a focus on bison to provide meat, marrow and grease in the inhabitants' diet, while they also opportunistically exploited elk and deer. The bones have been well preserved and show only slight modification by non-cultural agents. Based on the observed modifications, the large mammal remains were procured by hunters in close proximity to the village. These remains were then transported to the Skadeland site for further processing to access meat, marrow and grease, as is evident in the high rate of fragmentation and green bone breakage. After these resources were acquired, the bones were discarded and subjected to a brief period of exposure to carnivore and rodent damage. However, based on the minimal damage to these elements and lack of surficial weathering, the remains were only exposed for a brief period of time before being buried. The presence of fetal bison and an abundance of cranial elements match with what the ethnographic reports indicate to be ritualistic behavior. The exploitation of bison, elk and deer is the focus of subsistence foraging with ritualized products as secondary resources, and their extensive reference in mythology is likely bolstered by the dependence on these animals for survival.

The Skadeland assemblage, like other late prehistoric assemblages, consists of numerous locally available small mammal species that are represented by only a few identifiable specimens. These locally available resources would have been easily accessed by the Mill Creek villagers, and according to ethnographic and mythological analogy were hunted for 1) inclusion in ritual paraphernalia, 2) their fur and 3) as a minor part of the diet. The Skadeland small mammal remains may represent numerous hunting events focused on procuring the medicine of animal protectors. The small mammal element abundance and cutmark locations indicate dual patterning of exploitation for both furs and subsistence. The fox, river otter and skunk are represented by elements that indicate their use as trophy skins, while the beaver is represented by its meatiest element, supporting its use as a food resource.

The pocket gophers, while previously interpreted as a subsistence resource, appear to be used for their fur and to make decoys to attract birds of prey. The Skadeland site contains a minimum of eleven pocket gophers from a total of 56 identifiable elements, which aligns with the abundance of gophers at other Mill Creek locals including Phipps (MNI=8) and Brewster (330 skulls) (Dallman 1983). Even though, the pocket gopher bones recovered from the Skadeland site exhibit no sign of cultural modification or differential treatment of elements, they are present in a quantity inconsistent with expected naturally occurring populations. Therefore, Skadeland occupants must have procured and transported the gophers to the site. Additional analyses of the Brewster and Phipps gopher remains indicate a pattern of cranial disarticulation through the crushing of the occipital. Pit feature 8 at the Phipps site contains the post-cranial remains, which were interpreted as differential treatment of elements in which skulls remained in the pelt and post-cranial elements were discarded. Based on the abundance and differential treatment of skulls at the Phipps and Brewster sites, it is most plausible that gophers were exploited for their fur or use as decoys for capturing large birds, which would make this resource the focus of prestige foraging.

The final resource addressed is the abundance of avian remains, which has become a trademark of Mill Creek faunal exploitation. When identification of excessive numbers of raptor wing elements is combined with Mill Creek thunderbird effigies, these artifacts lead to the conclusion that bird remains are the result of ritual foraging for feathers and trade items (Alex 1971; Hamn 1961; Scott 1979). This conclusion is further supported by the ethnographic and mythological accounts, which highlight the use of feathers in ceremonial dress, medicine bundles and trade items. In mythology, the Thunderbird god was said to grant the people success in war and hunting, provided rain for the crops and sent bison close to the village, so the feathers and other items made from the remains of Thunderbird's helpers, the eagle, hawk, owl, crow and raven, were highly valued. The Skadeland site supports mythological and ethnographic inference, as the assemblage is dominated by the birds identified in mythology as helpers of the Thunderbird. Of the identified remains from Skadeland, 14 (67%) of the 21 individuals were identified as thunderbird's helpers, including eagles (n=2), hawks (n=7), and owls (n=5) represented only by wing and lower leg remains.

Therefore, the high occurrence of raptor wings and lower legs, coupled with the relative absence of other bird genera usually considered to be subsistence resources, suggests a focus on bird exploitation for ritual and trade use.

Overall, the Skadeland faunal evidence indicates both subsistence and prestige based foraging strategies were used by hunters. Therefore, the documentation of what has been called prestige hunting has enormous implications for cultural ecology and optimal foraging and, for that matter, hunter-gatherer studies in general. Prey may be hunted for entirely different reasons than subsistence efficiency, which means the messy business of culture has found its way in to the finely calibrated models of search time, encounter rates, and caloric returns employed in the service of optimal foraging efficiency (McGuire and Hildebrant 2005). Until these approaches consider the cultural dynamics driving exploitation, some degree of inaccuracy is guaranteed, as optimal foraging theories neglect the benefit of prestige when conducting cost-benefit analysis. For example, subsistence based foraging models would not predict avian remains to be the second most abundant resource exploited at the Skadeland site. It is the prestige associated with the capture of birds that allows an individual to rise to power within the society and have increased access to mate rather than solely their acquisition of dietary contributions.

Future Research

Archaeological research on the Mill Creek culture of northwest Iowa has provided a wealth of information about late prehistoric lifeways, but there is still more to learn if it is to become the best understood prehistoric culture in Iowa (Anderson 1987). As we begin to sort out the dietary versus cultural significance of various faunal resources, our understanding of

Mill Creek subsistence can inform us about the transition from hunter-gatherer to horticulturalist and allow for more conclusive interpretations to be made regarding their ancestors, mobility pattern and what ultimately led to their exodus from Iowa For example, we can better assess whether resource stress was the cause of their exodus from northwest Iowa, or whether warfare was a more likely reason.

As additional Mill Creek assemblages are analyzed using methodologies that facilitate intersite comparison, a broader understanding of subsistence and prestige foraging can be reached. To aid in the identification of ritual significance, a broader review of Mill Creek iconography is needed. Through an examination of these culturally constructed images, we can more clearly identify how animals were represented, providing further distinction about the ritual significance or certain species. A final research topic that will aid in the understanding of Mill Creek faunal exploitation is the taphonomic processes that affect small mammal, bird, and fish remains. The literature available is slim, and further experimental work is needed to examine the likelihood of cultural modifications such as cutmarks and the behavioral patterns that can be interpreted from these remains (Lyman 1994). Past researchers have paved the way for developing a deeper understanding of prehistoric culture, so we must continue in their footsteps applying new methodologies to answer the remaining questions about the Mill Creek culture in northwest Iowa.

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APPENDIX A
CEREMONIAL BUNDLES ASSOCIATED WITH MANDAN MYTHOLOGY

Okipa Bundle (Bowers 1950)

1. A buffalo-skin apron with buffalo-hair strands attached
2. Flat staff with the moon and thunderbird carved on one side, a star and sun on the other
3. A stuffed raven
4. Two-piece wooden pipe inlaid with a dark-colored stone
5. Jackrabbit-skin collar and anklets
6. Headdress of porcupine trimmed with jackrabbit skin
7. A set of buffalo teeth
8. A war-bonnet trailer of alternating raven and swan feathers
9. A buffalo-hair headdress with a stuffed owl attached
10. Four buffalo tails with white buffalo hair attached
11. A staff decoration consisting of a buffalo tail trimmed with weasel fur

Corn Ceremonies (Bowers 1950)

Sacred Robe Bundle

1. Robe, having belonged to Good Furred Robe, on which was painted a map of the world showing the Missouri River as a large snake and the hole through which the Corn People reached the earth
2. Good Furred Robe’s pipe, carved from wood, the stem being carved to represent a goose’s head and neck, the mouthpiece being the goose’s bill
3. Foxskin headdress
4. Bundle of young white sage
5. Moccasins made of buffalo hide
6. A clay pot
7. A strip of elkhide
8. A dried gourd rattle
9. A substance resembling and representing corn silk
10. One ear of white flint corn, one ear of yellow corn and one ear of white soft corn
11. A narrow strip of badger skin
12. Blackbird heads and the head of one green-headed duck
13. A whitetail deer skull with antlers attached to place the bundle on
14. 3 dried squash
15. 1 sunflower head
16. A robe made of kit-fox hides
17. A braid of cornhusks

Skull Bundle

1. Good Furred Robe's skull
2. Cornhusk Earing's skull
3. Uses Head for Rattle's skull
4. A bundle of young white sage
5. A substance resembling and representing corn silk
6. Foxskin headdress
7. A wooden pipe

Snow Owl Bundle (Bowers 1950:285)

1. Arrow-straightener of buffalo rib with perforations
2. Wooden groover
3. Rawhide with sand glued to it as polisher
4. Grape-vine
5. Tanned fawnskin
6. Two feet of white owl
7. Two feet of small owl
8. Yellow and black clay for painting
9. One large white-owl wing feather
10. Gray sage
11. Bow and lance
12. Buffalo robe
13. Magpie tail feathers
14. Plain black elbow pipe

People Above Bundle (Bowers 1950:302-303)

1. Cooper ring representing Old Woman Above
2. Cooper ring representing Sun
3. Cooper crescent representing Moon
4. One large gourd rattle
5. Six magpie tail feathers
6. Twelve owl tail feathers (the owl was associated with the moon and the night)
7. Human scalp, said to be taken from a Cheyenne Indian, killed by Moon when his son escaped
8. Left arm of a grizzly bear, used in the ceremony, since Corn Silk and her son did not have time to get a forearm of one of the Cheyenne
9. Grizzly bear skull
10. Tuft of long hair from a buffalo bull's lower jaw
11. A strip of hide from a buffalo calf's head
12. Long hair from a buffalo's foreleg
13. Buffalo left horn
14. Buffalo skull (because Corn Silk also married a buffalo)
15. One stuffed jackrabbit, which served as a scout for Sun

APPENDIX B
SKELETAL ELEMENT CODES

Cranium/Teeth
ANT antler
CRN cranium
MR mandible
MUN indeterminate molar
PUN indeterminate premolar
TFR indeterminate tooth fragment
HY stylohyoid

Postcranial Axial
AT atlas vertebra
AX axis vertebra
CE cervical vertebra
TH thoracic vertebra
LM lumbar vertebra
VT indeterminate vertebra
RB rib
SN sternal element
CS costal cartilage
SA sacral vertebra
SAC complete sacrum
CA caudal vertebra

Appendicular (Forelimb)
SC scapula
HM humerus
RD radius
RDU radius-ulna
UL ulna
CP all carpals
CPI intermediate carpal
CPR radial carpal
CPU ulnar carpal
CPS fused 2nd and 3rd carpal
CPA accessory carpal
CPF 4th carpal
CP indeterminate carpal
MC metacarpal
MCF 5th metacarpal

Avian Element Codes
CMC carpometacarpus
CRD coracoids
FIB fibula
HUX hallux
PHF-2W second wing digit
TMT tarsometatarsus
WING indeterminate wing bone

Appendicular (Hindlimb)
IM innominate
FM femur
TA tibia
TR all tarsals
LTM lateral malleolus
AS astragalus
CL calcaneus
TRC fused central and 4th tarsal
TRS fused 2nd and 3rd tarsal
TRF 1st tarsal
PT patella
TR indeterminate tarsal
MT metatarsal

Other Appendicular
MP indeterminate metapodial
PH all phalanges
PHF 1st phalanx
PHS 2nd phalanx
PHT 3rd phalanx
PH indeterminate phalanx
VP all vestigial phalanges
VPF 1st vestigial phalanx
VPS 2nd vestigial phalanx
VPT 3rd vestigial phalanx
SES all sesamoids
SEP proximal sesamoid
SED distal sesamoid
SDC distal caudal sesamoid
SE indeterminate sesamoid

Fragments
LB indeterminate long bone
FB indeterminate flat bone
CB indeterminate cancellous bone
UN unidentifiable fragment