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FAUNAL ANALYSIS OF THE SHEPARD SITE: A MIDDLE PLAINS VILLAGE ANCESTRAL WICHITA SITE IN WESTERN OKLAHOMA

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FAUNAL ANALYSIS OF THE SHEPARD SITE: A MIDDLE PLAINS VILLAGE ANCESTRAL WICHITA SITE IN WESTERN OKLAHOMA

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ABSTRACT

The Shepard site (34CU220) is an ancestral Wichita village located along a tributary of the Washita River in Western Oklahoma. It was excavated in 2001 prompted by destructive oil well pad construction. Radiocarbon dating places the occupation of the site within the Middle Plains Village period, specifically the Turkey Creek phase (AD 1250-1450), a time characterized by the re-intensification of bison hunting and a dependency on bison for subsistence. Through the analysis of the faunal assemblage, this research provides critical insights into the dynamic relationships between human societies and their environments, particularly through the study of bison. Employing socioecological systems theory and social zooarchaeology, this study examines how subsistence strategies shaped and were shaped by bison, reinforcing the interconnectedness of cultural identity and ecological resilience.

CHAPTER 1: INTRODUCTION

The Shepard Site (CU220), located in Custer County, Oklahoma, sits on a hill above Barnitz Creek, a tributary of the Washita River. The site was excavated in 2001 during salvage operations following construction by the El Paso Energy Company, which scattered much of the subsurface cultural material (Drass 2001a). Excavations revealed 18 pit features, including a circular pit near a house floor stain (Drass 2001a). A charcoal sample at the site was radiocarbon dated to AD 1290–1420, which corresponds with the late Middle Plains Village period (AD 1250–1450) (Drass 2001b). More specifically, these results align with the Turkey Creek phase (AD 1350–1450), a later adaptation of the Custer phase (AD 800-1300), both ancestral to the contemporary Wichita and Affiliated Tribes (Drass 1998:430, 432; Drass 2001).

The Middle Plains Village period saw a re-intensification of bison hunting due to climatic changes accompanied by unstable rainfall that led both bison to become more abundant in the mixed-grass prairies and past humans to adjust their settlement patterns (Drass 1989; Hoffman 1989). Bison provided food, tools, and raw materials, while communal hunts reinforced social ties and cultural identity (Drass 1998:431,433,437; Hoffman 1989). This underscores their importance not only as a resource but as a key part of the relational dynamics between humans and the environment. At CU220 the representation of bison in the faunal assemblage alongside limited ethnohistoric evidence from the later Contact period offers an opportunity to investigate these interactions further, particularly how subsistence practices and ecological dynamics shaped and upheld the reciprocal relationship between humans and bison.

Previous research at the site by Dr. Richard Drass focused on botanical remains, emphasizing the broad importance of flora in understanding how Plains Village societies responded to environmental and social changes (Drass 2008). However, the faunal remains have remained largely unanalyzed. This thesis addresses this gap by analyzing the faunal assemblage recovered from the Shepard Site. While all species identified in the assemblage are discussed, special attention is paid to the bison remains given their prominence in the collection and their cultural and ecological significance.

Specifically, the study sought to address three key objectives: 1) analyze the faunal remains at the Shepard Site; 2) examine the faunal assemblage holistically to understand the subsistence, material, and ecological roles of various species present at the site; and 3) compare these findings with evidence from contemporaneous archaeological sites to more broadly discuss human-animal interactions, particularly the role of bison, on the southern Plains during the Middle Plains Village period.

Additionally, this study incorporates ethnographic data from Dorsey's *The Mythology of the Wichita* (1904) and Wedel's *The Wichita Indians* 1541–1750 (1988), which, though documented during the protohistoric (1541–1750) and post-contact (18th–19th century) periods, reflect oral traditions and practices that provide valuable insights into ancestral Wichita perspectives on animals and subsistence. Where Wichita-specific data is limited, Weltfish's *The Lost Universe: Pawnee Life and Culture* (1977) is used, sparingly, as a comparative source, justified by the shared ecological and cultural contexts of these two Plains groups. While these sources postdate the Middle Plains Village period (AD 1250–1450), they offer meaningful perspectives on the general significance of bison and other fauna in Wichita lifeways.

Outline of Thesis

The following thesis is organized into eight chapters. The *Environmental Background* chapter contextualizes the faunal assemblage within Southern Plains ecological conditions and the *Cultural Background* chapter explores Southern Plains culture history from the Paleoindian to Contact period. The *Site Overview* chapter will introduce the Shepard site, including its location, excavation history, and background on contemporaneous sites. The *Theoretical Frameworks* section introduces the most relevant bodies of literature motivating this work including subsistence studies, social zooarchaeology, and socioecological systems theory.

The second half of the thesis delves into the methods, findings, and interpretations of the work. The *Methods* chapter outlines the analytical methods used for analyzing faunal remains, including taphonomic and taxonomic analysis, strategies for taxonomic and elemental identification, fragment and fracture analysis, and metrics for quantifying the data. The *Results* section presents the findings of this analysis, including overall assemblage preservation, species representations, human modified bone, elemental distributions, as well as primary and secondary butchery evidence. In the *Discussion and Conclusion,* the research objectives will be addressed, followed by concluding statements and future routes of research.

CHAPTER 2: ENVIRONMENTAL BACKGROUND

The environmental background of the Shepard site provides a crucial framework for understanding the ecological and cultural dynamics that shaped human activity in the region. Situated within the Southern Great Plains, the site's environment reflects a balance of climatic variability, diverse vegetation, and hydrological features. These factors not only influenced the availability of resources but also structured the interactions between human and non-human agents, such as bison. This section begins with an examination of the climate, vegetation, geology, and hydrology of the region to establish ecological context necessary for interpretation. Following this, a tailored discussion of bison ecology provides a baseline for understanding bison's ecological role, evolutionary adaptations, and historical interactions in the Southern Plains.

Environmental Setting

The Shepard Site, or 34CU220, is located Custer County, which resides within the Central Red-Bed Plains of western Oklahoma, a geomorphic province categorized by rolling hills, flat plains, and distinctive red soils derived from Permian-age rock formations (Johnson and Luza 2008). The region is situated within the larger Great Plains' ecosystem, spanning several states and supporting diverse flora and fauna. The Shepard Site's location along a tributary of lower Barnitz Creek situates it within a dynamic ecological and hydrological system, influenced by both natural and human history.

Climate

Custer County experiences a temperate climate characterized by hot summers, cold winters, and significant seasonal variability in precipitation (Henson 1978). The region receives an average annual rainfall of 25-35 inches, mostly occurring during the late spring and early summer due to convective thunderstorms (Johnson and Luza 2008). Winters are accompanied by occasional snowfall, but overall precipitation decreases during this season. Variability in rainfall can create periodic droughts, adding to the resilience of native vegetation and influencing land-use strategies (Henson 1978; Johnson and Luza 2008).

Geology

The geology of Custer County is dominated by Permian-age red beds, composed primarily of shale, siltstone, and sandstone (Fay 1976; Johnson and Luza 2008). These sedimentary rocks were formed in shallow marine and fluvial environments, giving rise to the red soils that define the region's landscape (Fay 1976). The Shepard Site's specific location features additional alluvial deposits, which contribute to soil variability and support riparian vegetation (Henson 1978). Soils in the area are predominantly clayey and loamy, with moderate fertility that historically has supported both natural grasslands and agriculture (Henson 1978; Johnson and Luza 2008).

Hydrology and Water Resources

The Shepard Site is part of the Washita River watershed, with its tributary flowing into the lower Barntiz Creek. This creek serves as a perennial water source, sustained by surface runoff, groundwater discharge, and intermittent springs (Johnson and Luza 2008). Streams and rivers in the region typically feature sandy and silty beds, which influence water clarity and distribution of aquatic vegetation (Carr and Bergman 1976). Groundwater resources are primarily drawn from the Rush Springs aquifer, a critical source of freshwater for agricultural and ecological needs (Carr and Bergman 1976; Johnson and Luza 2008).

Vegetation and Wildlife

The Shepard Site lies within the mixed-grass prairie ecosystem, representing a transitional zone between tallgrass prairies to the east and shortgrass prairies to the west. Native grasses such as big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), blue grama (*Bouteloua gracilis*), and switchgrass (*Panicum virgatum*) dominate the landscape (Fishbein et al. 2024; Johnson and Luza 2008; Mericl 1941). Interspersed with these grasses are forbs, such as the prairie sunflower (*Helianthus petiolaris*), prairie clover (*Dalea* sp.), and milkweed (*Asclepias* sp.), which together provide forage and habitat for a variety of wildlife species (Fishbein et al. 2024; Mericl 1941). Shrubs are also present in the landscape, including sumac (*Rhus* sp.) and sagebrush (*Artemisia tridentata*), offering cover for smaller mammals and birds (Fishbein et al. 2024; Mericl 1941). Riparian zones along Barnitz Creek are characterized by cottonwood (*Populus deltoides*), willow (*Salix humilis*), and sycamore (*Platanus occidentalis*) (Fishbein et al. 2024; Johnson and Luza 2008; Mericl 1941).

Wildlife in the region is also diverse, reflecting ecological richness of the mixed-grass prairie. Historically, large mammals such as bison (*Bison bison*) and medium mammals such as pronghorn (*Antilocapra americana*), white-tailed deer (*Odocoileus virginianus*), and mule deer (*Odocoileus hemionus*) were abundant, in addition to predators such as coyotes (*Canis latrans*), bobcats (*Lynx rufus*), and red foxes (*Vulpes vulpes*) (Blair 1939; Johnson and Luza 2008). Smaller mammals, including prairie dogs (*Cynomys ludovicianus*) and jackrabbits (*Lepus californicus*), play equally important ecological roles as prey species and soil engineers (Blair 1939; Johnson and Luza 2008). Avian species, from meadowlarks (*Sturnella* sp.) and grasshopper sparrows (*Ammodramus savannarum*) to raptors such as red-tailed hawks (*Buteo jamaicensis*) contribute to the region's complex food web. Reptile species include the common snapping turtle (*Chelydra serpentina*), yellow mud turtle (*Kinosternon flavescens*), ornate box turtle (*Terrapene ornata*), pond slider (*Trachemys scripta*), as well as various snakes, lizards, and skinks (Johnson and Luza 2008; Secor and Carpenter 1984). Amphibians, including frogs, toads, and salamanders are also common in riparian zones and seasonal wetlands (Johnson and Luza 2008). Fish in the area include the longnose gar (*Lepisosteus osseus*), sunfish (*Lepomis sp.*), and darter (*Etheostoma sp.*) (Johnson and Luza 2008).

Bison Ecology and Adaptations

Bison (*Bison bison*), is an iconic species of the Great Plains and is integral to the ecological and cultural history of North America. Taxonomically, bison belong to the Bovidae family and are closely related to other large ungulates such as cattle. Historically, bison have ranged widely across North America, but their presence in the Southern Plains ecological region—encompassing present-day south and central Texas up through central Oklahoma—was particularly critical due to the region's unique grassland ecosystems and climatic conditions (Guthrie 1970; Isenberg 2000; Meager 1986). This section explores the ecological role of bison, their evolutionary and behavioral adaptations, and their historical interactions with natural and human systems, with a focus on the Southern Plains during the Middle Plains Village Period (1200–1450 CE).

The evolutionary trajectory of bison highlights their unique adaptations to the Great Plains environment. Traits such as robust frames and a distinctive shoulder hump evolved to support efficient grazing and resilience to seasonal environmental fluctuations (Bamforth 2011; Guthrie 1970; Nowak 1999). These physical features enabled bison to thrive in the Plains, where they consumed a variety of grasses and dominated as grazers in an environment marked by climatic variability. Their dense fur then provided insulation during cold seasons, while their ability to store energy in the form of fat allowed for survival during periodic resource scarcity (Isenberg 2000; Meagher 1986).

The open grasslands of the Plains shaped bison behavior, particularly their tendency to form large herds (Lott 2003). This group behavior not only provided defense against predators but also facilitated grazing patterns that maintained the ecological balance of the prairie by promoting plant diversity and supporting nutrient cycling (Knapp et al. 1999; Lott 2003; Meagher 1986;). These grazing behaviors, characterized by selective consumption of grasses over other plants, reduced interspecies competition and encouraged plant diversity, which in turn supported a broader range of fauna (Lott 2003; Meagher 1986). Herd movement also helped distribute grazing pressure, allowing plant communities to recover and preventing overgrazing in localized areas—a critical adaptation in the Southern Plains, where vegetation recovery could be slow due to lower rainfall compared to the Northern Plains (Fuhlendorf and Engle 2001; Meagher 1986; Nowak 1999;).

As a keystone species, bison play a vital role in shaping grassland ecosystems across the Great Plains (Lott 2003; Knapp et al. 1999; Meagher 1986). Their selective grazing, which favors grasses over other plants, reduces competition and encourages biodiversity (Lott 2003; Knapp et al. 1999; Meagher 1986). Additionally, wallowing—rolling in dirt to shed parasites—creates small depressions that serve as microhabitats, further enriching ecosystem complexity (Lott 2003; Meagher 1986). These behaviors actively shape soil composition, vegetation structure, and water retention, underscoring bison's integral role in the resilience of prairie ecosystems (Lott 2003;

Meagher 1986; Vehik and Kraft 1995). For example, bison wallows often retain water after rainfall, creating temporary wetlands that support diverse plant and animal communities (Fuhlendorf and Engle 2001; Knapp et al. 1999). While these behaviors were present across the Plains, in the Southern Plains, the bison's role was further shaped by the region's distinct environmental conditions, including variable rainfall and temperature extremes (Bement et al. 2022:3-5; Wyckoff and Dalquest 1997:9, 16, 21).

The seasonal migration patterns of bison aligned with water availability and shifting vegetation zones, similar to other Plains regions, but with additional pressures from more erratic water sources and harsher seasonal variations (Bement et al. 2022:5; Meagher 1986; Nowak 1999; Wyckoff and Dalquest 1997: 9). During winter months, bison relied heavily on fat reserves and subsisted on lower-quality forage, while in the summer they migrated to areas with abundant water and nutrient-rich grass (Lott 2003; Plumb and Dodd 1993). These migrations influenced the distribution of resources, sustaining both bison populations and the ecosystems they inhabited; shaping vegetation dynamics but also created opportunities for other species to benefit from resource and habitat change brought about by bison activity (Knapp et al. 1999; Meagher 1986; Nowak 1999; Plumb and Dodd 1993). This pattern of migration, although not exclusive to the Southern Plains, was influenced by the region's more frequent droughts and variable precipitation, which dictated the timing and extent of bison movements (Bement et al. 2022:5; Wyckoff and Dalquest 1997:9).

Archaeological evidence demonstrates that bison migrations were crucial to Indigenous hunting strategies, and bison diets reflected seasonal fluctuations in forage availability, as shown by isotopic analyses of bone collagen (Carlson et al. 2015:203). In the Southern Plains, the combination of both summer and winter extremes likely meant that bison were more concentrated around ephemeral water sources during dry spells and shifted between habitats with varying grass types and water access (Bamforth 2011; Nowak 1999). These changes in diet and habitat usage were adaptations to the region's specific climatic conditions but reflect broader Plains-wide tendencies of seasonal resource use.

Bison populations in the Southern Plains, as elsewhere, fluctuated significantly over time in response to climatic shifts. During more arid periods, such as the Medieval Warm Period (approximately 950–1250 CE), bison likely contracted to areas with reliable water and more abundant forage, while during cooler, wetter periods like the Little Ice Age (approximately 1300–1850 CE), populations may have expanded as grasslands became more productive (Carlson et al. 2015:203; Mann et al. 2009). These climatic events affected both bison ecology and the subsistence strategies of Indigenous peoples, although the scale and timing of these fluctuations may have varied across the Plains.

While many of the behaviors observed in Southern Plains bison were shared across the broader Great Plains, the environmental pressures of the Southern Plains, including more extreme seasonal variation and less consistent water sources, meant that bison in this region adapted in specific ways to those conditions (Wyckoff and Dalquest 1997). By focusing on this geographic and temporal context, we gain a deeper understanding of the dynamic interplay between bison ecology, climate fluctuations, and human societies in the Southern Plains.

CHAPTER 3: CULTURAL BACKGROUND

The cultural history of the Southern Plains cultural area—encompassing northeast New Mexico, northwestern Texas, as well as western and central Oklahoma—offers a lens through which interactions between the region's inhabitants and their unique environment can be understood (Trabert and Hollenback 2021:7). The cultural practices of Southern Plains groups reflect the active ways in which these groups engaged with, modified, and imbued their surroundings with cultural meaning in addition to their responses to environmental conditions. The following chapter traces the cultural development from the Paleoindian through the Contact period, highlighting key shifts in subsistence strategies. By examining these periods, insight is gained into the dynamic interplay between people and place, providing a thorough foundation for interpretation of the Shepard site.

Southern Plains Culture History

Paleoindian (10,000-6000 BC)

The Paleoindian period marks the earliest accepted human occupation of the Southern Plains, occurring at the close of Pleistocene and the onset of the Holocene (Collins 1999; Bradley, Collins, and Hemmings 2010). Paleoindian cultures were characterized by highly mobile hunter-gatherer groups, focused on megafauna such as mammoths, mastodons, and bison. The climatic conditions of this period were cooler and wetter than the modern Southern Plains, supporting vast grasslands and large herbivores. Mobile settlement patterns tended to place campsites near reliable water sources. And although trade networks are not well-documented, the presence of non-local lithic material suggests some interaction between groups (Hofman et al. 1989:26).

Clovis or Llano culture (ca. 10,000-9,000 BC) is defined by its distinctive lanceolate shaped points with fluted base, which were used primarily to hunt mammoths (Frison 1998; Hofman et al. 1989: 26). Clovis groups were nomadic, following large game herds across the landscape (Bamforth 1985:243-244; Hofman et al. 1989:29). The majority of Clovis sites are concentrated in the Great Plains region, with examples in Oklahoma being the Jake Bluff site (34HP60) and Calvin Graybill #1 site (34DW33) (Bement and Brosowske 1999; Bement and Carter 2010; Thurmond 1990: 291).

Folsom culture (ca. 10,000-8,000 BC) is differentiated by distinctive lanceolate points with fluting and concave bases, reflecting a shift towards more specialized bison hunting (Amick 1995; Flenniken 1978; Hofman et al. 1989:34; Meltzer 2006). Folsom groups also developed additional tools, such as bone and antler implements, that aided in meat processing and highlight the culture's emphasis on bison hunting (Hofman 1989:36: Stout 2005). An example of a Clovis site in Oklahoma is the Cooper site (34HP45) located in the Oklahoma panhandle in Harper County (Carlson et al. 2015; Johnson and Bement 2009).

Possible ritual behaviors related to hunting are also evident, particularly at sites like the Cooper site (Bement 1999, 2003; Carlson et al. 2015 Johnson and Bement 2009). Here three bison kills were discovered and one kill with a lightning bolt zigzag symbol carved or painted with red ochre, suggesting ceremonial practices related to hunting (Bement 1997, 1999). The Cooper site is important for understanding Paleoindian hunting and butchering techniques as well, as it yielded a variety of tools used in the processing of bison (Brosowske and Bement 1997: 100). Paleoindian groups in the Southern Plains were therefore not only focused on subsistence activities but also engaging in behaviors suggesting more complex cultural systems related to the animals they relied on.

The Plainview culture (ca. 8,500-7,500 BC) is a late Paleoindian cultural group in Oklahoma. During this time hunting strategies were further refined, evidenced by mass bison kills and more varied diets including small game and plant resources (Bement 1999). Sites exhibiting the Plainview culture in Oklahoma include Ravenscroft (34BV198) and Bull Creek (34OS37) (Baker 2022; Bement et al. 2020; Carlson and Bement 2017; Muhammad 2017). Bison skull stacks at Ravenscroft have been interpreted as ritual activity (Baker 2022: 95).

Archaic (6000BC-AD1)

The Archaic period marks a significant cultural shift caused by adaptation to the warmer and drier climate of the Altithermal period (Antevs 1995; Hofman et al. 1989:36). Integral to this transition was the decline of megafauna and the rise of smaller game, leading hunter-gatherers to diversify their subsistence strategies to include a wider range of resources, including small game, fish, nuts, seeds, and roots. Newfound reliance on plant resources is evident in the widespread use of grinding stones, which were used to process seeds and other plant material (Hofman et al. 1989:36-37). Evidence of specialized tools for plant processing highlights a deeper integration of hunting and gathering as groups began to adapt to changing environments.

Settlement patterns of Archaic groups were typically seasonal and strategic, occupying temporary campsites near reliable water resources. Sites show evidence of hearths, storage pits, and middens, indicating either long-term or repeated use (Bement 1997: Wycoff and Taylor 1971). Findings suggest Archaic groups not only adapted to their local environments but also understood resource availability over time (Hall 1988). The flexibility of these settlement strategies allowed groups to exploit diverse environments, including upland prairies and river valleys, to maximize resource acquisition throughout seasonal movement.

The Archaic period is divided into three subphases: Early, Middle, and Late Archaic (Hofman et al. 1989:45). Early Archaic (8000-5000 B.P.) groups continued many of the practices of Paleoindian predecessors, including reliance on hunting. An example of an Early Archaic site is the Pumpkin Creek site (34LV49) in Love County (Wycoff and Taylor 1971). Middle Archaic (5000-3000 B.P.) groups can be distinguished by an increase in regional diversity and technological development. This phase is characterized by the development of specialized tools such as stemmed projectile points, scrapers, and grinding implements, signaling an emphasis on plant processing in conjunction with hunting (Hofman et al. 1989:45). An example of a Middle Archaic site is the Gore Pit Site (34CM131) in Comanche county (Hammatt 1976). The Late Archaic (3000 B.P. to 1 A.D.) is then marked by increasing importance of plant-based subsistence and early evidence of horticulture (Hofman et al. 1989:45). Evidence of semi-permanent settlements during the Late Archaic, however, did not apply to all groups, likely due to environmental differences (Bement 1997; Hall 1988). An example of a Late Archaic site is the Roulston Rogers site (34SM20) (Drass 1979).

Woodland (AD 1-1000)

The Woodland period in the Southern Plains represents a critical cultural shift, including the gradual introduction of ceramic technology, limited horticulture, and a continued reliance on hunting and gathering. During this period, some crops such as squash and sunflowers began to be cultivated, although full scale agriculture did not emerge until later (Brooks and Swenson 1985; Drass 2008:10). Additionally, evidence indicates maize cultivation as early as AD 100 (Drass 1997:7, 2008:12). The shift toward horticulture was less pronounced than in other regions, as the environment was less conducive to intensive agriculture. Hunting, particularly smaller game and bison remained central to subsistence during this period (Drass 1997:11; Wedel 1959:667).

Woodland sites in Oklahoma include Pruitt (34MR12) and a component of Brewer (34BL46) (Barr 1966; Hofman 1975:42).

Settlement patterns during the Woodland period were characterized by seasonal campsites, with groups establishing themselves along reliable water sources, providing access to arable land and a variety of environmental resources (Drass 1997:11; Hofman et al. 1989:67). Sites during this period show evidence of repeated occupation, indicating seasonal returning to locations (Drass 1997:11). The gradual development of ceramics, including cord-marked and plain wares, reflects the increasing importance of food storage and preparation in woodland lifeways (Drass 1997:10). The use of ceramic vessels allowed for cooking, storing, and transporting food; however, their presence is still limited at this time (Drass 1997:10; Hofman et al 1989:61, 72). An additional significant technological development near the end of the Woodland period was the introduction of the bow and arrow, which aided in hunting efficiency (Hoard 2012: 22). The bow and arrow allowed groups to supplement reliance on larger animals like bison through more effective hunting of small game.

Though the Woodland period saw the beginnings of trade and social complexity, these networks were still establishing themselves. Evidence of long-distance exchange, from Hopewellian centers in the east to the Southern Plains, includes the movement of non-local materials such as obsidian, marine shell, and copper (Hoard 2012:22-23; Johnson 1979;90-92; Logan 2006; Wedel 1959:544). The growth of these networks likely facilitated the development and spread of new technologies, ideas, and social practices across the region. Additionally, the social developments during the Woodland period sets the stage for the more complex societies that would emerge in the following Plains Village period, marked by further shifts to permanent settlement and more reliable horticulture (Hofman et al. 1989:61).

Early Plains Village (AD 1000-1250)

The Plains Village period is typically divided into three periods: Early Plains Village (AD 1000-1250), Middle Plains Village (AD 1250-1450), and Late Plains Village (AD 1450-1650) (Ahler and Kay 2007). Specific cultural phases that will be referred to in the following section are illustrated in Figure 3.1. Additionally, this broader period corresponds with the Medieval Warming Period (AD 800 or 900 to 1200), which brought a warming climate conducive to maize agriculture as well as a more concentrated bison populations around reliable water sources.

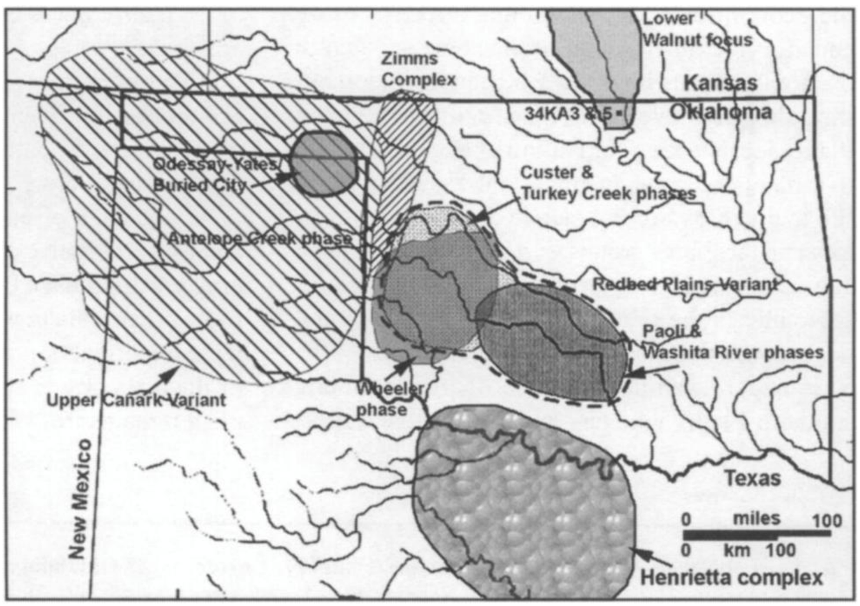

Figure 3.1: “Plains Village complexes in Oklahoma and north and west Texas” (Figure 1 in Drass 2008).

The Early Plains Village period marks a significant shift in the Southern Plains as societies transitioned from mobile foraging lifeways of the Woodland period to semi-sedentary village life (Ahler and Kay 2007; Drass 1997: 11; Hofman et al. 1989:72). This shift represents the beginning of more permanent settlements and increased reliance on agriculture, which would continue to develop in the Middle and Late Plains Village periods. Settlements occurred near rivers and streams with houses made of wood, grass thatch, and daub (Drass 1997:11-12). Subsistence revolved around hunting a variety of mammals including bison, some fish, and mussels, turtles, and birds. Additionally, plant cultivation became important at this time with archaeological evidence showing corn, beans, and squash, in addition to tobacco (Drass 1993; 1998; 2008). Two distinctive cultural phases emerged during this time in the Southern Plains; the Paoli and Custer phases (Drass 1998:430, 432).

The Paoli phase (AD 900-1250) represents one of the earliest semi-sedentary village lifeways in the Southern Plains (Drass 1998). This cultural phase developed from local Plains Woodland groups and is ancestral to the Washita River phase. Sites are concentrated along the Washita River above the Arbuckle Mountains and along the Canadian River. Characteristic sites for this phase include Densmore (34GV167), Jones (34GV55), and a component of Brewer, which exhibit minimal ceramic production and early evidence of maize cultivation (Drass 1993; 1997). Subsistence strategies include limited horticulture in conjunction with hunting of small game and gathering. Additionally, the presence of tools such as digging sticks and manos reflect the newfound focus on small-scale agriculture (Drass 1993:53; 1997:16).

The Custer phase (AD 800-1300) is centered in western Oklahoma (Drass 1998:432; Hofman 1984:41). Small villages were located on terraces along tributary streams of the North Fork of the Red River and the Washita River (Drass 1997:12). Sites characteristic of the phase include Mouse (34CU25), Phillips (34CU11), Hodge (34CU40), and certain components of the Duncan-Wilson rock shelter (34CD11) (Hofman 1975:42). Archaeological evidence indicates semi-subterranean structures and storage pits. Custer pottery is characterized by cord-marked or simple stamped designs (Drass 1998:433).

Subsistence was focused on bison hunting, supplementary maize cultivation, and gathering of wild resources (Drass 1998:433). The growing intensity of both bison hunting and agriculture is evidenced by greater quantities of bison bone and tool implements present at most sites (Baugh 1986:86-87; Hofman 1989:42). Evidence from Custer sites also indicates some localized trade of Alibates chert, likely sourced from the Texas Panhandle, as well as marine shell artifacts from the Gulf Coast (Hofman 1984:77).

Middle Plains Village (AD 1250-1450)

The Middle Plains Village period saw a continued expansion and diversification of Plains Village cultures, emphasizing a mixed economy of farming and bison hunting (Drass 1998:430, 432, 434). Villages were concentrated along rivers in central Oklahoma and tributary streams in western Oklahoma, creating a balance between agricultural productivity and access to natural plant and animal resources (Hofman et al. 1989:72). Additionally, sites from this period are viewed as ancestral to Wichita groups and the contemporary Wichita and Affiliated Tribes, although it is likely that their ancestors had occupied this region for a longer period of time.

Villages were composed of up to 20 rectangular or square houses made of wood and grass, with 2 to 4 center posts and no extended entryways. Distinct cemeteries were also associated with villages (Hofman et al. 1989:77). Overall, the Middle Plains Village period saw significant cultural and economic developments, marked by the blending of horticulture and bison hunting. The period also saw the development of distinct cultural phases, as outlined below.

The Washita River phase (AD 1300-1500) demonstrates cultural continuity with the earlier Paoli phase, while the Turkey Creek phase (AD 1300-1500) emerged out of the earlier Custer phase (Drass 1998:430, 432; Hofman et al 1989:71). While these two cultural complexes shared many similarities in settlement, subsistence, and artifact assemblages, key differences have emerged. Washita River groups were located in central Oklahoma and remained in major river valleys, with characteristic sites including Grant (34GV2), Arthur (34GV32), and Jones (34GD24) (Drass 1998; Hofman 1975:42; Brooks and Swenson. 1985:83). Turkey Creek groups tended to place their villages on ridge tops above secondary streams closer to prairie environments, reflecting a larger focus on bison hunting (Drass 1998:432). Characteristic Turkey Creek sites include Heerwald (34CU27), Goodman I (34CU1), Goodman II (34CU2), Goodwin-Baker (34RM14), McLemore (34WA5), and the Shepard site (Bobalik-Savage 1995; Brighton 1951; Pillaert 1963; Swenson 1951). The Little Deer Site (34CU10) also has a Turkey Creek component (Bethke et al. Forthcoming; Drass 1997).

Washita River subsistence was based upon seasonal bison hunting, cultivation of maize, beans, and squash, as well as foraging for supplementary resources (Drass 1998:430; Hofman 1989:77). Faunal remains at the Arthur and Grant sites show the presence of bison making up between 18-24% of each assemblage, including the presence of bison scapula hoes, tibia digging sticks, ulna digging sticks, horn core hoes, rib tools, and skill hoes (Baugh 1986:89).

Turkey Creek subsistence more heavily relied on the extensive utilization of bison, in addition to horticultural practices and gathering of foraged resources (Drass 1998:433). Sites such as Goodman II, Herwald, and McLemore show evidence of bison presence and a variety of bison bone tool types (Baugh 1986:89-91). Additionally, Turkey Creek sites show evidence of long-distance trade, with groups in the Southwest and Gulf of Mexico, through the presence of marine shell and obsidian sourced from New Mexico (Vehik 2002:44-46).

The Henrietta phase (AD 1150/1200-1450) is a regional Plains Village expression found in north-central Texas and south-central Oklahoma which extends into the Late Plains Village period (Drass 1998:434; Hofman 1989:85-86). Very little research has been conducted on this cultural phase; however, a number of sites have been identified as Henrietta phase including the Coyote (no site number assigned) and Glass (41MU24) sites (Woodall 1967; Lorrain 1967; Drass 1998). These sites are usually found on high terraces above the Red River or tributary streams, with some on lower terraces. Houses tend to be ovular shaped with small, shallow smudge pits (Drass 1998:434). Evidence of trade through contact with groups to the east and west includes non-local Alibates and obsidian (Drass 1998:434; Hofman 1989:86).

Additional Middle Plains Village cultures existed in far western Oklahoma, including Antelope Creek phase, Buried City complex, Odessa phase, and the Zimms complex (Hofman 1989:71). These cultures are characterized by distinct forms of residential architecture, specialized tool assemblages, and some evidence of control of resources.

The Antelope Creek phase (AD 1250-1500) is primarily located in the Texas and Oklahoma Panhandles, with well-known sites such as Two Sisters (34TX32) (Duncan 2002; Drass and Baugh 1997:199; Vehik 2002 51). This phase is known for its distinctive stone-slab architecture, including semi-subterranean earth lodges with stone foundations (Drass and Baugh 1997:199; Hofman 1989:80). The Antelope Creek people practiced a mixed economy, combining dual foraging and horticultural activities with intensive bison hunting (Duncan 2002; Lintz 1984:331; Stout 2005:74). The phase's decline around 1500 CE may be linked to climatic changes or social upheaval (Drass and Baugh 1997:199).

The Buried City complex (AD 1150-1350) is located in the Oklahoma and Texas Panhandles, with key sites such as 41OC29 in the Texas panhandle (Drass 2008:22; Hughes and Hughes-Jones 1987). This complex is characterized by multi-room stone structures (Drass 1998; Hofman 1989:83; Mendoza 2009). Like the Antelope Creek phase, the Buried City complex relied on a combination of maize agriculture and bison hunting. However, the emphasis on bison hunting appears to have been greater, as evidenced by the large quantities of bison remains and bone tools found at these sites (Brooks 1989: 84; Hofman 1989:84).

The Odessa phase (AD 1250-1475) is located from southwestern Kansas, into northwest Oklahoma and the Texas panhandle (Stout 2005:82). Key sites include the Miller site (34EL25), Lundeen site (14MD306), and Odessa-Yates (34BV100) (Wycoff and Brooks 1983). Architecture of this phase is often arranged in linear or circular patterns, suggesting communal living (Brosowske and Bevitt 2006:184; Mendoza 2009). Subsistence patterns relied heavily on horticulture with domesticates including corn, beans, squash, marshelder, and sunflower (Brosowske and Bevitt 2006: 186). Hunting across Odessa sites appears highly variable, however, bison dominates faunal assemblages of larger sites (Brosowske and Bevitt 2006: 187)

The Zimms complex (AD 1265-1425) is located in western Oklahoma, with key sites such as the Zimms Site (34RM72) (Stout 2005:59-61; Vehik 2002:48-51). The Zimms people relied heavily on bison hunting, with less emphasis on agriculture compared to other Middle Plains Village cultures (Drass 1998: Hofman 1989: 84). This complex represents a more mobile adaptation to the Southern Plains environment, with a strong emphasis on bison hunting.

Late Plains Village (AD 1350-1700)

The Late Plains Village period (AD 1350-1700) saw the continuation of regional diversification of ancestral Wichita communities across the Southern Plains (Hofman 1989; 91). This period is marked by the persistence of semi-sedentary village life, an increasing reliance on bison hunting, and the presence of European trade goods acquired through indirect exchange networks. Archaeological complexes associated with ancestral Wichita groups during this time include the Great Bend aspect (comprising the Little River and Lower Walnut complexes in Kansas), the Wheeler phase in western Oklahoma and the Garza complex in northwestern Texas (Drass 1998; Trabert et al. 2024: 10; Vehik 2006; Wedel 1959). These groups practiced a mixed economy of maize agriculture, bison hunting, and foraging, with variations in settlement patterns and subsistence strategies reflecting both environmental conditions and shifting social dynamics.

During this period, villages were often situated along major waterways, balancing agricultural productivity with access to wild plant and animal resources (Hofman et al. 1989:91, 95). Residential structures varied by region but were generally rectangular to circular, built using wooden frameworks covered with grass or clay, and often included central hearths and storage pits (Drass 1998; Hofman et al. 1989:95). Some sites also include evidence of defensive features, suggesting increased regional competition (Drass and Baugh 1997; Hofman et al. 1989:95).

The Great Bend aspect (AD 1450-1700) is primarily located in central Kansas along the Arkansas River and ancestral to the Wichita and Affiliated tribes. This aspect is divided into the Little River and Lower Walnut complexes, which share common traits such as large, semi-permanent villages, maize agriculture, and bison hunting (Blakeslee and Hawley 1999; Drass 1998; Vehik 2002, 2006; Wedel 1959:571). Great Bend aspect sites include 14MN328 which contains evidence of bison processing and corn cultivation (Adair 1989; Bozarth 1993),

Subsistence at Great Bend sites was based on a combination of maize, beans, and squash agriculture, supplemented by seasonal bison hunts (Adair 1989; Bozarth 1993; Holland 1998; Vehik 2006). Faunal assemblages from Tobias and Lower Walnut sites show high frequencies of bison remains, particularly marrow-rich limb bones, suggesting intensive butchery and processing activities (Blakeslee and Hawley 1999). Additionally, sites contain evidence of trade with neighboring groups, indicated by the presence of marine shell, obsidian, and metal artifacts introduced by Europeans (Drass 1998).

The Wheeler phase (AD 1450–1700) represents another ancestral Wichita cultural complex, primarily centered in western Oklahoma and the Texas Panhandle (Hofman 1989: 95; Drass and Baugh 1997:183). Wheeler phase sites are characterized by semi-subterranean earth lodges with stone slab foundations, similar to those of the Antelope Creek phase. Sites during this phase include the Duncan site (34WA2) and components of the Edwards I (34BK2) and Little Deer (34CU10) sites, which all show evidence of maize agriculture and bison hunting (Drass and Baugh 1997:194-195; Drass et al. 2019; Hofman 1989:95). However, the phase also reflects increasing interactions with ancestral Apache groups and the introduction of European trade goods, including metal tools and glass beads (Drass and Baugh 1997:187; Vehik 2002:39-40).

Subsistence in the Wheeler phase relied on a mixed economy of maize agriculture and intensive bison hunting. Sites contain grinding stones, bison scapula hoes, and ceramic vessels associated with food processing (Drass and Baugh 1997:191). The presence of long-distance trade goods further suggests that Wichita groups in this region were involved in broader exchange networks linking the Southern Plains to Spanish and Indigenous trade systems (Hofman et al. 1989: Trabert and Bethke 2021; Vehik 2002:39-40).

The Garza complex (AD 1450-1700) is a late Plains Village expression found in northwestern Texas, particularly along the upper Brazos River (Bamforth 2021; Cruse 2023; Hofman 1989: 99). This complex is characterized by small, dispersed settlements with an emphasis on bison hunting and limited agriculture (Hofman 1989:99). Sites include Lubbock Lake (41LU1) and Garza (41GA40) sites, both of which contain abundant bison remains, suggesting seasonal hunting camps (Baugh 1986:90; Hofman 1989:99). Garza complex sites are notable for their evidence of increasing mobility compared to earlier Plains Village settlements. Unlike the more permanent Great Bend and Wheeler phase villages, Garza sites appear to have been more temporary, reflecting a shift toward a greater reliance on bison hunting (Hofman 1989:99).

Overall, the Late Plains Village period represents a time of cultural continuity and adaptation among ancestral Wichita communities. Each phase reflects regional variations in settlement, subsistence, and trade. While maize agriculture remained a fundamental part of Wichita lifeways, increasing reliance on bison hunting and expanding trade networks with both Indigenous and European groups highlight the dynamic nature of this period (Vehik 2002). This period is critical for laying the groundwork for the complex interactions between the Wichita and European settlers during the contact period.

Contact Period (AD 1700-1850)

The Contact period in the Southern Plains was marked by direct interaction with European traders and settlers, as well as the spread of horses, all of which transformed bison hunting and warfare (Hofman 1989:101-102). Additionally, due to European expansion and intertribal conflicts this period saw the displacement of many groups Indigenous to the area (Hofman 1989:101-102). The Wichita and Affiliated tribes, who had long inhabited the Southern Plains, adapted to these changes by leveraging long-established trade networks, adapting their settlement patterns, and reinforcing alliances to maintain their economic and political autonomy (Baugh and Blaine 2017; Drass 1997; Trabert and Bethke 2021; Trabert et al. 2024; Wedel 1982).

Wichita villages during the Contact Period were often located near reliable water sources for access to resources and transportation. Settlement structures during this period continued Wichita traditions, with circular grass houses built on wooden frameworks, often enclosed by palisades, ditches, and earthen ramparts (Vehik 2006). Fortified villages like Bryson-Paddock (34KA5), Deer Creek (34KA3), and the Longest site (34JF1) reflect increased concerns over intertribal conflict, particularly with groups like the Osage and Comanche (Baugh and Blaine 2017:101; John 1975)

The Bryson-Paddock site (AD 1618-1785) is located in north-central Oklahoma and is situated on a high bluff overlooking the Arkansas River (Drass et al. 2004; Drass et al. 2019; Hartley and Miller 1977; Trabert et al. 2024). This Wichita (band) village was established in the early 18th century and excavations, as well as ethnographic records, reveal continuity in maize agriculture and bison hunting, supplemented by engagement in European trade, as evidenced by glass beads, metal tools, and gun parts (Hackett 1941:317-322,327; Wedel 1981:72-73). The village was fortified with a circular palisade and ditches, reflecting the need for defense during a time of increased intertribal conflict (Baugh and Blaine 2017:120-122; Brooks 1989; Drass et al. 2019).

The Deer Creek site (AD 1730-1785) is also located in north-central Oklahoma, 3 km southwest of Bryson-Paddock. Inhabited by the Taovaya band of the Wichita, Deer Creek was strategically positioned at the confluence of Deer Creek and the Arkansas River (Trabert et al. 2024:13-14). The village was fortified with a complex system of ditches, ramparts, and subterranean structures, which provided protection for non-combatants during raids (Vehik 2006). Excavations reveal an economy centered on maize, beans, and squash cultivation, alongside extensive bison hunting (Bell and Bastian 1967; Trabert et al. 2024:187-189). Deer Creek's fortifications, which included baffled entryways and covered interior shelters, were more elaborate than those found at earlier Wichita sites, reflecting the increased threat of raids during the 18th century (Drass et al. 2018a; Trabert et al. 2024:192-194). The village was likely abandoned in the mid-1750s due to ongoing conflicts with the Osage, leading the Taovaya to relocate south in clusters to the Red River (Newcomb 1993; Trabert and Bethke 2021:269; Trabert et al. 2024:13).

The Longest site (AD 1757-1811) is another significant Wichita village, located along the Red River in southern Oklahoma (Bell and Bastian 1967; Drass et al. 2018b; Duffield 1965; John 1975; Newcomb and Fields 1967). The Longest site, like its predecessors, was fortified with a circular palisade, earthen ramparts, and ditches (Baugh and Blaine 2017:120-122; Drass et al. 2018b:6-7). Archaeological evidence from the site indicates a continuation of maize agriculture, bison hunting, and European trade (Hofman 1989:102-103). However, by this time, the Wichita had shifted their economic focus from bison hide production to acting as intermediaries in the horse trade between the Comanche and French traders (Bolton 1987; Hickerson 1994; Hofman 1989:103). This shift reflects the broader changes in Southern Plains trade networks during the late 18th century.

CHAPTER 4: SITE OVERVIEW

The Shepard site (34CU220) is located in Custer County, Oklahoma and represents a significant Turkey Creek phase village. Situated on a sloping hill above Barnitz Creek, a tributary of the Washita River, initial observations indicated cultural materials extending down the slope to the east nearly reaching the creek (Drass 2001a, 2001b). Overall, this site has offered valuable insights into pre-contact lifeways, despite the challenges posed by modern land use and salvage excavation constraints. In this chapter I will first examine the Shepard's site's excavation, organization, features, and material culture. I will then provide an overview of several contemporaneous archaeological sites that will be discussed in the final chapter.

Excavations

The Shepard site was initially recorded in 1997, when cultural debris were observed on the surface of a plowed field (Drass 2001a, 2001b). Further investigation found soil staining interpreted as a pit feature (Drass and Earnst 1997). While no formal excavation took place at the time, collectors reported finding multiple artifacts.

In July of 2001, construction of a well pad for El Paso Energy Company led to the discovery of a significant number of cultural materials (Drass 2001a:5). The bulldozing activity had exposed a series of dark soil stains, indicating features, across the northern end of the well pad (Drass 2001a:5). The excavation was led by Dr. Richard Drass and Larry Neal, with support from volunteers from the Oklahoma Archeological Survey, local community members, and the landowner Charles Shephard (Drass 2001a, 2001b). Due to pressing construction activity excavators were only allowed 3 days to record site organization and possible cultural features and recover archaeological materials (Drass 2001a, 2001b). Additional monitoring and sampling occurred later in July when final construction resumed (Drass 2001b).

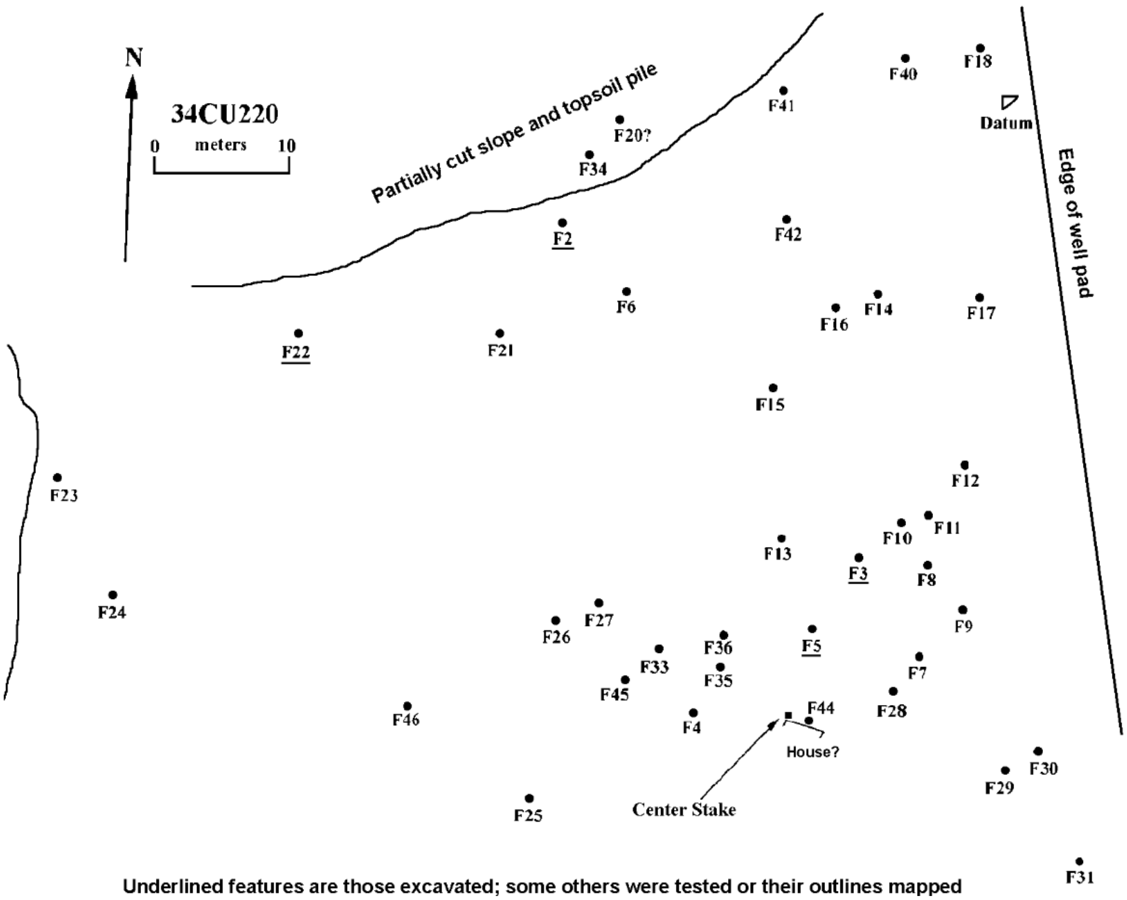

Figure 4.1: Map of Features at the Shepard Site (Drass 2001a, No Figure Number).

Salvage excavations are inherently limited in nature, often resulting in incomplete recovery and significant disturbances to archaeological contexts. At the Shepard site, construction truncated features, limiting their depth and compromising the stratigraphic integrity (Drass 2001a, 2001b). Features were flagged and mapped using a transit, and trowels were used to expose features and collect soil samples (Drass 2001a). Given the salvage nature of the excavation, the focus was on efficiently documenting and preserving materials rather than systematically excavating, which resulted in a lack of consistently recorded stratigraphy such as distinct levels. Provenience included feature numbers and dates for all material collected (Drass 2001b). Additionally, directional dimensions and depths were recorded for only 17 features (Drass 2001b). No additional information was recorded due to time constraints.

The site map shown in Figure 4.1 illustrates the distribution of features across the area. While a large portion of the site was destroyed by initial construction, salvage efforts documented 39 features, including pits, post molds, and potential house patterns (Drass 2001a; 2001b). Of these 39 features, information was recorded in the site notes for only the 17 which were excavated (Table 4.2) (Drass 2001a, 2001b). This section explores the features in greater detail, organized by feature type, to highlight their form, function, and significance within the larger occupational landscape of the site.

Table 4.1: CU220 Pit Dimensions for Excavated and Tested Features (Drass 2001a, No Table Number).

Feature	N-S	E-W	Depth	Comments**
F2[@]	280	287	12	Multiple pits & posts
F3[@]	143	150	25	Cylindrical pit
F5[@]	194	170	24	Cylindrical pit
F7	182	200	74	Deep circular pit
F22[@]	156	120	25-28	Bell-shaped pit
F24			~10	Circular?, mostly destroyed
F27			12-15	Circular, size not recorded
F28	150	170	37	Circular
F33	122	130	10-18	Circular pit
F34	138	140	20+	Not dug to bottom
F35	~150	~150	39	Circular
F40			~10	Size not recorded
F41			~10	Circular, Size not recorded
F42	224	194	20	Circular
F44	80	80	21-31	Cylindrical
F45	146	162	12	Irregular circular
F46	140	120	19-22	Circular
House	430+	410+	-	Rectangular?

*All measurements are in centimeters.
** Excavated features include only the bases of pits and shape is inferred from the bases. Tested pits are usually only identified as circular although outlines may be irregular in some cases.
[@] Indicates features completely excavated on 7-7-01. All other features tested for depth with small trenches or pits.

Sixteen of the recorded features were identified as pits (Drass 2001b). Pits at the site likely served multiple purposes, including storage, refuse disposal, or specialized activities. Feature 3 and Feature 5 were classified as cylindrical pits, meaning their walls were relatively straight and uniform in profile (Drass 2001b). Feature 3 was heavily affected by construction, with the bulldozer removing approximately 60 cm of soil in this area (Drass 2001a, 2001b). As a result, only the base of the pit remained, extending 14–28 cm below the dozed surface, where ash, pottery, bone, and chipped stone artifacts were recovered (Drass 2001b). Feature 7, previously mislabeled as Feature 43, was the deepest intact pit, reaching 74 cm below the surface (Drass 2001b). Within this feature, a bison humerus and scapula, along with large bone fragments, were recovered (Drass 2001b).

Evidence of overlapping pits was observed in Feature 2, indicating repeated use of the area and possible shifts in site activities over time (Drass 2001b). Within this feature, pottery, lithic tools, lithic debitage, and bone were recovered (Drass 2001b). The presence of post molds at the bottom of Feature 2 suggests it may have been part of a house structure, providing evidence of occupation and built features at the site (Drass 2001a, 2001b).

A bell-shaped pit, Feature 22, was characterized by a wide base and a constricted opening (Drass 2001a; 2001b). While its shape suggests it may have been used for storage, the large amount of ash within the pit led excavators to consider an alternative function as a hearth (Drass 2001b). Excavations revealed pottery, lithic tools, bone, burned rock, and charred organics, further supporting its use in activities involving fire (Drass 2001b).

In addition to Feature 2, another potential house structure was identified near the center of the well pad (Drass 2001a, 2001b). This was indicated by a straight, dark soil stain (Feature 44), thought to represent the edge of a rectangular house (Drass 2001b). However, due to bulldozer activity, the remaining walls were obscured. Adjacent to this structure, a circular pit (Feature 44) measuring 80 cm in diameter and 21 cm deep was identified (Drass 2001b). This pit was located just outside the house wall and may have been used during the occupation of the structure (Drass 2001b). Excavations in this area recovered charcoal, bone fragments, and burned stone (Drass 2001b).

Radiocarbon Dating

Radiocarbon dating of samples recovered from these features at the Shepard site has provided a temporal framework for understanding its occupation. A charcoal sample from the surface of a trash-filled pit was submitted for radiometric analysis, resulting in an estimated date range of AD 1407–1638 with a 95.4% confidence level, placing the Shepard site within both the Middle and Late Plains Village periods (Drass 2001a, 2001b). To refine the site's chronology, Dr. Richard Drass conducted additional analysis of two charred corn specimens from Features 22 and 44 resulting in a date of AD 1300 (Drass 2001a, 2001b). Based on these findings, Dr. Richard Drass suggests an occupation span from AD 1300 to 1450 in subsequent publications (Drass 2001a, 2001b, 2008).

Paleobotanical Analysis

Palaeobotanical research conducted by Dr. Richard Drass has incorporated flotation results from the Shepard site, offering additional insights. Soil samples from features yielded both light and heavy fraction, results shown in Table 4.2. Evidence supports the role of maize as a dietary staple and its integration into the broader economy of Turkey Creek phase communities (Drass 2008:13-15). Analysis revealed corn, dropseed, chenopod-amaranth, purlslane, grasses, carpetweed, and possible little barley fragments. These findings align with regional patterns of mixed economies, in which horticulture supplemented bison hunting and the gathering of wild resources. The culmination of paleobotanical investigations at the Shepard site as well as other Plains Village Period sites he examined were used by Dr. Richard Drass in a 2008 publication and reinforces the significance of the Shepard site within this broader framework.

Table 4.2: Quantities of Economically Important Plant Remains Recovered from the Shepard Site (adapted from Drass 2008 and 2001).

Domesticate	**Quantity**
Corn	264
Tobacco	0
Beans	0
Squash	1
Sunflower	2
Marshelder	2
Dropseed	12
Little Barley	1
Maygrass	0
Knotweed/Smartweed	0
Total	**282**

Other Analyses

In addition to faunal remains, lithic and ceramic objects were identified during the excavation (Drass 2001a, 2001b). Limited analysis has been done on these artifacts and only the initial recording of the site and landowner collections were reported in the Oklahoma Archaeological Society Newsletter by Dr. Richard Drass and Randy Earnst (1997). Additional information on artifacts identified during the 2001 excavation are included in the unpublished excavation notes, Drass (2001b).

A significant portion of the landowner's collection is pottery, comprising 21 sherds that include both decorated and plain specimens (Drass 2001b). The decorated pottery includes a painted sherd with finger-streaked designs and another sherd with an appliqué motif (Drass 2001b). The temper in the sherds has also been identified as crushed shell and stone, characteristic of the regional pottery traditions (Drass and Earnst 1997).

One painted sherd features a finger-streaked design applied vertically, with rounded streak ends resembling finger impressions (Drass 2001b). This piece measures 9.6 cm x 8.5 cm, with a thickness of 1.17–1.3 cm (Drass 2001b). Its core appears dark gray, and the interior is a reddish-brown shade, likely due to firing conditions. Additionally, an appliqué-decorated sherd measuring 5.3 cm x 5.5 cm showcases a raised appliqué element preserved above the break line (Drass 2001b). Its black core and crushed-shell temper further align with local pottery-making techniques (Drass 2001b).

Other notable ceramics include a rim sherd with an applied node at the body/rim junction and plain body sherds that may belong to the same painted vessel (Drass and Earnst 1997). A unique clay figurine was also recovered. Measuring approximately 6.7 cm long and 2.3 cm wide, it portrays a human figure, possibly a female with punctations that might represent tattoos (Drass and Earnst 1997).

Lithic and groundstone artifacts have yet to be analyzed, however, a fragment of a granite grinding basin, 1 sandstone abrader fragment, and 1 Alibates flake have been identified in the landowner's collection (Drass 2001b; Drass and Earnst 1997). Additionally, a number of artifacts are noted as observed but not collected including mano flakes, tested cobbles, mano fragments, daub, and additional bison bone, explanation as to why they were not collected is not given (Drass 2001b). Overall artifacts from 34CU220 closely resemble materials from other Turkey Creek Phase sites, such as Heerwald and McLemore (Drass and Earnst 1997). These comparisons suggest occupation during A.D. 1320–1450, bridging early and late phases of the region's Late Precontact period.

Comparative Sites

As was discussed in the previous chapter, significant Turkey Creek sites that have been excavated in the state of Oklahoma include Heerwald, Goodman I, Goodman II, Goodwin-Baker, McLemore, and a component of the Little Deer site. To better contextualize the Shepard site within the broader landscape of the Middle Plains Village period occupations, this section examines the six additional Turkey Creek sites. Each share temporal, cultural, and ecological connections with the Shepard site, offering critical insights into shared lifeways and regional variations in subsistence and material culture. This background sets up the final chapter to explore similarities and differences between the sites so that the social and environmental dynamics shaping Turkey Creek phase communities can be better understood.

Heerwald

The Heerwald site (34CU27) is situated on the southern terrace of Turkey Creek, a tributary of the Washita River in west-central Oklahoma. The site has been the focus of archaeological investigations since work by the Works Progress Administration in 1941 (Brighton 1951). More extensive studies occurred in 1957 during highway construction and again in 1983, with a testing program aimed at clarifying occupational components. The combined efforts identified 73 features, including storage pits, hearths, and midden deposits (Drass et al. 1987:153). The site's layout reflects a village organization with an even distribution across northern and southern areas.

Heerwald is a key site for understanding the Turkey Creek phase of the Middle Plains Village period. Radiocarbon dates, taken from a storage pit and a trash-filled gully during the 1983 excavation, place the site between A.D. 1420 and 1430 (Drass et al. 1987:153). This situates

Heerwald as a significant example of the strategies employed by Middle Plains village groups during this period, including horticulture and bison hunting.

Artifacts recovered from Heerwald include triangular unnotched and side-notched projectile points, thumb scrapers, abraders, and ceramics tempered with shale (Drass et al 1987:156-157). Botanical remains indicate a reliance on horticulture, with corn being prominent. Faunal remains were analyzed by Dr. Sheila Bobalik Savage, who found that the assemblage was dominated by bison (MNI of 39), with all skeletal elements represented, suggesting on-site processing and consumption (Bobalik-Savage 1995:78; Drass et al. 1987:157). Secondary species include deer, coyote, various small and very small mammals, along with birds such as turkey (Bobalik-Savage 1995:78, 101; Drass et al. 1987:157). The faunal assemblage, coupled with evidence of cultivated plants, reflects a mixed subsistence economy.

Bison remains constitute the largest faunal category at Heerwald, underscoring their importance in subsistence and cultural practices during this time. The presence of bison bone tools, such as scapula hoes, tibia digging stick tips, and horn core scoops, illustrates their utility beyond dietary purposes. The range of represented skeletal elements suggests that hunting and processing occurred locally, supporting interpretations of Heerwald as a stable, semi-sedentary village with access to substantial bison herds (Bobalik-Savage 1995; Drass et al. 1987).

The Heerwald site provides critical insight into the lifeways of Middle Plains Village communities. Its well-reserved features and artifact assemblage offer a comprehensive view of the interplay between horticulture, hunting, and settlement patterns. Given its extensive excavation and preservation, Heerwald serves as a valuable baseline for comparing the Shepard site.

Goodman I and II

The Goodman I site (34CU1) is located on a terrace of the Washita River in Custer County, Oklahoma (Gallaher 1951:188). The site was reported in 1941 to the University of Oklahoma Anthropology Department, by the landowner Boone Goodman (Gallaher 1951:188). Excavations began in February 1941 under the supervision of Lynn Howard as part of a Works Progress Administration (WPA) project directed by Dr. Forrest E. Clements. Two wattle- and-daub structures were revealed in excavation, one with a centrally located hearth and four center post holes arranged in a square pattern (Gallaher 1951:188-190). An additional, smaller, structure was identified nearby as well as additional features.

Artifacts recovered from Goodman I include chipped stone tools such as triangular projectile points, end scrapers, side scrapers, and a flake knife, with Alibates flint being the predominant raw material (Gallaher 1951:193-199). Ground stone artifacts include a metate and a sandstone awl sharpener (Gallaher 1951:199-201). Bone artifacts, though limited in number, include a fragmentary bison scapula hoe and multiple unidentified bone fragments (Gallaher 1951:201-203). Pottery at Goodman I is primarily Stafford Plain and Stafford Cord-marked, tempered with caliche and grit (Gallaher 1951:203-204).

The Goodman II site (34CU2) is located on a terrace above a floodplain of the Washita River near Stafford, Oklahoma, approximately a few hundred yards from Goodman I (Brighton 1951:165). The site was also reported by landowner, Boone Goodman, and excavation was performed in 1941 through the University of Oklahoma Anthropology Department and WPA (Brighton 1951:164). The proximity of the two sites has led researchers to consider them to be two different areas of the same village complex (Brighton 1951:165).

Two excavation areas at Goodman II yielded evidence of wattle-and-daub structures, village debris, fire pits, and storage features. In Excavation Area 1, a circular hearth approximately 1.5 feet in diameter was surrounded by several small features interpreted as post holes, likely part of a domestic structure (Brighton 1951:165-166). Excavation Area 2 revealed a more clearly defined house floor, a fireplace, and four cache pits. Artifacts from Goodman II include chipped stone tools such as triangular projectile points, end scrapers, drills, and flake knives (Brighton 1951:167). Notably, Alibates flint is the predominant lithic material. Ground stone tools include a broken metate and a sandstone awl sharpener (Brighton 1951:167). Analyzed bone artifacts are limited to modified bone, including a bison scapula hoe and a set of 29 Olivella shell beads associated with a burial (Brighton 1941:167). The ceramic assemblage consists of Stafford Plain and Stafford Cord-marked pottery, similar to Goodman I (Brighton 1941:167-168). The layouts and assemblages at both sites suggest that Goodman I and II were part of a semi-sedentary village with a mixed subsistence economy focused on bison hunting and plant processing (Brighton 1941; Gallaher 1941). However, the limited faunal data available from both sites restricts direct comparisons to the Shepard site.

Goodwin-Baker

The Goodwin-Baker site (34RM14) is located on the south side of Sandstone Creek, a tributary of the Washita River in western Oklahoma (Swenson 1951:5). The site was excavated in 1970 by the University of Oklahoma Archaeological Field School under the direction of Don G. Wyckoff (Swenson 1951:5). Excavations uncovered two wattle-and-daub house structures with centrally located hearths, as well as an open arbor, multiple pits, and sheet middens (Swenson 1951:5).

Radiocarbon and archaeomagnetic dating at Goodwin-Baker produced a range of A.D. 700 to 1800; however, the most reliable dates cluster around the early A.D. 1400s, placing the site within the Turkey Creek phase (Swenson 1951:5-6). The recovered ceramic assemblage includes a mixture of Late Precontact and early Contact Period types. Nocona Plain ceramics, commonly associated with the Henrietta Focus (A.D. 1200–1500) and Washita River Phase (A.D. 1100–1450), make up 19.6% of the assemblage. The remainder consists of Plain and Decorated Sandy and Silty Paste Ware, Little Deer Plain, and Southwestern trade wares, including smudged corrugated and glazed ceramics (Swenson 1951:6).

Lithic artifacts at Goodwin-Baker include a variety of scrapers, knives, drills, and projectile points. Fresno points are the most common, followed by Washita, and Harrell points (Swenson 1951). Alibates flint is the predominant raw material, consistent with other Edwards Complex sites. Analysis of faunal remains was restricted to modified bone. And includes 67 scapula hoes, 25 tibia digging stick tips a single carbonized bison skull hoe fragment, bone rasps, and bone beads (Swenson 1951:7). Additional trade materials include Olivella shell beads and a red pipestone pipe fragment, likely sourced from the eastern Plains (Swenson 1951:7). The presence of well-preserved wattle-and-daub structures, a diverse ceramic assemblage, and evidence of trade supports interpretations of the site as a semi-sedentary village engaged in both local subsistence activities and regional exchange networks (Swenson 1951). However, the faunal assemblage at Goodwin-Baker is not well-documented, limiting its utility for direct comparisons with the Shepard site.

McLemore

The McLemore site (34WA5) is located along Cobb Creek, a tributary of the Washita River in west-central Oklahoma. The site was originally reported in 1955 and excavated in 1980 with supervision by Dr. Robert E. Bell. The site was organized into three grids; grid A recovered 13 refuse pits and 7 post holes, grid B recovered a complete house pattern and 15 refuse or cache pits, grid C recovered 48 burials and one feature (Pillaert 1963:5). Radiocarbon dating of charcoal at the site place it within the range of AD 1300 to 1500, contemporaneous with the Turkey Creek phase of the Middle Plains Village period (Pillaert 1963:5). This situated McLemore as a significant example of Middle Plains livelihoods, including horticulture and bison hunting.

Artifacts recovered from McLemore include a number of lithics including triangular projectile points, drills, knives, metates, and ceramics tempered with caliche (Pillaert 1963). Palaeobotanical remains from the site remain unanalyzed, however, the presence of manos, metates, mortars, and pestles suggest plant processing was occurring at the site. Faunal remains include a number of mammals, birds, and reptiles. Mammal remains include bison (MNI of 4), deer, antelope, gopher, cottontail, jackrabbit, and coyote. Additional species present include ornate box turtle, American crow, turkey, duck, and prairie chicken (Pillaert 1963:76-77). In addition to the faunal assemblage, lithic evidence, such as of over 200 scrapers known to be utilized for hide processing indicates the importance of hunting in this community as well as the mixed subsistence economy (Pillaert 1963:10).

Bison has been identified as the preferred dietary fauna at the McLemore site reflecting their larger importance in subsistence during the Turkey Creek phase. Bison remains at McLemore are represented as both non-modified and modified specimens. Sixty-seven scapula hoes were recovered, six complete and sixty-one fragmentary (Pillaert 1963:76). Twenty-five tibia digging sticks were recovered, seven complete and seventeen fragmentary. One carbonized bison skull hoe fragment was also collected (Pillaert 1963:10). The range of skeletal elements at McLemore suggest processing occurred at the kill site and high utility elements were then transported back, supporting interpretations of McLemore as a semi-sedentary village with access to bison resources (Pillaert 1963).

Little Deer

The Little Deer site (34CU10) is a multicomponent site situated between the Canadian and Washita Rivers (Bethke et al. forthcoming). Surface artifacts and features were first recorded in 1948; however, official documentation did not occur under 1950 by Fenton Wheeler (Bethke et al. forthcoming). Excavations were then performed in 1995 and 1997, led by Dr. Richard Drass and Susan Vehik (Bethke et al. forthcoming).

Excavations identified three features. Feature 1, a small trash pit, is the only confirmed Turkey Creek phase component, dating to approximately A.D. 1260–1280. Feature 2, a large pit, contained a diverse artifact assemblage, including Edward Plain pottery, lithics from Florence-A and Edwards chert, and botanical remains such as charred corn and walnut shell (Bethke et al. forthcoming). Feature 3, a burned structure adjacent to Feature 2, dates slightly later, between A.D. 1315 and 1390, and is also attributed to the Wheeler phase (Bethke et al. forthcoming). The remaining excavation areas contained early contact materials dating from A.D. 1500–1700, aligning with the Wheeler complex (Bethke et al. forthcoming). Going forward, all discussion and comparison in Little Deer with only include Feature 1.

Faunal remains from Feature 1 of Little Deer are limited but provide some insight into subsistence practices. Identified species include bison (*Bison bison*), white-tailed deer (*Odocoileus virginianus*), pronghorn antelope (*Antilocapra americana*), dog or coyote (*Canis sp.*), and various small and very small mammals such as raccoon (*Procyon lotor*), badger (*Taxidea taxus*), beaver (*Castor canadensis*), black-tailed jackrabbit (*Lepus californicus*), and eastern cottontail (*Sylvilagus floridanus*) (Bethke et al. forthcoming). Reptilian remains include ornate box turtle (*Terrapene ornata*), smooth softshell turtle (*Trionyx muticus*), and common snapping turtle (*Chelydra serpentina*) (Bethke et al. forthcoming). Avian and fish remains are also present, including wild turkey (*Meleagris gallopavo*), quail (*Callipepla* sp.), and catfish (*Ictaluridae* sp.) (Bethke et al. forthcoming).

Despite plow zone disturbances, excavations revealed a stratified sequence of occupations. The artifact assemblage suggests a long-term occupation spanning from the late precontact to early contact periods, with shifting material culture reflecting broader regional interactions (Bethke et al. forthcoming). The site is significant in understanding the transition from Plains Village lifeways to early Wichita settlements.

CHAPTER 5: THEORY

To better understand the cultural practices reflected in the Shepard site's material remains, this chapter will explore the theoretical frameworks employed in this thesis to examine the interplay between human subsistence, ecological systems, and social structures. My engagement with foodways literature (Briggs 2011; Harris 1985; Hastorf 2017; Meigs 1984; Peres 2017; Scarry et al. 2023) initially shaped my approach to this research, emphasizing the different dimensions of food practices. However, I found that a combination of other theoretical approaches—subsistence studies, socioecological systems theory, and social zooarchaeology—provided a more comprehensive framework for interpreting the Shepard site data.

Subsistence studies lay the groundwork for understanding the relationships between humans and edible resources from economic, social, and symbolic perspectives (Binford 1978; Harris 1985; Hastorf 2017; Smith 1992). Additionally, while this study acknowledges the dynamic relationship between human societies and their environments, it rejects environmental determinism, which presupposes that ecological conditions unilaterally dictate human behavior (Reitz and Wing 2008:12). Instead, this thesis emphasizes the reciprocal and culturally mediated interactions between people and their surroundings. The subsequent sections on socioecological systems theory and social zooarchaeology offer a more nuanced perspective highlighting the interrelated nature of these relationships as socially and ecologically embedded. By integrating these theoretical frameworks, the chapter highlights the complex roles that animals played not only as resources but also as ecological and cultural agents within a system of human-environmental interactions.

Subsistence Studies

Subsistence studies have been foundational in shaping the field of zooarchaeology, which has been historically focused on understanding the procurement, processing, and consumption of animal resources by past people (Gifford-Gonzalez 2018:12-13; Reitz and Wing 2008:27-28). These works provide a basis for understanding practical, ecological, and technological dimensions of human lifeways. By analyzing faunal remains, researchers can reconstruct patterns of hunting, butchery, and resource allocation, offering insights into how human populations adapted to environmental constraints and opportunities (Binford 1978:15-38; Gifford-Gonzalez 2018:89-90). Rooted in ecological anthropology, subsistence studies emerged from the integration of archaeological, anthropological, and ecological methods to explore how human societies adapt to their environments (Binford 1978; 1-14, 245-342; Gifford-Gonzalez 2018:19-26).

The development of subsistence studies has been shaped by several theoretical frameworks that emphasize human-environmental interactions and adaptive strategies (Gifford-Gonzalez 2018:26-27; Reitz and Wing 2008: 27-28, 39-40). Initially Julian Steward's concept of cultural ecology laid the groundwork for subsistence studies through its emphasis on adaptive relationships between human societies and their environments (Steward 1955). This approach conceptualized subsistence as a cultural response to ecological constraints.

Lewis Binford then transformed subsistence studies with the application of optimal foraging theory (OFT), shifting the field from descriptive analyses of faunal remains to interpretive frameworks that link material evidence to broader ecological and cultural processes (Binford 1978:1-14; Reitz and Wing 2008; 48-49). OFT refers to models of human subsistence decisions, such as cost-benefit analyses, that view subsistence as aimed to maximize resource efficiency (Binford 1978:1-14; Emlen 1974).

Additionally, Binford's development of utility indices marked a turning point in the discipline, allowing researchers to quantify the economic value of different skeletal elements and infer patterns of resource transport, processing, and consumption (Binford 1978:19-38). Utility indices quantify the caloric or material value of different bones, offering insights into transport decisions, butchery practices, and site use (Reitz and Wing 2008; 228-231). For instance, high-utility elements, such as limbs rich in meat and marrow, were often transported to residential sites, while low-utility elements were more likely to be discarded near kill sites (Frison 1996).

These indices have been expanded on and refined by a number of zooarchaeologists since their initial publication, including the development of specific indices for bison (Brink 1997; Emerson 1990; Lyman 1992; Outram 2001). Critiques of utility indices come from their reliance on generalized assumptions about animal processing and transport, which may not account for variability in human behavior, environmental conditions, or cultural practices (Lyman 1992; Metcalfe and Jones 1988; Speth 2022). In response, scholars like Brink (1997) have refined bison utility indices by incorporating more nuanced factors, such as carcass size, processing time, cultural preferences, to better reflect the complexity of decision-making. Similar refinements have been applied to deer and pronghorn indices, accounting for factors such as seasonal availability, hunting techniques, and cultural preferences for specific cuts of meat (Jacobson 2000, 2003). These updates to Binford's original models have allowed for more accurate interpretations of subsistence and have highlighted the need for context-specific applications of utility indices (Brink 1997; Emerson 1990; Outram 2001).

In addition to the development of utility indices, subsistence studies have increasingly emphasized the importance of resource diversification as a strategy for mitigating risk and ensuring long-term food security (Bird and Bliege-Bird 2002; Bliege-Bird and Bird 2008; Bliege-Bird et al. 2009; Hawkes et al. 1991). Rooted in OFT and cultural ecology, diversification reflected the adaptive logic of balancing high-risk, high-reward resources (e.g. large game) with lower-risk alternatives (e.g. small game or fish) to buffer against environmental variability (Jazwa et al 2020). In the southern Plains, Haury (2008) highlights how Wichita communities relied heavily on bison while supplementing their diet with box turtles, deer, and small game, demonstrating how diverse resource use supported resilience. This strategic management of resources not only ensured food security but also played a key role in shaping social structures (Bird and Bliege-Bird 2002; Bliege-Bird and Bird 2008; Bliege-Bird et al. 2009).

The distribution of resources, such as the allocation of high-value cuts of meat, as well as nutrient-rich parts like marrow, fat, and organs, further reveals the role of subsistence in reinforcing social hierarchies and cultural norms (Binford 1978:135-165; Hastorf 2017). Subsistence is inherently cultural, reflecting social organization, identity, and power dynamics (Gifford-Gonzalez 2018:554-557; Hastorf 2017; Reitz and Wing 2008: 54-55). Communal hunting, a hallmark of Plains societies, required significant social organization, cooperation, and coordination (Brink 2008). The division of labor during hunting and butchery often mirrored broader social structures, reflecting roles tied to gender, age, or status within the community (Reitz and Wing 2008:285-286). For example, access to specific resources or technologies, such as storage pits or specialized hunting tools, often signified control over subsistence and could reflect power dynamics within communities (Harris 1985; Smith 1992).

Subsistence studies act as a useful foundation for interpreting zooarchaeological assemblages by offering insights into how human societies adapted to ecological constraints, developed technological innovations, and organized social life around resource use (Reitz and Wing 2008; 27-28). Through the integration of theoretical frameworks such as cultural ecology, optimal foraging theory, and utility indices, this approach examines the dynamic interplay between human behavior, environmental conditions, and material practices.

Socioecological Systems Theory

The Socioecological Systems (SES) framework is an interdisciplinary approach to conceptualizing the interconnectedness of human societies and natural ecosystems (Gunderson and Holling 2002; Holling 1973; Liu et al. 2007). It emphasizes the complexity and co-evolution of human and ecological systems, rejecting reductionist approaches that isolate humans from their environmental context (Van Der Leeuw and Redman 2002). Berkes and Folke (1998) further highlight the importance of social mechanisms, such as traditional ecological knowledge, in building resilience and managing socioecological systems.

Central to SES are concepts such as feedback loops, thresholds, resilience, and robustness. These tools help researchers analyze how human and ecological components interact and adapt over time (Liu et al. 2007; Solich and Bradtmoller 2017; Turner et al. 2003). Feedback loops capture interactions within systems where changes in one component influence others, either stabilizing (negative feedback) or amplifying (positive feedback) the system (Berkes et al. 2003). Thresholds represent critical tipping points where systems can transition into new states, such as the collapse of bison populations following overexploitation (Gunderson and Holling 2002; Holland-Lulewicz 2024; Solich and Bradtmöller 2017).

SES research also recognizes the nonlinear dynamics of these systems, where cause-and-effect relationships are often disproportionate, leading to sudden, transformative shifts (Van Der Leeuw and Redman 2002). This complexity highlights the need to examine both short-term interactions and long-term legacies to fully understand socioecological dynamics (Liu et al. 2007). The SES framework provides a valuable lens for understanding the reciprocal relationship between the ancestral Wichita and bison populations on the Southern Plains. By focusing on feedback loops, thresholds, and resilience, this analysis frames their interactions as dynamic and interdependent.

In the ancestral Wichita-bison SES, feedback loops illustrate the interdependence of human and ecological systems. Subsistence practices, such as seasonal hunting, aligned with bison migrations, reflecting a deep understanding of local ecological patterns. These practices supported grassland regeneration, which in turn sustained bison populations and ensured long-term resource availability for Wichita communities (Bozell 1995; Drass 2008:7-9). This interspecies relationship emphasizes how Wichita cultural practices were closely attuned to the ecological needs of the region. Furthermore, socioecological systems theory provides a comparative perspective on how human societies have historically shaped and been shaped by their environments, reinforcing the importance of feedback loops in maintaining balance (Redman 1999; Solich and Bradtmoller 2017).

Positive feedback loops, such as overhunting, had the potential to destabilize these systems by diminishing bison herds and reducing the availability of key resources. However, negative feedback mechanisms, such as the Wichita’s strategic seasonal mobility and diversified subsistence practices, were culturally informed strategies that contributed to ecological balance and resource sustainability (Drass 1997). Adaptive practices help create a resilient socioecological system capable of adapting to environmental fluctuations, which highlights the interplay between social and ecological factors (Scoones 1999; Solich and Bradtmoller 2017).

While little is known about ancestral Wichita fishing practices, societies elsewhere such as the Calusa of southwestern Florida developed sophisticated fisheries management practices, such as the construction of watercourts, which created feedback loops that stabilized fish populations and supported their socioecological system (Holland-Lulewicz 2024). These practices not only ensured resource availability but also reinforced the social and political structures that depended on them. The Calusa's reliance on large-bodied fish species with high salinity tolerance allowed their system to adapt to environmental changes, such as fluctuations in rainfall and salinity, without crossing critical thresholds (Holland-Lulewicz 2024:427-428). This highlights the importance of resource diversification and ecological knowledge in maintaining system stability.

Resilience within the ancestral Wichita-bison SES was rooted in their diversified subsistence economy, which included hunting, agriculture, and foraging. This variety buffered communities against challenges such as droughts or resource shortages (Drass 2008:26-27). Pre-contact communities in the Great Plains, for example, used strategies involving landscape modifications, including controlled burns, which enhanced forage availability for bison and supported broader ecological health (Roos et al. 2018; Stewart 2009; Wedel 1961). These practices reflect a capacity to respond to environmental challenges while embedding ecological knowledge within cultural traditions.

In addition to resilience, the concept of robustness highlights how socioecological systems can be actively structured to deal with uncertainty and environmental variability (Holland-Lulewicz 2024). Work on the Yup'ik of Southwest Alaska exemplifies this through a flexible subsistence strategy centered on salmon, marine mammals, and caribou, which buffered them against resource fluctuations during the Little Ice Age (Masson-MacLean et al. 2020). Their ability to shift focus between resources in response to environmental stress, along with sophisticated bone and antler technology, stabilized their system through negative feedback loops (Masson-MacLean et al. 2020). Such adaptive strategies, which can be applied to other temporal and spatial contexts, illustrate how robustness reduces uncertainty and ensures stability during rapid change.

Building on the SES framework, symmetrical anthropology emphasizes the co-construction of resilience by recognizing non-humans not just as ecological agents but also as cultural participants (Descola 2013; Latour 2005). This relational view deepens our understanding of how ancestral Wichita cultural practices, such as seasonal mobility, actively shaped and were shaped by bison populations, creating a dynamic and adaptive socioecological system.

The SES framework offers a powerful tool for understanding the interconnectedness of human and ecological systems. By examining feedback loops, thresholds, resilience, and robustness this framework reveals the adaptive strategies that supported the sustainability of Plains Village societies. The relationship between the ancestral Wichita and bison exemplifies the reciprocal and dynamic nature of human-environmental interactions, where cultural practices were both shaped by and actively shaped ecological conditions. This perspective underscores the importance of integrating cultural and ecological factors to interpret long-term socioecological stability, offering insights into the resilience of past and present societies (Berkes and Folke 1998; Gunderson and Holling 2002; Holland-Lulewicz 2024; Masson-MacLean et al. 2020; Solich and Bradtmoller 2017).

Social Zooarchaeology

Social zooarchaeology is an interdisciplinary framework that further moves beyond the utilitarian view of animals as resources in order to explore their active roles as participants in social, cultural, and ecological systems (Russel 2012). Within this approach the importance of examining human-animal interactions is emphasized and embedded in broader social and symbolic networks. Social zooarchaeology considers how animals shape and are shaped by human identities, rituals, and power structures. This is done through the integration of principles from symmetrical anthropology, a framework that challenges the rigid boundaries of nature/culture and human/animal, positioning animals as agents with the capacity to influence human lives (Descola 2013; Latour 2005).

The conceptual foundations of social zooarchaeology highlight the relational nature of human-animal interactions and the dual roles of animals, as both material and symbolic agents. Building on frameworks such as actor-network theory and symmetrical anthropology, social zooarchaeology asserts that humans and animals co-create their shared worlds (Latour 2005; Russell 2012:11-13). Holland-Lulewicz and Holland-Lulewicz (2023) expands on this relational perspective through network analysis, demonstrating how human–animal–environment interactions form complex social and ecological networks. Such approaches emphasize that animals are not passive nodes but active participants within broader socioecological systems. Within this framework, animals function not only as resources but also as symbols of power, abundance, and cultural cohesion (Zedeño 2008).

Social zooarchaeology is particularly well-suited to Plains archaeology, where bison played multifaceted roles in subsistence, technology, and ideology. In Southern Plain’s societies, bison remains were transformed into tools, ornaments, and ceremonial objects (Drass 1998; Hofman et al. 1989:78-79). Among the ancestral Wichita, the roles of bison extended beyond material to the symbolic, positioning bison as central figures in the construction of social identities and cultural resilience (Frison 1996; Vehik 2002). Mythological narratives further positioned bison as spiritual agents, connecting human communities to a more-then-human world (Dorsey 1904; Hultkrantz 1979). Such roles highlight how animals contribute to the construction of cultural memory, shaping human identities and social structures (Boisvert et al. 2021; Helmer 2024).

In addition to the theoretical lens of social zooarchaeology, the framework also provides a methodological outline for examining the complex interplay between humans and animals. Social zooarchaeology encourages researchers to consider 1) agency through how animals, as social actors, influence human practices and ideologies, 2) symbolism, through the roles of animals in rituals, mythology, and social hierarchy, as well as 3) resilience, through the ways human-animal interactions contribute to the sustainability of cultural and ecological systems (Folke 2006; Golling 1973; Russel 2012; Zedeño 2008). Recent work further critiques traditional economic models of animal domestication, emphasizing the social and symbolic dimensions of human-animal interactions (Huey 2021; Sykes 2014).

Applied to the ancestral Wichita, social zooarchaeology enables a holistic analysis of bison as both material resources and cultural agents, shaping and reflecting human lifeways. Communal bison hunting among the ancestral Wichita illustrates the relational nature of human-animal interactions (Drucker 1966; Hoard 2012:24). These events insinuate strategic planning and collective action, in addition to reinforcing group cohesion and ecological knowledge (Brink 2008; Frison 1996; Hoard 2012:19).

The importance of bison is also evident symbolically within Wichita mythology, where bison are portrayed as providers of life and abundance (Dorsey 1904). An example of this is the story, *The Coyote Who Became a Buffalo*, in which "Coyote" seeks to gain the power and sustenance of the Buffalo (Dorsey 1904:278-280). "Coyote" follows the Buffalo and is told that only brave individuals can become Buffalo, which leads him to attempt to prove his bravery four times. This story reinforces the Buffalo's role as a powerful and aspirational figure in Wichita mythology, symbolizing strength, abundance, and the potential for transformation. Through both their material and their symbolic roles, bison functioned as central figures in the construction of Wichita identity and resilience.

Similar symbolic practices are evident in other Indigenous societies. For instance the practice of bundling, where animal bones were not merely discarded but intentionally bundled and buried as part of ritual feasting practices illustrates how both consumption and deposition can have symbolic connections (Wallis and Blessing 2015; Zedeño 2008). These practices underscore the relational ontologies that position animals as active participants in social and cosmological networks, shaping human identities and cultural memory across diverse contexts. Narratives such as these are not only capable of structuring spiritual beliefs but also guiding subsistence and social practices, essentially embedding animals within cultural memory (Wallis and Blessing 2015; Zedeño 2008).

Social zooarchaeology also emphasizes that human-animal interactions are inherently co-constructed, with mutual dependencies shaping cultural and ecological systems (Russel 2012). In the scheme of the Southern Plains, subsistence practices not only enhanced the reliance on bison but in doing so maintained the health of grassland ecosystems critical for survival (Vehik and Kraft 1995). This dynamic interplay between cultural practices and ecological systems underscores the resilience of Wichita lifeways and further reflects the principles of socioecological systems theory (Berkes et al. 2003; Holling 1973).

Social zooarchaeology, informed by symmetrical anthropology, provides a robust framework for understanding human-animal interactions in Plains archaeology. By examining bison as cultural and ecological agents, this approach reveals the depth of their integration into Wichita social and ecological systems. Furthermore, by weaving the SES framework with symmetrical anthropology and social zooarchaeology, this research frames resilience not only as an ecological phenomenon but also as a cultural process. The dynamic interplay between human practices and non-human populations exemplifies how resilience emerges through the co-construction of ecological and social systems, revealing the reciprocal relationships that sustained ancestral Wichita communities.

Positioning fauna within these frameworks allows for a more nuanced understanding of how the ancestral Wichita adapted to their environments while concurrently constructing cultural meanings within their subsistence practices. By examining the archaeological evidence of social, ecological, and technological dimensions of faunal use, the approach used here underscores the interconnectedness of biological and cultural factors in shaping human-animal relationships.

CHAPTER 6: METHODS

Human environmental interactions are inherently complex and context specific, influenced by diverse ecological, cultural, and temporal factors. Understanding these relationships requires a holistic approach integrating multiple techniques and lines of inquiry (Reitz and Wing 2008: 27-28). Many of the core methods utilized by zooarchaeologists, such as taxonomic identification and taphonomy, were initially developed in fields such as biology and ecology and have since been refined to fit the needs of archaeological goals (Lyman 1994; Reitz and Wing 2008: 38-40; Stiner 1991, 2002, 2004). Behavioral archaeology has further contributed to these methods, with researchers like Binford (1981) emphasizing the role of taphonomy and site formation processes in interpreting faunal assemblages. By integrating these varied lines of inquiry, zooarchaeologists can better interpret the reciprocal relationships between humans and their surroundings, revealing insights into resource use, ecological impacts, and cultural practices over time (Binford 1981; Broughton and Miller 2016; Gifford-Gonzalez 2018; Lyman 1994).

This chapter outlines the methodological framework employed in this study to analyze the faunal assemblage from the Shepard site. To achieve this, the chapter is organized into several key sections, each addressing a specific aspect of zooarchaeological analysis: taphonomy, taxonomic and elemental representation, fragment size and fracture characteristics, as well as data quantifications.

Taphonomy

Taphonomy refers to the study of the changes a deposit undergoes from the time of an organism's death to its archaeological collection (Gifford-Gonzalez 2018; Reitz and Wing 2008: 119-121, 128-131). Key distinctions are made between first-order changes, occurring immediately after death, and second-order changes, which arise later during post-depositional phases (Behrensmeyer 1978; Lyman 1994). This study focuses on assessing bone surface modifications, which provide signatures of various taphonomic agents (Gifford-Gonzalez 2018; Lyman 1994, 2008). Taphonomic analysis distinguishes between changes caused by human activities and those resulting from natural factors (Grayson 1984; Lyman 1994). These distinctions clarify the agents—human, animal, or environmental—responsible for modifications witnessed on zooarchaeological remains. Recording taphonomic observations will help form the basis of a more nuanced interpretation of human-environmental interactions at the site, allowing for a clearer understanding of subsistence practices and site use (Binford 1981; Lyman 1994; Outram 2001).

Gnawing

Biotic agents, such as rodents and carnivores, leave distinctive marks on a bone, including tooth punctures, scratches, and gnawing (Lyman 1994; Reitz and Wing 2008:137-138; Shipman 1981). Gnawing on the bone surface of a specimen can indicate post-depositional disturbance and exposure as well as scavenger activity (Reitz and Wing 2008:137-138; Todd and Rapson 1988). Gnawing affects bone survivorship by selectively destroying certain skeletal elements or portions, leading to differential preservation of more robust specimens (Lyman 1994). Carnivores tend to target bones with high marrow content, crushing them in the process, which reduces the likelihood of their recovery in the assemblage (Binford 1981; Gifford-Gonzalez 2018:233-238). Rodents, comparatively, gnaw bones to wear down their incisors, which leaves parallel grooves that do not alter bone survivorship as dramatically but do obscure surface modifications (Lyman 1994; Gifford-Gonzalez:275-277).

Animal gnawing on bone surfaces was identified and differentiated based on characteristic patterns: rodents leave closely spaced parallel grooves, while carnivores target cancellous bone ends, producing irregular, broad grooves and pit-like fractures (Lyman 1994). All specimens were examined for gnawing during analysis, and any evidence of rodent or carnivore activity was recorded.

Weathering

Weathering describes the physical and chemical changes to bones caused by environmental exposure, such as temperature, moisture, and air. These changes provide crucial insights into post-depositional processes, such as the speed of deposition and preservation conditions (Behrensmeyer 1978; Lyman 1994; Reitz and Wing 2008:122-125; Todd 1987).

This analysis employed a weathering system adapted from Behrensmeyer (1978) and Todd (1987), using categories that range from unweathered to heavily degraded by weathering. Category 0 describes unweathered bones with no visible surface alterations. Category 1 represents early signs of degradation, including fine, shallow linear cracks. In Category 2, bones exhibit moderate exposure, characterized by surface flaking, fine cracks, and some open cracks. Category 3 includes bones with over 50% of the surface intact but with numerous open cracks and extensive flaking. In Category 4, less than 50% of the surface remains intact, with visible fibrous bone and moderate flaking. Category 5 describes severe degradation, with little to no intact surface, extensive flaking or exfoliation, and a fragile structure. Finally, Category 6 represents extreme degradation, with large areas of fibrous bone, crumbling, and disintegration. Each bone specimen was assessed and categorized based on these criteria to evaluate the extent of exposure and differentiate weathering effects from human or animal modifications.

Diagenesis

Diagenetic changes, including chemical, biological, and physical alterations, were documented to understand how burial environments affected bone preservation (Behrensmeyer 1978; Reitz and Wing 2008:122-125). These modifications are critical for understanding how the depositional environment, including burial environment, soil composition, and vegetation, impacted preservation and for determining between natural and anthropogenic alterations to bone (Gifford-Gonzalez 2018:359; Reitz and Wing 2008:122-125). Observed modifications including root etching, mineral staining, and chemical weathering, were recorded, all of which provided context for distinguishing natural processes from anthropogenic alterations (Gifford-Gonzalez 2018:359-362; Lyman 1994, 2008).

Burning

Burning may be associated with both natural and cultural factors (Gifford-Gonzalez 2018; Outram 2002, 2004; Shipman 1981). Burning was recorded based on patterns associated with exposure temperature and duration as either “carbonized” or “calcined.” Carbonized bone indicates a shorter exposure and/or lower temperatures and can be distinguished by a black color. Calcined bone indicates a longer exposure and/or higher temperature and appears as white, chalky bone.

Human Modifications

Human modifications, a central focus for this study, include indicators of butchering and tool production (Binford 1981; Lyman 1994; Reitz and Wing 2008:128-131). A single specimen may undergo a single modification or a sequence of modifications depending on cultural activity

(Lyman 1994). Observed modifications for this study included indicators of butchery (cutmarks, hack marks, chop marks, and blunt impacts) as well as bone tool manufacture (visible scrapes and scratches, abrasions/grinding/polishing, worked bone, and punctures) (Binford 1981; Lyman 1994). Specimens showing post-excavation or lab-related damage were also noted in analysis, however, excluded from cultural modification quantifications and are not discussed further. Analyzing the distribution of human modifications across skeletal elements allows for an understanding of butchery patterns that reflect subsistence strategies, resource use, and technology, which in turn relate to cultural preference and ecological relationships (Binford 1981; Brink 1997, 2001; Emerson 1990; Lyman 1994).

Taxonomy and Elemental Representation

Taxonomic identification is an initial step in the zooarchaeological process, involving the classifying remains to the most specific taxonomic level possible, ideally to species. This is an essential process for reconstructing human-animal interaction at archaeological sites as it identifies what types of animals are present in the assemblage (Lyman 1994; Reitz and Wing 2008:57-60). Taxonomy also offers ecological insights into past environments, providing a lens through which broader socioecological site contexts can be seen through (Gifford-Gonzalez 2018).

For this study, taxonomic identification relied heavily on the comparative collections housed at the Oklahoma Archaeological Survey and focused on size, morphology, and known landmark features such as muscle attachment sites. However, the process was not without challenges. Fragmentation, weathering, and bone modifications frequently obscured diagnostic features and required additional time with specimens (Lyman 1994). This is why reference collections are invaluable in zooarchaeological analysis as they provide access to modern reference that can be compared to archaeological samples for species and element identification (Lyman 1994; Gifford- Gonzalez 2018:106). Unlike traditional zoology manuals, which often rely on idealized visuals or photographs, physical collections capture the variability found in real-world specimens, making them a more reliable resource for identification (Lyman 1994; Gifford-Gonzalez 2018:106).

Species and family identification were made when possible. General taxonomic categories were generated for specimens not able to be identified to that level following those established by Bobalik-Savage (Trabert et al. 2024:91-94). For mammals these included: unidentified large mammal (e.g., horse, bison, elk, bear), medium mammal (e.g., deer, pronghorn, mountain lion), small mammal (e.g., wolf, coyote, dog, beaver, raccoon, badger), very small mammal (e.g., skunk, rabbit, squirrel, rat, mouse, mole), and mammal size unknown (categories based on Trabert et al. 2024:91-94). For birds only unidentified bird was documented. For reptiles and amphibians these included: unidentified turtle, frog or toad. Due to time constraints and the scope of the thesis, fish remains were labeled as unidentified fish, size unknown. Intermediary categories were also used where size was less clear, these included: medium/large and medium/small for mammals and birds. For instance, fragmented mammal ribs may exhibit characteristics that could indicate bison or deer-sized mammal, therefore the category of unidentified medium/large mammal was used.

Element identification can precede or follow taxonomic classification, depending on the condition of the bone (Gifford-Gonzalez 2018:176-178). Skeletal element identification involves determining which skeletal element a given bone or bone fragment belongs to. This step is integral to taxonomic classification and contributes to understanding how animals were utilized by humans in the past (Lyman 1994; Reitz and Wing 2008). Element identification typically relies on diagnostic landmarks, such as muscle attachment sites, cortical bone thickness, morphology, and articular surfaces, which indicate a bone's placement within the skeletal system (Gifford-Gonzalez 2018:171; Reitz and Wing 2008:67-68).

For this study, specimens were first assessed for key diagnostic landmarks such as epiphysial shape, surface shape, and muscle attachment locations (Lyman 1994). When identifiable, elements were recorded with attention to anatomical orientation, including proximal or distal ends for long bones and medial or lateral distinctions. Ageing estimates were based on the degree of epiphysial fusion and dental wear stages as available (Frison and Reher 1970; Hill 2008; Todd et al. 1996). Siding was determined through asymmetry, articulation patterns, and muscle attachment positioning.

While complete or nearly complete specimens may be easily identified to element, fragmented remains present different challenges. Fragments with preserved landmarks often enable element identification to guide taxonomic classification. Conversely, eroded, burned, or modified fragments may first require general taxonomic and bone type classification based on traits like size or cortical thickness (Lyman 1994). Fragmentation has a significant effect on the degree to which a specimen can be identified to element and/or taxon (Lyman 1994; Reitz and Wing 2008:74-75). Smaller fragments often lack the diagnostic landmarks for confident identification and lead to broader taxon categories. Therefore, in this study fragments unidentifiable to a specific element were assigned general classifications: long bone, flat bone, cancellous bone, and indeterminate bone.

Fragment Size and Fracture Characteristics

Following the recording of taphonomic, taxonomic, and elemental representations, the analysis of bone fragments is an accompanying component of zooarchaeological analysis (Lyman

1994). Further exploring bone fragments provides insight into taphonomic processes and allows for differentiation from human subsistence and cultural practices (Gifford-Gonzalez 2018). For this study, two primary methods of fragmentation analysis were employed, for all bison and large mammal specimens: fragment size analysis and fracture characteristic analysis (Bethke 2022; Emerson 1990; Hill 2007; Jazen et al. 2014; Todd 1987; Wilfong and Hill 2022). Bison and large mammal specimens are the focus of these analyses as they are critical for identifying in-bone nutrient extraction, which are common in bison exploitation.

These methods provide insight into the possible processes responsible for bone breakage, whether intentional from human activity or natural forces (Binford 1978; Broughton and Miller 2016; Janzen et al. 2014; Lyman 1994). Both methods provide the opportunity for continued insights into preservation and modification of bone, contributing to the understanding of specific human behaviors, such as selective bone processing for tools or within bone nutrients, which is central for understanding the role of bison at the Shepard site (Lyman 1994; Outram 2008).

Fragment Size

By classifying fragments by their sizes, researchers are able to infer the overall degree and character of fragmentation for the assemblage and determine the taphonomic history (Lyman 2008). This study employed the "Fragmentation Index" specifically for the bison (Bison bison) and large mammal assemblage, which is calculated by dividing MNE by NISP (Lyman 2008: 250-254). To further understand the degree of fragmentation, an assemblage can be divided into size classes based on a specimen's largest dimension (Grayson 1984). For the purpose of both the Fragmentation Index and fragment size analysis, all bone types of both identified elements as well as more general categories (excluding teeth), were measured. Including all bone types in the analysis, regardless of fragment size or preservation, allowed for a more complete understanding of the fragmentation processes at play (Morin 2020:537).

For this study a 11-category system was employed to classify each bone fragment by its maximum dimension, the longest linear measurement of each fragment (Driesch 1976; Outram 2001; Schiffer 1987). Size categories begin with 0-2cm and then proceed in 1cm intervals ending with >10cm, as per the method laid out in Outram (2001:405). Each fragment was measured using a digital caliper to obtain its maximum dimension and weighed using a digital scale to note its mass. Depending on the size of the fragment measurements were rounded to the nearest centimeter. In addition to numerical categories whole and partial elements were also noted and separated, with whole referring to a complete skeletal element and part to an identifiable portion of a skeletal element.

In the context of the bison bone assemblage from the Shepard site, fragment size is especially valuable for understanding the extent of human processing specimens underwent. Complete specimens would indicate elements not targeted for raw materials or in-bone nutrients, while partial elements could have been targeted for marrow (Kooyman 2004). Comparatively smaller fragments could be the result of taphonomic processes or secondary processing for marrow or bone grease (Bethke 2022:129-130; Church and Lyman 2003:1077-1078; Janzen et al. 2014:518-519; Outram 2001: 404-406, 2002:52, 2004; Morin and Soulier 2017: 96-97, 110-111; Wilfong and Hill 2022:360-361).

Fracture Characteristics

Fracture characteristics of bison (Bison bison) and large mammal specimens were also analyzed through the examination of bone breakage, in order to assess whether fractures were the result of human activity or natural taphonomic processes (Grayson 1984). This analysis is useful in identifying patterns of breakage, which offers insight into human behaviors such as primary butchery techniques and processing for marrow and/or bone grease, providing key insights into subsistence practices at the site (Bethke 2022:129-130; Broughton and Miller 2016; Karr et al. 2010:217-218; Outram 2002:60-62).

For this analysis, I employed Outram's Fracture Freshness Index (FFI), which evaluates fractures based on three main characteristics: angle, outline, and texture (Outram 2001, 2002, 2004). Each of these categories is assessed using a scoring system that assigns numerical value to each characteristic from 0 to 2 based on their relative "freshness" (Karr et al. 2010:217-218; Outram 2002:53-56). The angle of the fracture is categorized as either acute (less than 45°), obtuse (more than 90°), or right (90°) (Outram 2002:54). The outline of the fracture is then described in terms of its shape and direction. Possible outline categories include transverse (a fracture cutting perpendicularly across bone), spiral (a helical fracture pattern), diagonal (a fracture at an angle to the long axis of the bone), as well as less common columnar, stepped, and longitudinal (Outram 2002:53-54). The texture of the fracture surface is assessed for three characteristics smoothness, roughness, and fibrousness. Fresh fractures are typically indicated by a smooth fracture surface, while older fractures show rough or fibrous surfaces (Outram 2002:54).

Only fragments ≥3 cm in size were included in the FFI analysis, as smaller fragments do not provide sufficient surface area to accurately assess fracture characteristics (Karr et al. 2010; Outram 2002). This exclusion ensures that the FFI scores reflect reliable and consistent data for interpreting fracture patterns. Each specimen was then assigned an overall score based on the above categories, resulting in fracture freshness scores (FFI) ranging from 0 (entirely fresh) to 6 (completely dry). The FFI scores were calculated by summing the scores for three criteria: fracture angle, fracture outline, and fracture texture. Each criterion was scored as 0 (entirely consistent with fresh fracture), 1 (some unfresh features), or 2 (unfresh features dominate), with the total FFI score ranging from 0 to 6 (Outram 2002:56-57). For example, a specimen with a helical fracture outline, smooth texture, and acute or obtuse fracture angles would score 0 (entirely fresh) across all criteria, resulting in a total FFI score of 0 (fresh). In contrast, a specimen with a transverse or diagonal fracture outline, rough or granular texture, and right-angle fractures would score higher across the criteria, resulting in a total FFI score closer to 6 (completely unfresh) (Outram 2002:56-57).

The combination of fracture freshness analysis along with fragment size analysis allows for a comprehensive understanding of the bison assemblage. Together, these methods allow for the identification of cultural behaviors, such as butchering strategies and resource extraction, and help differentiate these from taphonomic alterations, providing a clearer picture of human-animal interaction at the Shepard site (Bethke et al. 2018; Karr et al. 2010:217-221; Kooyman 2004; Speth and Spielmann 1983; Todd and Rapson 1988). This dual approach is crucial for understanding not just the preservation of the assemblage, but also the ways in which humans utilized bison resources beyond simple consumption, including the use of bones as raw materials for tool making and the extraction of marrow and grease.

Data Quantification

This study utilized a suite of quantification techniques developed by zooarchaeologists to further interpret data collected from primary data analysis. Taxonomic abundances were quantified using the Number of Identified Specimens (NISP), the total mass of bone in grams, and the Minimum Number of Individuals (MNI). Elemental representations were quantified using NISP, total mass, the Minimum Number of Elements (MNE), and for the bison assemblage, Minimal

Animal Units (MAU) and Minimum Animal Units standardized (MAU%) (Gifford-Gonzalez 2018:188-192, 196-197). Together, these metrics provide a comprehensive view of faunal abundance and utilization of animal species at the Shepard site (Reitz and Wing 2008:184-185).

Number of Identified Specimens (NISP) and Minimum Number of Individuals (MNI)

NISP, which counts identifiable fragments for each taxon, is a widely used and consistent method in zooarchaeology (Gifford-Gonzalez 2018:187; Lyman 1994; Reitz and Wing 2008:184-185, 217-218). However, it has limitations, including its tendency to inflate the significance of highly fragmented taxa where multiple fragments from a single individual can be counted as separate specimens (Gifford-Gonzalez 2018:188; Lyman 2008). MNI, on the other hand, estimates the smallest number of individual animals necessary to account for all identified elements of a specific taxon within an assemblage (Reitz and Wing 2008:210-211). This method relies on identifying and counting the occurrence of distinct skeletal elements and comparing this count to the number of times a given element is represented in the body of a given species (Reitz and Wing 2008:210-211). MNI is calculated by considering age, size, and side of elements to ensure accurate representation. It is important to note that MNI can be influenced by both fragmentation and survivorship and therefore should be understood as a minimum estimate. By estimating MNI, this method helps address the question of how many individuals of each species are represented at the Shepard site.

Minimum Number of Elements (MNE) and Minimum Animal Units (MAU and %MAU)

MNE and MAU are employed to better understand carcass utilization. MNE determines the smallest number of skeletal elements which account for all the identified NISP of a specific element in an assemblage (Grayson 1984; Lyman 1994; Reitz and Wing 2008:220-221, 225-226).).

Some skeletal elements are more durable and likely to survive in the archaeological record, and therefore are more identifiable, which may lead to inflated MNE estimates if those elements are overrepresented (Binford 1981; Lyman 1984; Reitz & Wing 2008). To perform this, landmark features, sides, and epiphysial fusion were taken into account for all specimens (Stiner 1991, 2002, 2004). For this study MNE was quantified for only bison and large mammal specimens. Bone fragments unidentifiable to element, such as long bone, rib, scapula, vertebra, cancellous, indeterminate, and flat bone fragments, were not included in MNE quantifications. This choice was made due to the inability to determine the unique morphology of these fragments (Stiner 2002).

The MNE for the bison assemblage was then used to calculate MAU and MAU%. MAU refers to the number of complete anatomical units represented in the assemblage. The MAU is obtained by dividing each MNE by the number of times a specific element appears in a complete skeleton (Binford, 1978, 1984; Lyman, 2008; Reitz and Wing, 2008). For example, in the case of a femur, a complete bison skeleton would include two femora (one per side), so the MNE for femora would be divided by two to calculate the MAU. The MAU% was then calculated for later analytical comparisons, by first determining the most plentiful element and dividing all MAU% by the MAU of that given element (Bethke 2022:132-134; Binford 1978:72, Lyman 2008:227-228; Reitz and Wing 2008:225-230). Through this calculation the representation of each skeletal element is expressed as a percentage relative to the most abundant part in the assemblage.

The development of MAU and MAU% came out of a need to better understand skeletal part representations, with a focus on bone utilization (Gifford Gonzalez 2018:196-197; Reitz and Wing 2008:228-229). MAU provides insight into the number of anatomical units of each element, which can reveal patterns in butchering, transportation, and processing. MAU% takes this a step further by placing each element’s representation in context with the most abundant element in the assemblage, allowing researchers to see which parts were favored or selectively processed. These quantifications aid in identifying patterns of skeletal part representations that may reflect cultural behaviors such as selective transportation or secondary processing (Bethke 2022:132-134; Brink 2001; Emerson 1990, 1993).

CHAPTER 7: RESULTS

Analysis of the Shepard site resulted in a total assemblage of 12,227 specimens (NISP), with a combined mass of 15,451 grams. In the following section I will be discussing the results of this analysis beginning with the overall preservation of the assemblage, an exploration of the broader faunal inventory, and human-modified bone. Following this, the results of bison specific analysis, including butchery analysis, fragment size analysis, fracture analysis, and the application of utility indices, will pe presented.

Preservation

The taphonomic analysis of the Shepard site assemblage assesses the physical and chemical processes that influenced the condition of the remains post-death. The Shepard site assemblage exhibits a remarkable degree of preservation, with most specimens showing limited evidence of significant post-depositional alterations. The majority of specimens exhibit minimal weathering and burning is uncommon within the collection. Evidence of animal modifications is rare, further supporting the assemblage's relatively stable condition. These observations suggest a favorable preservation environment, though detailed analyses of weathering, burning, and modifications will be addressed in the following sections.

Weathering

The Shepard site assemblage shows minimal evidence of weathering (Table 7.1). The majority of the assemblage (83.6%) shows no visible signs of weathering (Category 0), suggesting that most of the material did not undergo prolonged surface exposure. Weathering is present in small proportions across Categories 1 through 6, with moderate to severe weathering (Categories

3-6) accounting for only 5.7% of the total assemblage. This pattern suggests that while some material experienced exposure to the elements, most specimens were either buried quickly or preserved in a context which minimized surface degradation.

Table 7.1: Distribution of Weathering Categories for Faunal Remains at the Shepard Site.

Weathering Categories	NISP	NISP%
0	10,220	83.59%
1	983	8.04%
2	370	3.03%
3	511	4.18%
4	49	0.40%
5	12	0.09%
6	82	0.67%
Total	**12,227**	**100.00%**

The distribution of weathering categories aligns with expectations for an assemblage deposited in a relatively stable environment, potentially reflecting controlled disposal or burial practices, aligning with the assemblage coming from village trash pits (Haury 2008:526; Trabert et al. 2024; 97). However, the presence of a small percentage of heavily weathered specimens (Category 6, 0.67%) may indicate variability in preservation conditions.

Animal Modifications

Evidence of animal modifications is limited within the Shepard site assemblage, with 99.9% of specimens showing no signs of such activity (Table 7.2). Out of the total assemblage, 0.1% (NISP=13) exhibit evidence of animal modifications, with 0.05% (NISP=7) showing rodent gnawing and 0.05% (NISP=6) showing carnivore damage.

Table 7.2: Distribution of Animal Modification Categories for Faunal Remains at the Shepard Site.

Animal Modifications	**NISP**	**NISP%**
No Evidence	12,214	99.90%
Rodent	7	0.05%
Carnivore	6	0.05%
Total	**12,227**	**100.00%**

The extremely low frequency of animal modifications suggests that scavenging or rodent activity had minimal impacts on the integrity of the assemblage. This pattern likely reflects either rapid burial of the material or a deposition context that limited access to scavenging animals (Binford 1981; Lyman 1994; Reitz and Wing 1999). The even distribution of rodent and carnivore modifications further suggests that while both types of animals had access to the assemblage, this access was restricted.

Burning

Burning is rare within the Shepard site assemblage, with 95% of specimens showing no signs of thermal alterations (Table 7.3). Of the remaining specimens, carbonized bones (4%) are most common, followed by calcined specimens (0.65%). The low frequency of burned bone suggests that burning was not a dominant post-death process, nor does it appear to have been a significant aspect of cultural practices related to this assemblage. The low presence of carbonized and calcined bones could reflect selective burning, incidental contact with fire, or waste disposal practices (Lyman 1994; Reitz and Wing 2008).

Table 7.3: Distribution of Burning Stages for Faunal Remains at the Shepard Site.

Burning Stage	**NISP**	**NISP%**
Unburned	11,669	95.44%
Carbonized	478	3.91%
Calcined	80	0.65%
Total	**12,227**	**100.00%**

Diagenic Modifications

Diagenic modifications, which result from chemical and environmental processes post-burial, were observed in approximately 21% of the Shepard site assemblage (Table 7.4). Of the overall specimens analyzed, 79.03% (NISP=9,663) show no evidence of diagenic alterations, highlighting the good preservation of the assemblage. However, the remaining specimens exhibit varying degrees of modification caused by chemical weathering, root etching, and staining.

Table 7.4: Distribution of Diagenic Modification Categories for Faunal Remains at the Shepard Site.

Diagenic Modifications	**NISP**	**NISP%**
No Evidence	9,663	79.03%
Chemical Weathering	88	0.72%
Root Etching	271	2.22%
Staining	2205	18.03%
Total	**12,227**	**100.00%**

Staining is the most frequently observed diagenic modification, affecting 18.03% (NISP= 2,205) of the assemblage. This high percentage suggests significant exposure to soil conditions conductive to staining, such as prolonged contact with minerals or organic materials in the sediment. Root etching, which affects 2.22% (NISP=271) of the assemblage indicated some interaction with plant roots during or after deposition, though the extent is minimal. Chemical weathering was observed on only 0.72% (NISP=88) of the assemblage, suggesting that chemical dissolution or surface degradation were not major factors influencing the assemblage's condition.

Faunal Inventory

Taxonomic data were analyzed by NISP, NISP%, Mass, and where applicable, MNI as well as MNI%. In order to facilitate comparisons between broad taxonomic categories, NISP% was calculated for Mammals, Birds, Reptiles/Amphibians, and Fish, excluding specimens that could not be identified to even a broad category. However, unidentified fragments within each category (where the exact species could not be determined) were included in these calculations.

The taxonomic analysis of the Shepard site identified a diverse range of fauna represented by 12,227 specimens (NISP) (Table 7.5). Of these 30.6% were identifiable at least to the family level (NISP=3,743), representing a total mass of 13,890.7 grams (89.9% of the total mass). The remaining 69.4%, (NISP= 9,306) were classified as one of the unidentified categories previously laid out, contributing a total mass of 2,128.6 grams (13.8% of the total mass).

Of the identified specimens 117 (NISP) were considered modified bone, which are included in these counts but will be discussed in more detail the next section. Mammals comprised the majority of the assemblage (NISP 2,561), contributing 68.26% (NISP%) of the identified assemblage. Aquatic species, including reptiles, amphibians, and fish, then make up the next largest category (NISP 1,050), making up 27.98% (NISP%) of the assemblage. Birds make up the smallest category (NISP=141), consisting of 3.76% (NISP%) of the assemblage. The following subsections explore the contributions of each taxonomic group, beginning with mammals, followed by birds and reptiles/amphibians.

Table 7.5: Taxonomic Distribution of Faunal Remains Recovered from the Shepard Site (Gary McAdams, Personal Communication, 2025).

Species (Common, Wichita, Scientific)	**NISP**	**NISP%**	**MNI**	**MNI%**
Mammal				
Bison/né:rhir?a (*Bison bison*)	1738	14.21%	8	21.62%
Deer/ta:?a (*Cervidae indeterminate*)	95	0.78%	2	5.41%
Wolf/wase?ekha:r?a (*Canid lupus*)	10	0.08%	1	2.70%
Dog or Coyote/kici:ye:h or k?ita:ka (*Canidae indeterminate*)	23	0.19%	1	2.70%
Hares and Rabbits/ ko:kis (*Leporidae indeterminate*)	13	0.11%	2	5.41%
New World Rats and Mice/ te?e:csariya:h & nikisiwa:c?a (*Cricetinae Indeterminate*)	6	0.05%	1	2.70%
Unidentified Large Mammal	70	0.57%	-	-
Unidentified Medium/Large Mammal	191	1.56%	-	-
Unidentified Medium Mammal	118	0.97%	-	-
Unidentified Small/Medium Mammal	19	0.16%	-	-
Unidentified Small Mammal	72	0.59%	-	-
Unidentified Very Small Mammal	13	0.11%	-	-
Unidentified Mammal, Size Unknown	193	1.58%	-	-
Bird				
Ravens, Crows, Magpies, and Jays/ka:w (*Corvidae indeterminate*)	33	0.27%	2	5.41%
Turkey/ne?e:siwa:c?a (*Meleagrididae indeterminate*)	10	0.08%	1	2.70%
Kites, Hawks, Eagles, and Harrier/kase?eya:a?a & ko:s (*Accipitridae indeterminate*)	8	0.07%	1	2.70%
Duck Sized Bird/sacikic (*Anas so. Large*)	1	0.01%	1	2.70%
Owls/nikir?i:c (*Strigidae indeterminate*)	1	0.01%	1	2.70%
Canadian Goose (*Branta canadensis*)	1	0.01%	1	2.70%
Unidentified Bird, Size Unknown	87	0.71%	-	-
Aquatic (reptiles, amphibians, fish)				
Box Turtle/kik?i:s (*Terrapene sp.*)	870	7.12%	11	29.73%
Soft Shell Turtle/kik?i:s (*Trionyx sp.*)	73	0.60%	1	2.70%
Snapping Turtle/kik?i:s (*Chelydra serpentina*)	3	0.02%	1	2.70%
Unidentified Turtle, Size Unknown	43	0.35%	-	-
Frogs and Toads/takik (*Salientia indeterminate*)	5	0.04%	2	5.41%
Unidentified Fish, Size Unknown/ka:c?a	56	0.46%	-	-
Unidentified	8475	69.31%	-	-
Total	**12227**	**100.00%**	**37**	**100.00%**

Mammals

Bison/né:rhir?a (*Bison bison*) remains make up the majority of the mammalian assemblage at the Shepard site (NISP=1,738; MNI=8) representing 14.03% (NISP%) of the overall assemblage and 21.62% (MNI%) of the identified assemblage. Human modifications to bison bones will be discussed later in regard to processing strategies. These findings underscore the central role of bison in the subsistence practices of the site's inhabitants.

Age-at-death analysis of bison specimens provides insight into the site's subsistence strategies and are usually estimated based on dental eruption and tooth wear (Klein and Cruze-Uribe 1983). A total of four loose bison teeth were identified: 1 left premolar, 1 right premolar, 1 third-premolar side unknown, and 1 molar side unknown. The three premolars exhibit characteristics consistent with juvenile dentition, including small size, lack of wear, simple cusp patterns, and less pronounced enamel ridges (Frison and Reher 1970; Todd et al. 1996). Based on the eruption sequences described by Frison and Reher (1970), these teeth likely represent individuals under 2 years of age if deciduous, or between 1 and 3 years of age if permanent. The additional molar exhibits moderate wear on the occlusal surface, suggesting an individual in adulthood (4-8 years old). This estimate is based on the wear stages outlined by Hill (2008) and Frison and Reher (1970). However, the small sample size and lack of associated mandibles limits the precision of the age estimates.

In addition to dental remains, 37 unfused bison elements—including the proximal and distal ends of long bones and vertebral epiphyses—suggest the exploitation of juvenile and subadult bison. Unfused epiphyses are typically associated with individuals under 3–4 years of age (Frison and Reher 1970; Hill 2008). An unfused right femur (proximal epiphysis) and left innominate (ilium and acetabulum) likely represent individuals under 2 years of age, as these elements fuse early in the bison life cycle (Todd et al. 1996). Additionally, partly fused cervical and thoracic vertebrae (NISP=3) indicate the exploitation of subadult bison, likely between 3–4 years of age.

Deer/ta:?a (*Cervidae indeterminate*) remains represent another important mammal resource at the site (NISP= 95; MNI=2) representing 0.78% (NISP%) of the total assemblage and 5.41% (MNI%) of the identified assemblage. Of the 95 specimens 3 have associated cutmarks; a left patella, rib fragment, and lumbar vertebra, indicative of primary butchery (Binford 1981:107-134). The deer assemblage includes unfused cervical, lumbar, and thoracic vertebrae, as well as a proximal right metacarpal, indicating the presence of juvenile deer. The unfused metacarpal, in particular, suggests an individual under 1.5 years of age, as this element typically fuses by 18 months (Haugen 1975). Deer likely played a supplementary role in the diet of the site's inhabitants, contributing smaller but valuable portions of meat and other resources. Their presence also suggests hunting practices targeting a range of species, potentially reflecting opportunistic or seasonal strategies (Lyman 1994; Vehik 1977).

Canid remains are the next most abundant mammal group, composed of both smaller dog/kici:ye:h or coyote/k?ita:ka specimens (*Canid* indeterminate) and specimens identified as Wolf/wase?ekha:r?a (*Canis lupus*) based on morphological characteristics. A total of 23 specimens (NISP) were identified as dog or coyote (MNI=1) accounting for 0.19% (NISP%) of the total assemblage and 2.70% (MNI%) of the identified assemblage. An additional 10 specimens (NISP) were identified as wolf (MNI=1) representing 0.08% (NISP%) of the total assemblage and 2.70% (MNI%) of the identified assemblage. Canid remains did not present with any human modifications.

Small and very small mammal remains are a minor component of the Shepard site assemblage, represented by two distinct groups: opportunity hunted and commensal species. Hares and rabbits/ko:kis (*Leporidae indeterminate*) are the more abundant of the two (NISP=13; MNI=2) comprising 0.11% (NISP%) of the total assemblage and 2.70% (MNI%) of the identified assemblage. These remains likely reflect occasional hunting or opportunistic collection of these mammals for dietary purposes or resources such as their fur (Drass 1997:135). New world rats/te?e:csariya:h and mice/nikisiwa:c?a (*Cricetinae indeterminate*) are represented by a smaller number of specimens (NISP=6; MNI=1) comprising 0.05% (NISP%) of the total assemblage and 2.70% (MNI%) of the identified assemblage. These remains may reflect natural site formation processes rather than cultural introduction.

Birds

Within the category of birds, the *Corvidae* family is notable as it represents 0.27% (NISP%) of the total assemblage and 5.41% (MNI%) of the identified assemblage (NISP=30; MNI=2). Corvids include ravens, crows/ ka:w, magpies, and jays, which are often associated with scavenging or opportunistic foraging (Sutton 1967; Wood and Schnell 1984). Their presence at the Shepard site is significant for understanding environmental interactions as they present with a larger NISP than expected (Bobalik-Savage 1995; Haury 2008). While their small sample size limits detailed interpretation, their inclusion in the assemblage may reflect natural deposition or human interaction.

Within the bird category, turkeys (*Meleagris* spp.) represent 0.08% (NISP%) of the total assemblage and 2.70% (MNI%) of the identified assemblage (NISP=10; MNI=1). Additionally, seven cutmarks were identified on a right turkey Humerus, indicating primary butchery (Hoard

2012:384-385) Turkey remains exhibit moderate preservation with minimal evidence of post depositional changes.

The *Accipitridae* family, including hawks/kase?eya:a?a, eagles/ko:s, and related birds of prey, constitutes 0.07% (NISP%) of the total assemblage and 2.70% (MNI%) of the identified assemblage (NISP=8; MNI=1). The presence of raptors may reflect natural deposition, or a more symbolic role given their mentions in Wichita mythology, which will be discussed further in Chapter 8.

Duck-sized bird/sacikic s (Anas sp. Large) are represented by a single right humerus and account for 0.01% (NISP%) of the total assemblage and 2.70% (MNI%) of the identified assemblage (NISP=1; MNI=1). Ducks and other waterfowl are often associated with wetland environments, and their presence at the Shepard site may offer insight into the local ecology and resource availability (Sutton 1967; Wood and Schnell 1984).

The *Strigidae* family/, represented by a single left radius, also comprises 0.01% (NISP%) of the total assemblage and 2.70% (MNI%) of the identified assemblage (NISP=1; MNI=1). Owls/nikir?i:c are primarily nocturnal predators, and their presence could reflect natural deposition rather than active human use (Sutton 1967; Wood and Schnell 1984). Nonetheless, the inclusion of raptors in faunal assemblages invites consideration of their potential symbolic roles.

The Canadian Goose (*Branta canadensis*) is represented by a single left metacarpal, constituting 0.01% (NISP%) of the total assemblage and 2.70% (MNI%) of the identified assemblage (NISP=1; MNI=1). Geese are typically associated with wetland and riparian environments, and their presence at the Shepard site suggests the potential utilization of waterfowl as part of subsistence, raw material acquisition, or natural deposition (Sutton 1967; Wood and Schnell 1984).

Aquatic Species

Box turtles/kik?i:s (*Terrapene* sp.) account for 7.12% (NISP%) of the total assemblage and 29.73% (MNI%) of the identified assemblage (NISP=870; MNI=11), consistent with similar sites (Hoard 2012). Box turtles are terrestrial and often associated with open woodlands or grasslands, making them a valuable resource for understanding the site's interaction with local ecosystems. This significant presence underscores both their potential importance to the site's subsistence practices as well as the high fragmentation of turtle carapace, which makes up 88.28% of the box turtle specimens.

Soft-shell turtles/kik?i:s (*Trionyx sp.*) comprise 0.60% (NISP%) of the total assemblage and 2.70% (MNI%) of the identified assemblage (NISP=73; MNI=1). In addition to box and soft-shell turtles, snapping turtle/kik?i:s (*Chelydra serpentina*) was also observed (NISP=3; MNI=1) comprising 0.02% (NISP%) of the total assemblage and 2.70% (MNI%) of the identified assemblage. Frogs/takik and toads (*Salientia* indeterminate) make up 0.04% (NISP%) of the total assemblage and 5.41% (MNI%) of the identified assemblage (NISP=5; MNI=2). Finally, unidentified fish make up 0.46% of the total assemblage (NISP=56).

Seasonality

While the turtle remains at the Shepard site do not provide specific age data, their hibernation patterns offer valuable insights into the timing of their exploitation. Box turtles, which are terrestrial, typically end hibernation between mid-March and late April in Oklahoma and remain active until mid-September to early November (Collins 1974; Dodd 2001). Aquatic turtle species, such as soft-shell and snapping turtles, hibernate during the winter and become active in the spring (Dodd 2001).

Archaeological studies from other Plains village sites support the use of turtle remains as an indicator of warm-season occupation (Bobalik-Savage 1995; Flynn 1986; Graves 2008; Haury 2008). Large concentrations of turtle remains at similar sites have been interpreted as a reflection of warm-season exploitation, as their availability declines significantly during winter hibernation (Bobalik-Savage 1995; Flynn 1986; Graves 2008; Haury 2008). A similar pattern at the Shepard site suggests that turtle exploitation likely occurred in the spring through early fall.

Three of the six bird species identified at the Shepard site are migratory or partially migratory (Sutton 1967; Wood and Schnell 1984). *Accipitridae* indeterminates include both permanent and migratory residents of Oklahoma. For example, red-tailed hawks are year-round residents, while harriers are summer residents, and eagles are winter visitors (Sutton 1967; Wood and Schnell 1984). Waterfowl, including ducks and geese, are strongly associated with fall and winter occupation, as they arrive in Oklahoma between October and November and remain through the winter (Sutton 1967; Wood and Schnell 1984).

Waterfowl remains have been used to infer seasonal occupation, as migratory species were available from October to May, while summer migrants such as avocets and nighthawks were present from April to October (Trabert et al. 2024:109-114). Additionally, turkeys and prairie-chickens, which gather in fall and winter (Trabert et al. 2024:109-114). The combination of warm-season indicators (box-turtles) and cold-season indicators (waterfowl) suggests a multi-seasonal occupation, with human activity spanning both warm and cold months.

Human Modified Bone

Within the Shepard site faunal assemblage seventy bones and one shell have been modified (Table 7.6). A total of 59.15% of these items are made from bison bone (Table 7.7). All modified specimens are categorized as either modified shell, polished bone, decorated bone, bone tube/bead, or one of four tool types: antler tool, awl/needle, scapula hoe, and tibia digging stick. In the following section each modified bone type and their presence at the Shepard site will be elaborated on.

Table 7.6: Frequency of Human-Modified Faunal Remains from the Shepard Site.

Human Modifications	**NISP**	**NISP%**
Modified Shell	1	1.41%
Decorated Bone	1	1.41%
Antler Tool	2	2.82%
Bone Bead	2	2.82%
Tibia Digging Stick	6	8.45%
Scapula Hoe	8	11.26%
Awl/Needle	11	15.49%
Polished Bone	40	56.34%
Total	**71**	**100%**

Table 7.7: Frequency of Human-Modified Faunal Remains by Species from the Shepard Site.

Species	**NISP**	**NISP%**
Bison (*Bison bison*)	42	59.15%
Deer (*Cervidae Indeterminate*)	16	22.54%
Unidentified Medium Mammal	10	14.08%
Unidentified Bird, Size Unknown	1	1.41%
Unidentified Large bird	1	1.41%
Canidae Indeterminate	1	1.41%
Total	**71**	**100%**

Modified Shell

One modified mussel shell fragment is present in the collection (NISP=1). The fragment was originally designated as modified shell by Donnita Pitzer and Rhonda Fair during the original 2001 excavation. The fragment appears to have intentional scalloping along the edge (Figure 7.1). The specimen has a maximum length of 4.74 cm, and a thickness of 0.19 cm. Shells can be used for personal adornment or as tools, which may reflect social or symbolic practices at the site (Hofman 1989).

Figure 7.1: Modified Mussel Shell with Scalloping. Feature 22, South 1/2.

Decorated Bone

Decorated bone refers to any bone or bone fragment that has been engraved, carved, incised, stained, or had any other decorated element applied to it (SNM 2021). One decorated bone fragment is present in the collection and identified as an unidentified medium mammal rib or long bone fragment (NISP=1). The fragment shows scalloping on the edge, with an unidentified purpose (Figure 7.2). The specimen has a maximum length of 1.23 cm and a thickness of 0.31 cm. The limited presence and small size restrict further categorization of this specimen. However, a lack of polishing or use wear makes it unlikely this specimen is a fragment of a bone tool.

Figure 7.2: Unidentified Medium Mammal Decorate Bone Fragment. Feature 34.

Polished Bone

Polished bone includes any bone or bone fragment that exhibits a smooth, shiny surface resulting from prolonged use (SNOMNH 2021). 57.14% of modified bone within the collection are identified as polished bone fragments (NISP=40). Additionally, 72.50% of polished bone fragments were identified as bison. The additional specimens included fragments from a *Canidae Indeterminate* rib, deer antler, radius, and metacarpal, as well as an unidentified large bird long bone and unidentified medium mammal rib and long bone.

Polished bison bone fragments were identified as long bones, ribs, and scapulas, with the latter two elements making up 89.66% of polished bison bone. The large number of polished bison bones, specifically scapula and tibia fragments, could indicate a larger pattern of tool production, which will be discussed in the following Chapter 8. A characteristic example of a polished bison rib fragment is shown in Figure 7.3.

Figure 7.3: Polished Bison Rib Shaft Fragment. Feature 2, Fill Above Pit.

Bone Tubes and Beads

Bone tubes and beads are any small section of bone through which a hole has been drilled. The two are differentiated by length, with bone tubes being 2cm or longer and bone beads being less than 2cm in length (categories used by Bobalik-Savage in Trabert et al. 2024:135-136). Within the Shepard site assemblage one of each has been identified; an unidentified bird bone tube (NISP=1) and an unidentified medium mammal bone bead (NISP=1), shown in Figure 7.4. The former has a length of 3.22 cm and diameter of 1.15 cm. Additionally, the bone tube has heavy polishing and multiple cut marks. The bone bead has a length of 1.78cm and a diameter of 0.63 cm, as well as cutmarks and polishing. Bone tubes and beads, often used for personal adornment or as trade items, suggest not only cultural significance but also possible social interactions between groups, reflecting a wider exchange network at the Shepard site (Hoard 2012:411; Vehik 2002).

Figure 7.4: Bone Bead/Tube. Left: Unidentified Bird Bone Tube, Feature 2 South 1/2. Right: Unidentified Medium Mammal Bone Bead, Feature 5 East 1/2.

Antler Tools

Two antler tools have been identified within the Shepard site assemblage (NISP=2). Both specimens are made from deer antlers and exhibit evidence of modification, including intentional shaping and polishing. The exact function of these tools is unclear, weathering and fragmentation have distorted any characteristics that may have identified them as antler scrapers or flakers, however, they could have been used for skinning, scraping, or as tools for working other materials (Trabert et al. 2024:91; Wedel 1959:246-247; 1970:36-45). The first antler tool has a length of

13.92 cm, thickness of 3.52, and was previously reconstructed following the 2001 excavation. The second antler tool has a length of 9.18 cm, thickness of 1.81cm, and shows evidence of carbonization (Figure 7.5).

Figure 7.5: *Cervidae Indeterminate* Antler Tool with Wear Pattern. Feature 22.

Awls/Needles

Bone awls/needles constitute 15.49% of the modified bone and shell artifacts (NISP=11). These tools were primarily manufactured from deer (*Cervidae Indeterminate*) bone (NISP=5) and unidentified medium mammal bone (NISP=6). These artifacts exhibit evidence of extensive use, including polishing and wear patterns. The degree of polishing varies among the specimens, with some showing minimal wear on the tips, while others exhibit heavy polishing suggesting prolonged use. One specimen also exhibited cut marks on the awl shaft indicative of modification

(Figure 7.6). The tips of the awls/needles are generally pointed and well-preserved, though one is blunt and rounded. Bone awls/needles are commonly associated with hide-working, basketry, or textile production, activities that are consistent with semi-sedentary or sedentary lifeways (Bamforth 2021; Wilson 1987).

Figure 7.6: Proximal End of *Cervidae Indeterminate* Awl/Needle Fragment, With Polishing and Cutmarks. Feature 3.

Scapula Hoes

Scapula hoes represent 11.27% of the modified bone and shell artifacts at the Shepard site (NISP=8). All specimens show clear evidence of polishing, indicative of prolonged use, additionally one specimen exhibits cut marks reflecting the tool's shaping or maintenance (Figure 7.7). The extent of polishing varies across fragments from light to heavy, with one fragment exhibiting heavy polishing on more than 50% of the specimen's surface area. Bison scapula hoes are expected at late pre-contact sites in the Southern Plains, likely used for horticultural activities such as digging or cutting grass, suggest that the site's occupants engaged in semi-sedentary practices related to horticulture (Bamforth 2021; Bobalik-Savage 1995:79-80, 2006, 2014; Wilson 1987).

Figure 7.7: Scapula Hoe Fragment from the Shepard Site, Showing Polishing and Cut Mark Indicative of Use and Modification. Feature 22, North 1/2.

Tibia Digging Sticks

Multiple bison tibia fragments (NISP=6) have been identified as digging sticks, tools created by splitting the tibia to form a wedge-shaped cutting edge. Tibia digging sticks make up 8.45% of the modified bone and shell artifacts at the Shepard site. Heavy polishing on the edge is characteristic of the tool type and present on all specimens, indicating consistent wear from repeated use. Intentional hollowing of the distal end of the bone is also a feature of this tool type and is well shown by one specimen as seen in Figure 7.8.

Additionally, one specimen exhibits cutmarks on the surface suggesting intentional shaping during production. Tibia digging stick fragments in this assemblage include both intentionally shaped distal and proximal ends, as well as polished shaft fragments. Tibia digging sticks, often associated with subsistence activities such as plant gathering and digging for tubers, further illustrating cyclical relationship between hunting, processing, and agriculture (Bamforth 2021; Hofman 1989; Wedel 1988).

Figure 7.8: Bison Tibia Digging Stick Fragments. Left: Distal Portion with Polishing, Feature 2 South 1/2. Right: Worked Proximal End, Feature 2 East 1/2.

Bison Processing Strategies

The following section presents the results of analyses conducted on the bison assemblage from the Shepard site, focusing on assemblage composition, butchery patterns, and fragment and fracture characteristics. The primary goals are to quantify the skeletal elements recovered, document evidence of butchery, and identify patterns of bone fragmentation. Understanding this data provides insight into how bison were utilized by Shepard's site inhabitants and broader relationship between ancestral Wichita and bison in this context.

Assemblage Composition

The most frequently identified species found at the Shepard site is bison (NISP=1,738; 11,917.4g). Additionally, most of the specimens identified as unidentified large mammal (NISP=70; 154.4g), while not determined to be bison due to an absence of diagnostic features, are most likely bison given their size, density, and the prominence of bison specimens recovered at the site. Both categories, bison and unidentified large mammal, were combined in the following analysis and will be referred to as "bison."

Of these specimens 104 were identified to skeletal element, representing the majority of the bison skeleton (Table 7.8). However, skeletal elements are unevenly distributed, with appendicular elements dominating the assemblage (Figure 7.9). Appendicular elements make up approximately 69.24% of the identified specimens, and the highest MAU% are the femur, tibia, and metacarpal. Axial elements account for 30.77% of the identified specimens. The lowest MAU% are the caudal vertebrae and ribs from the axial region and second phalanx from the appendicular. The dominance of appendicular elements in the assemblage, particularly the femur and tibia, is consistent with patterns observed in experimental and ethnoarchaeological studies, which note that these elements are often targeted for marrow and grease extraction due to their high fat content (Binford 1978; Morin 2007; Outram 2001; Speth 1983; Vehik 1977).

Table 7.8: Elemental and Regional Representation of Bison Remains from the Shepard Site, Showing NISP, Mass, MNE, MAU, and MAU% Values.

Element	NISP	Mass (g)	MNE	MAU	MAU%
Axial Region					
Cranium	1	80.7	1	1	14%
Atlas	1	11.3	1	1	14%
Axis	0	0	0	0	0%
Cervical	7	146	6	1.2	17%
Thoracic	16	280.8	12	0.9	13%
Lumbar	4	28.9	3	0.6	9%
Sacrum	33	421.1	1	1	14%
Caudal	4	8.7	1	0.2	3%
Rib	15	198.2	6	0.2	3%
Sternum	1	47.3	1	1	14%
Appendicular Region					
Innominate	4	306.1	2	1	14%
Scapula	17	567.5	8	4	57%
Humerus	9	601.3	4	2	29%
Radius	6	256	4	2	29%
Ulna	4	112.7	4	2	29%
Metacarpal	10	744.3	8	4	57%
Carpals	0	0	0	0	0%
Femur	34	1209.5	14	7	100%
Patella	6	175.2	5	5	71%
Tibia	17	708	13	6.5	93%
Fibula	2	14.9	2	1	14%
Astragalus	1	100.7	1	0.5	7%
Metatarsal	5	376.6	3	1.5	21%
Sesamoid	3	13.4	1	0.04	1%
First phalanx	2	55	2	0.3	4%
Second phalanx	1	17.5	1	0.1	1%
Third phalanx	0	0	0	0	0%
Vestigial phalanx	0	0	0	0	0%
Digits	0	0	0	0	0%
Total	**203**	**6481.7**	**104**	**-**	**-**

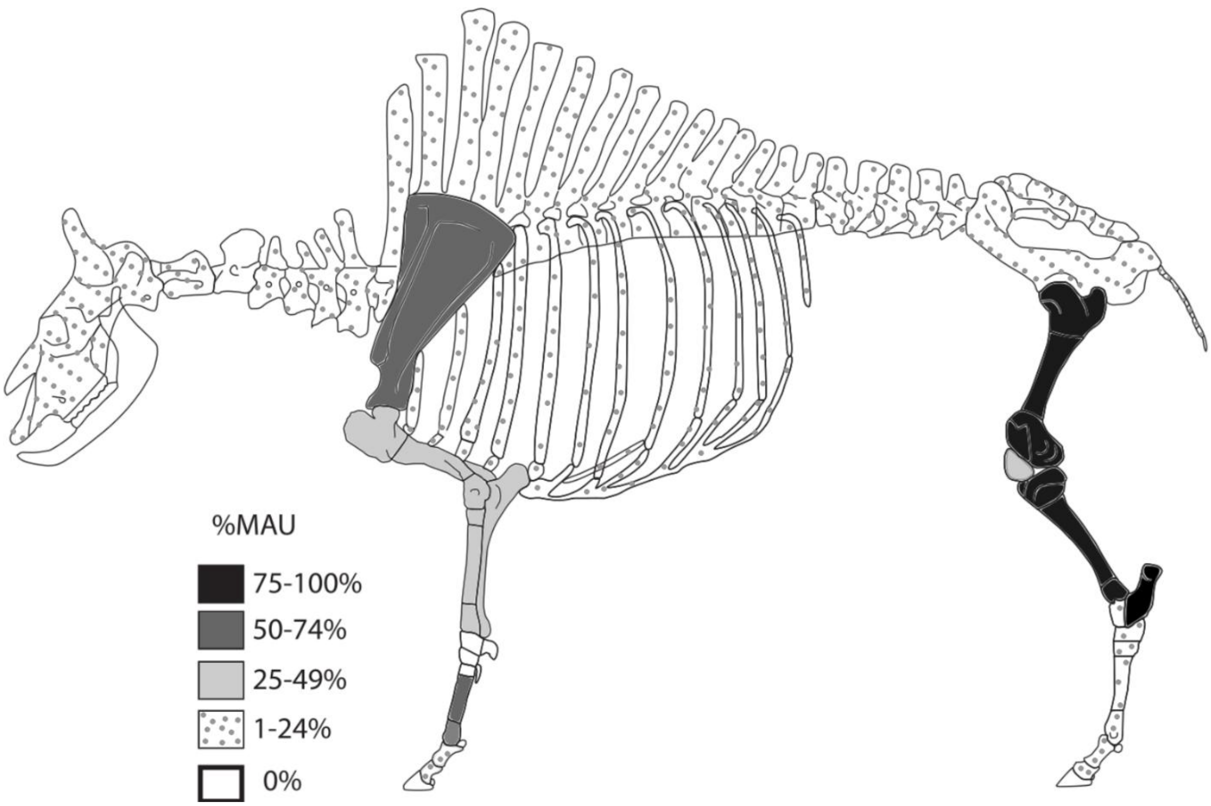

Figure 7.9: Visual Representation of a Bison Skeleton, Colored to Reflect Minimum Animal Unit Standardized (MAU%) Values for Recovered Elements at the Shepard Site.

Additionally, all unidentifiable bison fragments were also counted, weighed, and sorted by bone type (e.g. long bone, cancellous bone, flat bone). Specimens identified as ribs or scapulas but lacking further diagnostic features to determine siding were also categorized as fragments (NISP= 439; 2.021.2g). Bone specimens so fragmented that even general categories were not possible were labeled as “indeterminate bone” (NISP=237; 178.3g). Of the unidentifiable bison fragments cancellous bone fragments make up most of those specimens (NISP 500; 1,095.9g), followed by rib bone and long bone fragments (Table 7.9).

Table 7.9: NISP, NISP%, and Mass(g) for Bison Fragments by Bone Type.

Fragment Type	NISP	NISP%	Mass(g)
Tooth Fragment	5	0.31%	5.9
Flat Bone	46	2.87%	80.3
Ind. Vertebra Fragment	49	3.05%	80.7
Scapula Fragment	85	5.30%	689.4
Indeterminate Bone	237	14.77%	178.3
Long Bone	329	20.50%	2111.4
Rib Fragment	354	22.06%	1331.8
Cancellous Bone	500	31.15%	1095.9
Total	**1605**	**100.00%**	**5573.7**

Cutmarks, Hack-marks, and Impact Scarring

A number of butchery and secondary processing marks were observed on bison specimens and examined based on frequency, targeted elements, and location (Binford 1981; Lyman 1994). Cutmarks were identified on 53 specimens across multiple skeletal elements, with a total of 498 individual cutmarks recorded. The majority of cutmarks are concentrated on the axial skeleton, specifically the ribs, indicative of meat removal. Cutmarks on the appendicular skeleton are then concentrated on long bone epiphysis, indicative of disarticulation. This pattern is consistent with selective transportation of elements high in meat, marrow, and grease from the kill site (Wilfong and Hill 2022:358-359).

Hack-marks and impact scars were comparatively less frequent, with 10 hack-marks on 6 specimens and 5 instances of impact scars across 5 specimens. Hack-marks were identified primarily on the axial skeleton, including the ribs and scapula. Impact scaring, however, was more common on the appendicular skeleton with evidence on a tibia, femur, humerus, and long bone fragment, in addition to the ribs. Hack marks are indicative of primary disarticulation of the carcass, whereas impact scaring is associated with intentional bone breakage using blunt implements

(Bethke 2022:126-128). A detailed breakdown of cutmarks, hack-marks, and impact scarring by element is presented in Table 7.10.

Table 7.10: Number of Bison Specimens (NISP) with Cutmarks, Hack-marks, and Impact Scarring by Element at the Shepard Site.

Element	NISP Cutmarks	NISP Hack-marks	NISP Impact Scaring
Femur	2	0	1
Humerus	1	0	1
Long Bone	2	0	1
Radius	1	0	0
Rib	36	4	1
Scapula	9	2	0
Tibia	1	0	1
2nd Phalanx	1	0	0
Total	**53**	**6**	**5**

Fragment and Fracture Analysis

In order to measure the intensity of fragmentation for this assemblage the "Fragmentation Index," was applied, which involves dividing the MNE by the NISP and scaling this number from zero to one (Lyman, 1994:336, 2008; 250-254). The fragmentation index for bison at the Shepard site indicates a high degree of fragmentation, with an index score of 0.04. High fragmentation suggests processing activities and/or post-depositional processes (Brink 1997; Morin and Soulier 2017:96-97, 110-111; Outram 2001, 2002). The following section focuses on fragment size distribution and fracture freshness index (FFI) scores to better understand the heavy fragmentation of the bison assemblage.

The bison assemblage is characterized by a prevalence of small fragments (less than 5 cm), which account for over 75% of the total NISP, however, only 0.96% of the total weight (g) (Figure

7.10, Figure 7.11). Fragments measuring 0-2 cm are the most common (NISP=443), while larger fragments (>10 cm) and partial or complete elements represent less than 10% of the assemblage. This distribution is heavily skewed toward smaller size classes, a pattern commonly associated with intensive processing (Bethke 2022:129-130; Binford 1978; Brink 1997; Church and Lyman 2003:1080-1081; Janzen et al. 2014:522-523; Morin and Soulier 2017:110-111; Morin 2020: 536-537).

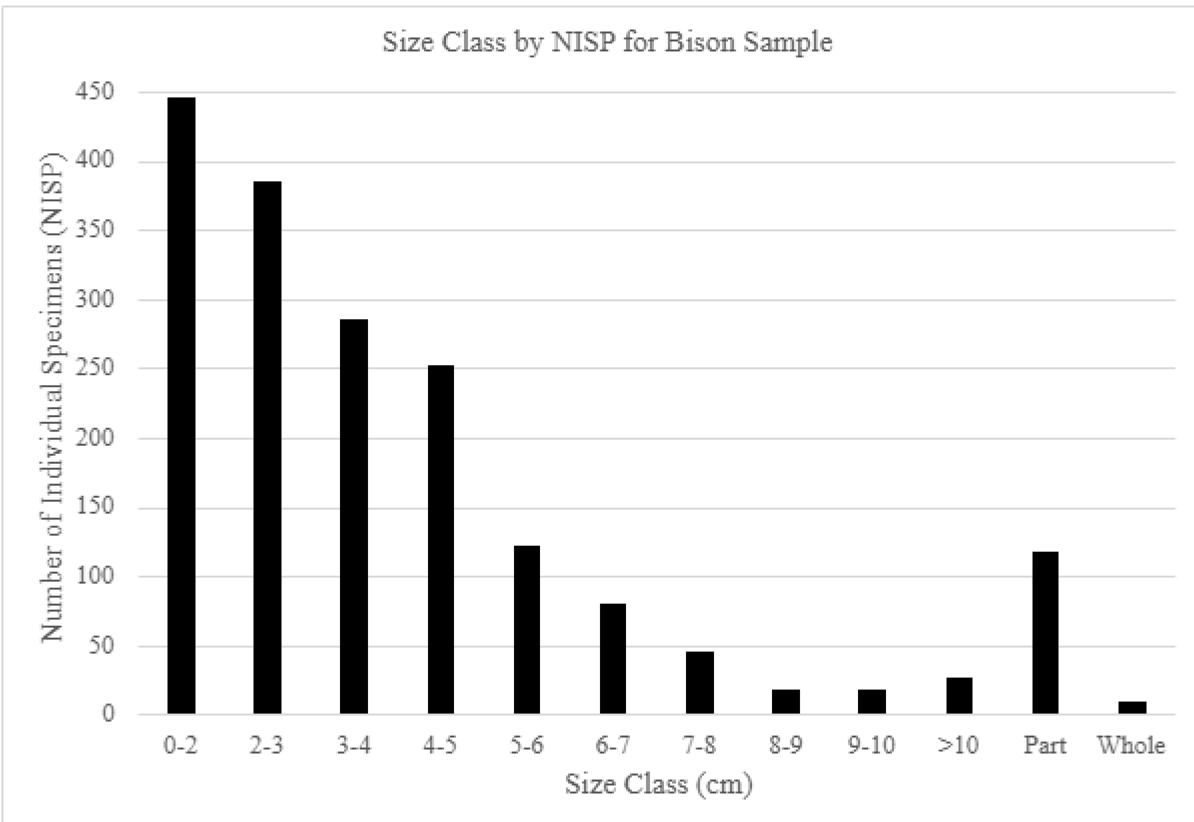

Figure 7.10: Graph Showing Fragment Size Classes by NISP for Bison Sample at the Shepard Site.

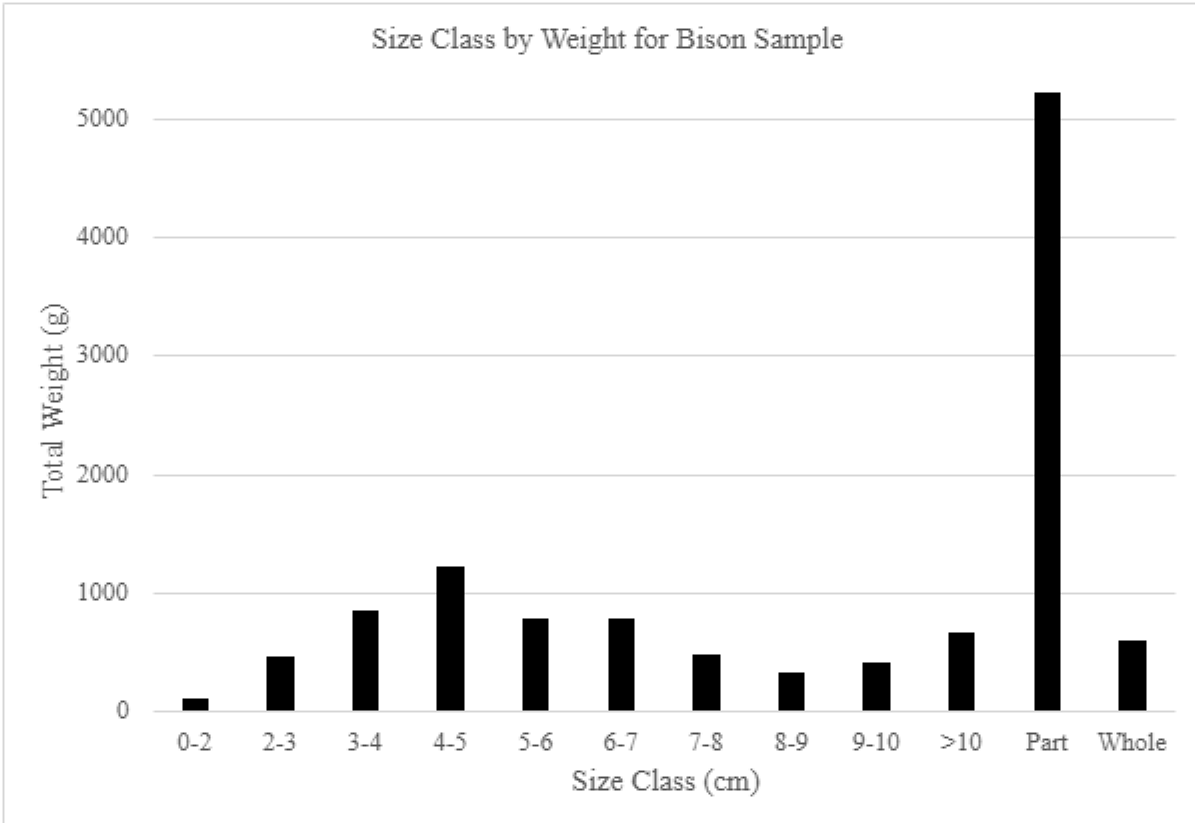

Figure 7.11: Graph Showing Fragment Size Classes by Weight (g) for Bison Sample at the Shepard Site.

The Fracture Freshness Index (FFI) was applied to assess the timing of bone breakage relative to processing activities. FFI scores range from 0 (entirely fresh) to 6 (completely dry), with 0–1 indicating fresh fractures (consistent with deliberate processing), 2–3 indicating moderately fresh fractures, and 4–6 indicating dry fractures (consistent with post-depositional breakage) (Bethke et al. 2018; Karr et al. 2010:217–219; Kooyman 2004; Outram 2001, 2002, 2004). For this analysis, FFI scores are reported in relation to fragment size class to determine whether fragmentation resulted from human agency or post-depositional processes (Figure 7.12).

Small fragments (>5cm) exhibited 18.87% fresh fractures. Moderately fresh fractures accounted for 33.97%, while un-fresh fractures made up 47.16%. The presence of fresh fractures suggests that at least some small fragments were broken while the bones were still fresh, likely small chips that were broken off during marrow extraction (Church and Lyman 2003:1080–1081; Janzen et al. 2014:520–523; Morin and Soulier 2017:102–107; Outram 2001:404). However, the high proportion of un-fresh fractures indicates that a significant portion of small fragments were broken after deposition, potentially due to taphonomic processes such as trampling or weathering (Brink 1997; Kooyman 2004).

Medium-sized fragments (5-10cm) show a higher distribution of fresh fractures, with a total of 41.46% exhibiting fresh fractures. The higher proportion of fresh fractures suggests that medium-sized fragments were more likely to have been broken during processing activities, such as marrow extraction (Church and Lyman 2003:1080–1081; Janzen et al. 2014:520–523; Morin and Soulier 2017:102–107; Outram 2001:404). The moderately fresh fractures (36.59%) should again be interpreted cautiously, as they do not provide conclusive evidence of fresh breakage. The lower proportion of un-fresh fractures (21.95%) compared to small fragments indicates less post-depositional breakage in this category.

Large fragments (>10cm) exhibited 50% fresh fractures, 50% moderately fresh fractures, and no un-fresh fractures. The prevalence of fresh fractures suggest that large fragments are the result of processing activities occurring while the bones were still fresh. Additionally, the abundance of moderately fresh fractures and lack of un-fresh fractures supports fragmentation during early stages of bone breakage.

Partial elements showed 13.79% FFI 0 and 13.79% FFI 1, totaling 27.58% fresh fractures. Moderately fresh fractures (FFI 2–3) accounted for 34.48% (17.24% FFI 2 and 17.24% FFI 3), while unfresh fractures (FFI 4–6) made up 37.94% (24.14% FFI 4, 6.90% FFI 5, and 6.90% FFI 6). The proportion of fresh fractures in partial elements is higher than in large fragments but lower than in medium-sized fragments. This suggests these bones were occasionally processed while fresh, although not as commonly as medium-sized fragments or they were subject to further post deposition breakage following their initial breakage. The moderately fresh fractures (FFI 2–3) should again be interpreted cautiously, as they do not provide conclusive evidence of fresh breakage.

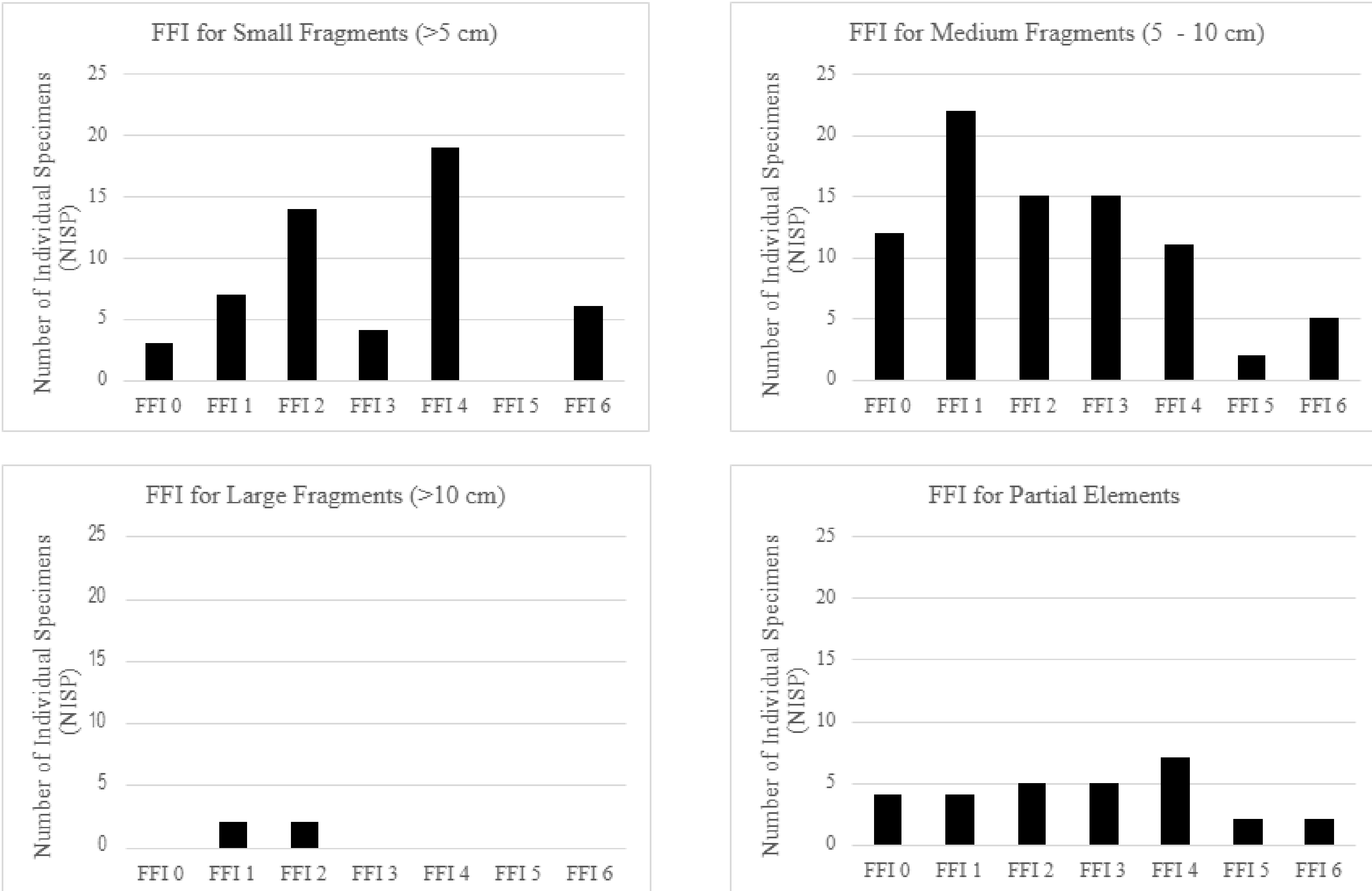

Figure 7.12: Graphs Showing Fracture Freshness (FFI) Scores by Fragment Size Class for Bison at the Shepard Site.

To further understand the selective processing of bison, elemental frequencies can be compared to utility indices derived from experimental and ethnoarchaeological research which provide information on what elemental frequencies mean in relation to animal products being utilized at a site (Binford 1978; Brink 1997; Emerson 1990; Kooyman 2004). Utility indices developed by Emerson (1990), which rank elements based on protein (meat), fat, marrow, and grease, are used here in comparison with MAU% values for bison (Table 7.11). This comparison helps identify which elements were targeted for specific resources by Shepard's site inhabitants.

Table 7.11: Compares the MAU% Values for Bison Skeletal Elements at the Shepard Site to Emerson's (1990) Utility Indices for Total Products, Protein, Fat, Marrow, and Grease.

Element	MAU%	(S)MAVGTP (Total Products)	(S)MAVPRO (Protein)	(S)MAVGTP (Total Fat)	(S)MAVGTP (Marrow)	(S)MAVGTP (Grease)
Axial Region						
Cranium	14%	14.2	10.9	16.7	0.0	-
Atlas	14%	6.4	6.6	5.9	0.0	2.4
Cervical	17%	56.6	59.0	50.7	0.0	4.8
Thoracic	13%	84.7	62.9	100.0	0.0	24.1
Lumbar	9%	82.9	60.0	99.5	0.0	29.8
Sacrum*	14%	-	-	-	-	-
Caudal	3%	1.5	0.9	1.8	0.0	4.5
Rib	3%	100.0	100.0	93.0	0.0	55.0
Sternum	14%	52.9	42.4	58.6	0.0	4.6
Appendicular Region						
Innominate	14%	54.9	51.3	54.0	6.7	97.6
Scapula	57%	31.6	43.7	16.7	36.9	43.6
Humerus	29%	31.6	43.7	17.1	71.5	71.8
Radius	29%	16.5	20.6	11.2	68.0	51.6
Ulna**	29%	-	-	-	-	-
Metacarpal	57%	3.9	3.6	3.9	29.2	33.0
Femur	100%	69.4	94.8	38.7	98.2	100.0
Patella	71%	-	-	-	-	-
Tibia	93%	40.9	42.7	25.4	100.0	71.7
Fibula	14%	-	-	-	-	-
Astragalus	7%	13.6	16.0	10.0	55.2	49.6
Metatarsal	21%	7.5	8.0	6.4	40.6	38.9
Sesamoid	1%	-	-	-	-	-
1st phalanx	4%	-	-	-	-	-
2nd phalanx	1%	-	-	-	-	-

*Combined with Innominate (Emerson 1990)

**Combined with Radius (Emerson 1990)

A Spearman's rank correlation revealed no statistically significant relationship between MAU% values for bison and Emerson's (1990) utility indices for total products (Spearman's ρ= -

0.092, P = 0.727), protein (Spearman's ρ= -0.003, P = 0.993), or total fat (Spearman's ρ= -0.178, P = 0.497). However, there was a strong, statistically significant positive correlation between MAU% and marrow utility values (Spearman's ρ= 0.712, P = 0.001). A moderate positive correlation with bone grease is on the cusp of significance (Spearman's ρ= 0.436, P = 0.091) therefore it will be further explored to reach a conclusive result.

Common appendicular elements at the Shepard site, such as the femur and tibia, have high utility indices for marrow (98.2 and 100.0) and grease (100.0 and 71.7), making them prime targets for in-bone nutrient processing (Bethke 2022:132-134; Brink 1997; Brink and Dawe 1989; Emerson 1990; Morin and Soulier 2017:96-97; Wilfong and Hill 2022:360-361). This pattern is consistent with ethnographic and archaeological evidence of marrow and grease extraction from long bones (Brink 1997:265; Emerson 1990:112; Morin and Soulier 2017:102). Additionally, bones most heavily utilized for grease rendering, the humerus, radius, femur, tibia, and metapodials, are often absent from an assemblage due to the high levels of fragmentation (Brink, 1997, 2001; Emerson 1990; Jones and Metcalfe 1988; Lyman, 1994). This aligns with the lower MAU% of the humerus and radius at the Shepard site (both 29%).

This pattern contrasts with axial elements, which are underrepresented in the assemblage and have lower marrow and grease utility indices. Low MAU% for axial elements in conjunction with their marrow and grease indices suggest they are less represented due to an inability to intensively utilize them following primary butchery and therefore they were not brought back to the site (Wilfong and Hill 2022:360-361). This pattern is consistent with ethnographic accounts of the "schlepp effect," where axial elements were often left behind at kill sites or processing areas due to their low meat and fat yields, as well as the high cost of transporting these bulky, low-utility parts (Brink 2008:212; Emerson 1990:115; Outram 2002:58).

However, some scholars argue that relying on a single utility index oversimplifies the complex choices involved in carcass processing (Brink 1997, 2001). In doing this the complex choices past individuals made in relation to large game hunting are simplified, and Brink (2001) advocates instead for an approach that associates specific carcass parts with food resources. Following Brink's (2001) approach, whole and partial long bone analysis provides for a more nuanced discussion of intensive processing to better understand intensive processing (Table 7.12). To do this MNE for complete long bones and for combined proximal and distal ends of long bones was calculated and compared to the mean marrow weight per element, adapted from Bethke (2022) based on compiled data collected by Emerson (1990), Brink (1997), and Brink and Dawe (1989). This allows for the identification of which elements were targeted for marrow extraction.

Table 7.12: Compares MNE for Complete Long Bones and Proximal/Distal Ends to Marrow Weight Following Brink (2001).

Element	**MNE Complete**	**MNE (Prox/Dist)**	**Frequency (Prox/Dist)**	**Marrow Weight (g)**
Humerus	0	4	28.57%	117.56
Radius/Ulna	0	8	57.14%	78.89
Metacarpal	1	7	50.0%	19.84
Femur	0	14	100.0%	110.99
Tibia	0	9	92.86%	123.97
Metatarsal	0	3	21.43%	22.22
Total	**1**	**45**	**-**	**-**

The marrow weight comparison reveals clear patterns of intensive processing for bone marrow at the Shepard site. The high frequency of proximal and distal ends for the femur (100%) and tibia (92.86%) suggests that these elements were processed for marrow. This is consistent with the high marrow weight value for the femur (119.99g) and tibia (123.97g), which suggests this element was a prime target for marrow extraction. The general absence of complete long bones, prevalence of large fragments and partial elements, and evidence of fresh fracturing (FFI 0–1) and impact scarring on shafts further support intensive marrow extraction, as these patterns align with documented marrow processing behaviors (Outram 2001; Morin and Soulier 2017). These patterns align with ethnographic and experimental studies of bison processing, which show the femur and tibia as being consistent targets for marrow extraction due to their fat content and ease of processing (Brink 1997; Emerson 1990). The intensive processing of these elements at the Shepard site suggests that marrow extraction was a key subsistence activity, providing a valuable source of dietary fat and calories for the site's inhabitants.

In contrast, the humerus and radius/ulna show lower frequencies of proximal/distal ends (28.5% and 57.14%). The proximal/distal ends of the radius/ulna and metapodials are only moderately represented in the assemblage. Given that these elements have lower marrow weights, it is possible that these elements were less intensively selected for additional processing. However, the lower frequency proximal/distal ends of the humerus, despite having a high marrow weight (117.56g), may suggest these elements were subject to additional processing following marrow extraction. Ethnographic and experimental studies demonstrate that bones were often processed sequentially for marrow and grease (Brink 1997; Outram 2001:194; Quigg 1997; Vehik 1977). For example, after marrow was extracted from long bones, the remaining fragments could be further broken down and boiled to render grease (Binford 1978; Outram 2001; Weitzner 1979).

Table 7.13: Compares MNE and Frequency of Proximal/Distal Ends of Long Bones to Grease Weight Following Brink (2001).

Element	MNE	Frequency	Grease Weight (g)
Humerus (prox.)	1	11.11%	125.98
Humerus (dist.)	3	33.33%	53.43
Radius/Ulna (prox.)	7	77.78%	72.58
Radius/Ulna (dist.)	1	11.11%	39.78
Metacarpal (prox.)	5	55.56%	9.20
Metacarpal (dist.)	2	22.22%	14.31
Femur (prox.)	9	100.00%	73.33
Femur (dist.)	5	55.56%	139.81
Tibia (prox.)	6	66.67%	87.88
Tibia (dist.)	3	33.33%	16.98
Metatarsal (prox.)	1	11.11%	10.19
Metatarsal (dist.)	2	22.22%	17.15
Total	**45**	**-**	**-**

Grease rendering is a highly destructive process that involves breaking bones into small pieces to access the cancellous tissue, evidenced by a high proportion of small, fresh fractures (Brink 1997; Vehik 1977). The underrepresentation of proximal/distal humerus ends raises questions about whether this element was broken up for grease rendering after marrow extraction or was subject to other post depositional processes that obscured its identification (Brink 1997; Outram 2001:194). The moderate positive correlation between MAU% and bone grease utility values ($\rho = 0.436$, $P = 0.091$), though not statistically significant, hints at the potential exploitation of bones for grease rendering. Therefore, to evaluate the potential for grease rendering, the MNE for proximal and distal ends of long bones was compared to the mean grease weight per portion of element, adapted from Bethke (2022) based on data compiled by Emerson (1990), Brink (1997), and Brink (2001) (Table 7.13).

Overall, there is no consistent patterning diagnostic to grease rendering seen in the assemblage. The tibia's representation offers no clear evidence, with its high-grease proximal end

(87.88g) appearing frequently (66.67%) while the low-grease distal portion (16.98g) occurs less often (33.33%), an inverse relationship that contradicts expectations for grease rendering. The radius/ulna similarly shows frequent proximal portions (77.78%) despite moderate grease value (72.58g), while the distal end occurs rarely (11.11%) with lower grease potential (39.78g), Metapodials further demonstrate this lack of systematic processing, with proximal metacarpals appearing moderately (55.56%) despite minimal grease content (9.20g). Two outliers to this pattern are the humerus and femur. The high-grease proximal humerus end (125.98g) occurs rarely (11.11%), with the low-grease distal end (53.43g) occurring more frequently (33.33%), which suggests that the proximal end of the humerus could have been subjected to grease rendering. Similarly, the high-grease distal femur end (139.81g) occurs less frequently (55.56%) than the low-grease proximal end (100.00%, 73.77g), suggesting the possibility of further processing.

Based on elemental portions present/absent from the assemblage, the grease weight comparison does not strongly support grease processing at the Shepard site. Fragment and fracture analysis support this conclusion as well. While the assemblage does contain some small, fresh fragments (18.87% FFI 0–1), the majority of small fragments are either moderately fresh (33.97% FFI 2–3) or un-fresh (47.16% FFI 4–6). When combined with the statistical results, these patterns suggest grease extraction was not a primary activity at the site, though occasional processing of select element portions with a high grease weight, like the proximal humerus, may have occurred.

CHAPTER 8: DISCUSSION AND CONCLUSION

The primary aim of this research was to create a holistic picture of the varied interactions between inhabitants of the Shepard site, an ancestral Wichita community, and fauna. The results of this research highlight the diversity of species represented in the faunal assemblage, shedding light on the range of resources utilized by the Shepard site inhabitants and the ecological complexity of their environment. Specifically, the study sought to address three key objectives: 1) analyze the faunal remains at the Shepard Site; 2) examine the faunal assemblage holistically to understand the subsistence, material, and ecological roles of various species present at the site; and 3) to incorporate these findings into broader discussions of the significance of human-animal interactions during the Turkey Creek phase. The following discussion synthesizes the results of the faunal analysis, integrating theoretical frameworks and comparative data to evaluate faunal use.

Non-Bison Fauna at the Shepard Site

The analysis of faunal remains from the Shepard site provides insights into the subsistence strategies of the ancestral Wichita during the Middle Plains Village period. In particular, the faunal remains illustrate the diversity of species that contributed to ancestral Wichita subsistence practices, material culture, and socioecological systems. The following sections explore the significance of these faunal remains by further examining their physical presence at the site and also linking them to comparative archaeological data and ethnographic accounts that underscore their importance.

Deer (ta:?a)

Deer played a supplementary but valuable role in the subsistence strategy, comprising 5.41% (MNI%) of the identified assemblage. While deer remains are less abundant than bison, their presence suggests opportunistic hunting as part of a broader seasonal strategy. Within ethnographic accounts deer are depicted as a resource that, while valued, could not sustain a community on its own (Dorsey 1904). In *Trouble Among the Chief's Children,* a cautionary tale is presented of the character "Man-fond-of-Deer-Meat" who relies exclusively on deer meat (Dorsey 1904:234-239). In this story deer as a subsistence resource is presented as a supplementary resource, that cannot be relied solely upon without risk to health as the man begins to waste away and is then no longer able to hunt. Deer are also represented at contemporaneous sites: Heerwald (MNI=8), McLemore (MNI=6), and Little Deer Feature 1 (MNI=1), further supporting their supplementary role in Turkey Creek subsistence (Bethke et al. Forthcoming; Bobalik-Savage 1995: 78; Pillaert 1963: 76).

At the Shepard site, the small number of deer bones and the cutmarks present on three specimens—a left patella, a rib fragment, and a lumbar vertebra—suggest that deer were processed for meat similarly to bison, however, with less dependency. This idea is consistent with the understanding that medium game species like deer may have been hunted more sporadically, depending on the availability of bison or other resources (Drass 1997:135; Hoard 2012:491; Lyman 1994; Vehik 1977). Hunting deer was typically done in small groups or individually, often in close proximity to villages (Drass 1997:135; Hoard 2012:491). Additionally, deer hunting was more likely to be done in warmer months, when they would be more easily tracked, and their hides could be used for clothing and shelter (Pratt 1935).

Deer not only provided meat but also hides for clothing and antlers that were used for tools (Pratt 1935; Stahl 1978). At the Shepard site, two modified deer antler tools were identified, though their specific function remains unclear due to weathering and fragmentation. These tools exhibit intentional shaping and polishing, suggesting their use in activities such as skinning, scraping, or working other materials (Trabert et al. 2024:91 Wedel 1959:246–247, 1970:36–45). Additionally, bone awls/needles made from deer bone (NISP=5) and other medium mammal bone (NISP=6) were recovered, showing evidence of extensive use, including polishing and wear patterns. These tools are consistent with hide-working, basketry, or textile production, activities associated with semi-sedentary or sedentary lifeways (Bamforth 2021; Trabert et al. 2024; 189; Wilson 1987).

Comparatively, at the Goodwin-Baker and Goodman II sites, bone tools made from deer and other medium mammals were also present, though in varying quantities (Brighton 1951; Swenson 1951). At Goodwin-Baker, antler flakers and bone awls were recovered, indicating the use of deer antlers for tool-making and hide-working (Swenson 1951:7). At Goodman I, while fewer bone tools were recovered, the presence of bone awls indicates that deer were still utilized for crafting and toolmaking, albeit on a smaller scale (Brighton 1951:168). These findings align with the patterns observed at the Shepard site, where deer were used not only for meat but also for their antlers and bones, which were transformed into tools for various domestic and crafting activities.

Canids

Canids, including dogs (k?ita:ka), coyotes (kici:ye:h), and wolves (wase?ekha:r?a), appear to have held a non-subsistence role at the site, representing 5.40% (MNI%) of the identified assemblage. The absence of butchery indicative human modifications (cutmarks, hack-marks, impact scaring) on canid remains suggests these species may not have been directly utilized for food or post-depositional conditions have obscured any evidence of their utilization. While the archaeological record does not provide definitive evidence of their use as a food source, ethnographic accounts indicate that young dogs were occasionally consumed, highlighting their potential role in Wichita diets (Hoard 2012:362). Dogs/coyotes are also represented at contemporaneous sites: Heerwald (MNI=3), McLemore (MNI=1), and Little Deer Feature 1 (MNI=1), however, wolf specimens are not identified at any other Turkey Creek sites (Bobalik-Savage 1995: 78; Pillaert 1963: 76; Bethke et al. forthcoming).

Both dogs/coyotes and wolves appear in ethnographic and mythological contexts, though they were rarely associated with consumption. For example, *The Story of Child-of-a-Dog* involves a supernatural hero born of a dog, but at no point does this dog serve a purpose associated with hunting or consumption (Dorsey 1904:130-149). The minimal presence of canid remains in the faunal record may suggest that their role was more symbolic or practical in nature, possibly linked to hunting practices or other non-subsistence roles. Ethnographic and archaeological evidence suggests that dogs, in particular, were likely domesticated and served practical roles such as hunting companions, vermin control, and village sentinels (Hoard 2012:362; Trabert et al. 2024:106). Given the different roles canids may have played, their disposal might have differed from that of other species, potentially leading to their underrepresentation in trash pit features. At the Shepard site, a dog/coyote rib fragment (NISP=1) was identified with polishing. Canid bones were often utilized for crafting tools and ornaments, such as bone beads and tubes, reflecting their material value in Wichita lifeways (Trabert et al. 2024:106).

Small and Very Small Mammals

Small and very-small mammal remains at the Shepard site are a minor component of the faunal assemblage, composed of two distinct groups: opportunistically hunted species (hares and rabbits (*Leporidae* indeterminate/kó:kis) and species intrusive to the site (New World rats and mice (*Cricetinae* indeterminate)). The former category makes up 5.41% (MNI%) of the identified assemblage. Ethnographic mentions of the hunting of jackrabbits, often by children, supports their limited role in subsistence activities and the material use of their fur (Dorsey 1904:70-71). These remains likely reflect opportunistic hunting and natural site formation processes rather than targeted consumption (Lyman 1994).

However, opportunistic small and very small mammal species such as rabbits, squirrels, and racoons, are represented ethnographically and archaeologically as important supplementary protein sources. These animals were individually or opportunistically hunted and were able to provide a steady supply of meat when larger game was unavailable (Hoard 2012:368; Pratt 1935). This is illustrated through the assemblages of contemporaneous sites where a variety of small and very small mammals are present. Heerwald's assemblage includes eastern cottontail, black-tailed jackrabbit, badger, skunk, beaver, prairie dog, gopher, and muskrat (Bobalik-Savage 1995: 78) McLemore's assemblage includes only rabbit and gopher and Feature 1 of Little Deer includes only rabbit, gopher, and badger (Bethke et al. Forthcoming; Pillaert 1963:76). Notably, the Shepard site lacks diversity in opportunistically hunted small and very small mammal species.

Very small mammals also include New World rats and Mice (*Cricetinae* indeterminate) which make up 2.70% (MNI%) of the identified assemblage and may have been attracted to refuse at the Shepard site. The remains of these species lack evidence of burning, butchering, or other human modifications. Their small size and lack of cultural modifications suggest that they are commensal animals, intrusive to the site and not representing human behavior.

Birds

Birds were also likely consumed by the ancestral Wichita, specifically turkey, ducks, and prairie chickens (Hoard 2012; Trabert et al. 2024). Bird hunting provided a source of protein and was an important part of seasonal foraging (Hoard 2012:383-384). The seasonal availability of migratory birds would have made them a predictable resource during specific times of the year, further integrating them into the Wichita's cyclical subsistence practices. Additionally, the use of feathers for ornamental and utilitarian purposes, such as tool and ceremonial object creating, demonstrates an ability to integrate both practical and symbolic uses of environmental resources (Hastorf 2017). Bird remains at the Shepard site reflect a mix of subsistence and symbolic roles.

The Corvids or ka:w (ravens, crows, magpies, and jays) constitute 5.41% (MNI%) of the identified assemblage and are associated with scavenging and opportunistic foraging (Sutton 1967; Wood and Schnell 1984). While the small sample size limits a detailed interpretation, it is plausible that the Corvidae remains represent either natural deposition or incidental human interaction. Their presence at both Heerwald (MNI=1) and McLemore (MNI=2), though with less abundance, hint at occasional or seasonal interactions with Corvids, possibly during times when other resources were scarce or when their presence was more pronounced (Bobalik-Savage 1995: 78; Pillaert 1963: 76). While there are no direct ethnographic references to the consumption of Corvids, they appear frequently in Wichita mythology, suggesting cultural significance beyond subsistence (Dorsey 1904:192-194, 243-245, 284, 312).

In contrast, turkey or ne?e:siwa:c?a (*Meleagris spp.*), representing 2.70% (MNI%) of the identified assemblage, show clearer evidence of human interaction. Seven cutmarks on a right turkey humerus suggest that these birds were actively processed, consistent with butchery practices identified in previous studies (Hoard 2012:384). The presence of turkeys at both Heerwald (MNI=4) and McLemore (MNI=2) further supports their role as a resource across the region, though their relatively low numbers suggest they were not a primary food source (Bobalik-Savage 1995:78; Pillaert 1963:76). Turkeys were domesticated in the American Southwest around 200-500CE, however, in Oklahoma there is no definitive timeline of turkey domestication prior to European contact (Schorger 1966).

Ethnographic accounts describe wild turkeys as important game for young hunters, as seen in the story *Young-Boy-Chief and His Sister* (Dorsey 1904:218-224), reinforcing their role in skill development rather than as a primary food source. Additionally, bone tubes, at Shepard, made from unidentified medium/large bird bones suggest possible use in personal adornment or as trade items (Hoard 2012; Vehik 2002). The discovery of two bird bone beads at Goodman I further supports the use of bird bones for crafting ornaments, which may have held cultural or protective significance (Gallaher 1951:202). In *The Story Young Boy Chief Who Became an Otter*, a woman sings about placing bone beads under the feet of a child, likely as protection (Dorsey 1904; 170).

Raptors, including hawks (kase?eya:a?a), eagles (ko:s), and owls (nikir?i:c) and waterfowl (sacikic) are minimally represented in the assemblage, 5.40% (MNI%), with no evidence of human modifications. Their presence likely reflects purposeful use and their inclusion in Wichita mythology—such as the sacred status of eagles—suggests they held symbolic importance (Dorsey 1904:113, 165-171, 218).

The single duck bone, for example, aligns with ethnographic accounts of waterfowl hunting, as depicted in *The Story of Child-of-a-Dog*, though their limited representation indicates they were not a significant dietary component (Dorsey 1904:130-149). The representation of raptors (MNI=5) and waterfowl (MNI=1) at Heerwald further supports their cultural significance, though their low numbers at both sites suggest they were not a significant dietary component (Bobalik-Savage 1995:78).

Aquatic Species

Ethnographically, fishing and the use of aquatic resources provided an important, however secondary component of the ancestral Wichita diet. While fish (ka:c?a), turtle (kik?i:s), and mussel are not represented archaeologically as a primary source of nutrition, they complemented the diet by providing variety and important nutrient benefits (Hoard 2012;419, 439). At the Shepard site, unidentified fish (NISP=56) suggest that aquatic resources were utilized, albeit on a limited scale making up 0.46% (NISP%) of the total assemblage. This pattern is echoed at Heerwald, where a single gar (MNI=1) was identified, and in Feature 1 of Little Deer, where catfish (MNI=2) were present, indicating that fishing practices were adapted to local water systems and seasonal availability (Bethke et al. Forthcoming; Bobalik-Savage 1995:78). Fishing provides a complementary protein source, which becomes important during periods when large game or agricultural crops are less common (Wedel 1959; 587). Fish were likely caught seasonally, with fishing practice optimized to local water systems and fish migration patterns (Turner-Pearson 2008).

Freshwater mussels, box turtles, and softshell turtles were also gathered by the ancestral Wichita and valued for both their nutritional and material value. Mussels were collected for their meat and their shells, which were used to create tools and ornaments (Drass 1997:125; Pratt 1935). The shells of mussels were often fashioned into beads, scrapers, and other utilitarian objects, in addition to personal adornments, suggesting their importance beyond subsistence (Hoard 2012:451). A single modified mussel shell fragment with intentional scalloping along the edge was identified at the Shepard site, suggests its use for personal adornment or as a tool at the site (Hofman 1989). Turtles were useful for both protein and their carapaces, which were likely used as containers or tools (Hoard 2012:371; Pratt 1935). Both mussels and turtles were gathered opportunistically, often in wetlands or along riverbanks, where they would be most abundant (Drass 1997:125).

Box turtles are the most abundant aquatic remains at the site, reflecting their potential importance in the subsistence strategy, 29.73% (MNI%) of the identified assemblage. Box turtles are also represented at contemporaneous sites: Heerwald (MNI=31), McLemore (MNI=9), and Little Deer Feature 1 (MNI=2), further supporting their potential importance in Turkey Creek subsistence (Bethke et al. forthcoming; Bobalik-Savage 1995: 78; Pillaert 1963: 76). While ethnographic accounts do not directly reference the consumption of turtles, they are often associated with healing or guidance in Wichita mythology (Dorsey 1904:187-191). The presence of soft-shell turtles and snapping turtles as only 5.40% (MNI%) of the identified assemblage, suggests they were occasionally utilized, though their role was likely secondary. The Heerwald assemblage also includes soft shell turtle (MNI=3) and snapping turtle (MNI=4), while other contemporaneous sites do not (Bobalik-Savage 1995: 78).

Amphibians, such as frogs and toads (takik), are minimally represented, 5.41% (MNI%) in the Shepard site identified assemblage and were likely not a significant food source. While there are no specific ethnographic references to Wichita consumption of amphibians, broader Plains ethnographic accounts, such as Weltfish (1977:474), describe instances of survival strategies involving frog legs, suggesting that amphibians may have been consumed in times of scarcity. The absence of Wichita-specific references, however, leaves their role in Wichita subsistence unclear. Comparatively, the Heerwald site and Feature 1 of Little Deer show more diverse reptile and amphibian representations, including cooter turtles and both venomous (MNI=1) and non-venomous snakes (MNI=1) in Feature 1 of Little Deer (Bethke et al. forthcoming; Bobalik-Savage 1995). This regional variation highlights the potential for localized differences in the use of aquatic and semi-aquatic resources.

In sum, the faunal remains from the Shepard site and contemporaneous sites reveal a diverse subsistence strategy that incorporated both primary and secondary food resources, which present larger implications about the Turkey Creek phase. These resources not only provided nutritional variety but also materials for tools, ornaments, and other cultural items, reflecting a holistic approach to utilizing the environment. The varied exploitation of fauna highlights the flexibility and diversity of ancestral Wichita subsistence practices during this period. Furthermore, the integration of subsistence, technology, and cultural practices underscores the varied interactions between humans and fauna. Ethnographic and archaeological evidence underscores the symbolic and practical significance of these animals, highlighting the interconnectedness of subsistence, technology, and cultural practices in Wichita lifeways.

Bison Utilization

The preliminary analysis of the faunal assemblage, as a whole, sets the stage for a more detailed examination of how bison were specifically utilized at the Shepard site. In the following section, the varied ways in which bison contributed to subsistence and material culture will be explored. This includes an exploration of butchery practices and in-bone nutrient processing, as well as a discussion of bone tool production and its cultural significance. By integrating archaeological evidence, data from six comparative sites, as well as, ethnographic and mythological accounts, this discussion situates human-bison interaction within the broader context of the Middle Plains Village period lifeways.

Subsistence Roles

The faunal assemblage at the Shepard site highlights the central role of bison, representing 21.62% (MNI%) of the identified assemblage (MNI=8). Ethnographic accounts, such as those by

Dorsey (1904) and Wedel (1988), emphasize the importance of bison as a primary food source for the Wichita, with Spanish conquistadors like Juan de Oñate and Juan Martinez de Montoya describing bison meat as the "principal and best sustenance" (Wedel 1988:19). The story *The Coyote and the Buffalo* underscores this point, discussing a time when the people suffered because the buffalo were hidden, and therefore "Coyote" had to track down the herd (Dorsey 1904:191-194). The prominence of bison remains at the Shepard site, both in quantity and elemental abundance, suggests that inhabitants relied heavily on this species for subsistence.

This pattern is consistent with contemporaneous sites, such as Heerwald (MNI=39) and McLemore (MNI=6), where bison dominate the faunal assemblages, further underscoring their importance in Plains subsistence strategies (Bobalik-Savage 1995:78; Pillaert 1963:76). At Goodman I, Goodman II, and Goodwin-Baker, bison are mentioned in the context of tool production, but the lack of quantified faunal data makes their dietary role unclear (Brighton 1951; Swenson 1951). However, the absence of bison in Feature 1 of the Little Deer site suggests regional variability in bison exploitation, possibly due to differences in local ecology, hunting practices, seasons of occupation, site function, collection size, or recovery context (Bethke et al. forthcoming).

Ethnographic accounts and experimental archaeological studies reveal that bison butchery was a systematic and communal activity (Binford 1978; Brink 1997). For example, in the story *The Coyote, Prairie Turkey, and Squirrel*, "Coyote" negotiates the division of meat after butchering a buffalo, highlighting the social and practical aspects of meat distribution (Dorsey 1904:345). Experimental studies further demonstrate that butchery marks, such as cutmarks and hack-marks, are concentrated on meat-rich axial elements (e.g. ribs and vertebrae) and at joint surfaces for disarticulation (Binford 1978; Brink 1997). These patterns are clearly reflected in the bison assemblage from the Shepard site and additional Turkey Creek sites.

At the Shepard site, cutmarks are the most frequent butchery mark (NISP=53, 498 individual marks), with a strong concentration on ribs and long bone epiphyses. This distribution aligns with evidence suggesting that ribs were subjected to primary butchery (meat and fat removal) due to their high meat yield (Brink 1997; Emerson 1990). The presence of hack-marks on ribs and scapulae further supports this interpretation, as these marks are indicative of disarticulation, a key step in primary butchery (Binford 1978; Brink 1997). This mirrors ethnographic accounts of communal butchery, where meat- and fat-rich portions were systematically removed and shared among participants (Dorsey 1904:345; Wedel 1988:30). For example, in *The Coyote and the Wild-Cat*, "Coyote" uses fire to transform a buffalo discarded rib bone into a whole rib with meat and fat, which illustrates how value was placed on maximizing the nutritional yield of all elements (Dorsey 1904:281-283). Additionally, in *The Man Who Went to Spirit-Land* the protagonist is instructed to take fat from the shoulder of a buffalo after killing it (Dorsey 1904:300-305).

The distribution of butchery marks and skeletal elements at the Shepard site also highlights the selective transportation of bison parts from kill site(s) to processing areas at villages (Brink 1997; Emerson 1990; Lupo 2006). While axial elements like ribs and vertebrae were often processed on-site for their meat, appendicular elements were transported for their additional marrow and grease content (Brink 1997; Emerson 1990). The high frequency of appendicular elements in the Shepard assemblage, particularly the femur (MNE=14; MAU%=100) and tibia (MNE=13; MAU%=93), further supports the idea that these elements were transported to the site for intensive processing (Emerson 1990). The Shepard site assemblage thus provides a clear example of these well-documented butchery and transport practices.

The bison assemblage from the Shepard site also offers compelling evidence for marrow processing. Marrow, a fat found within the medullary cavities of long bones, is obtained through breaking open long bones, typically using hammerstones or other blunt tools (Brink 1997; Outram 2001). The process leaves distinct signatures, including impact scars, spiral fractures, and high fragmentation, particularly in long bones such as the femur, tibia, and humerus (Binford 1978; Morin and Soulier 2017). The Shepard site assemblage provides clear evidence of these signatures. The high frequency of partial appendicular elements, particularly the femur (MAU%=100) and tibia (MAU%=93), suggests that these bones were targeted for their marrow content. Impact scars on the humerus, femur, tibia, and long bone fragments, along with the high fragmentation index (0.04), indicate intentional breakage using blunt tools. The earlier comparison of the Shepard site with Emerson's (1990) utility indices also indicated a strong significant correlation between MAU% at the Shepard site and marrow yield ($\rho = 0.712$, $P = 0.001$). These patterns align with experimental and ethnographic evidence, demonstrating the importance of marrow as a key subsistence resource at Shepard (Brink 1997; Morin and Soulier 2017; Outram 2001).

Ethnographic and experimental evidence suggests that marrow extraction was sometimes followed by bone grease rendering, a process that involves further breaking cancellous bone followed by boiling and rendering (Brink 1997; Outram 2001:194; Quigg 1997; Vehik 1977). This sequential processing—first extracting marrow and then breaking the bones further for grease—reflects a comprehensive approach to maximizing the nutritional yield of bison bones. Bone grease was used in pemmican, a mixture of dried meat, grease, and sometimes plant materials, which provides a lightweight, long-lasting, and nutrient-dense food supply. While pemmican production is well-documented in the Northern Plains, direct evidence for it in the Southern Plains is more limited, though it may have been practiced in the Northwest Texas and Western Oklahoma during the Middle and Late Plains Village periods (Bobalik-Savage 1995; DeMarcay 1986; Quigg 1997; Quigg et al. 1993). Bone grease is also known to be valued for its medicinal properties in Wichita culture. In *The Origin of the Eagles*, for example, a turtle is described as using buffalo grease to heal “Young-Boy-Chief" by rubbing it over his wounds (Dorsey 1904:187-191).

However, there is not strong evidence for intensive grease processing at the Shepard site. The dominance of a high degree of small bone fragments (<5 cm), which account for over 75% of the assemblage, could be a key indicator of grease processing (Morin and Soulier 2017). However, many of these fragments do not exhibit fresh fractures, which does not support the probability of grease extraction (Brink 1997; Outram 2001). Similarly, patterns in elemental part representations do not correlate with patterns indicative for grease rendering with the exception of possibly the humerus. This is unusual for a Middle Plains Village site in the Southern Plains, as bone grease extraction was becoming a significant activity during this period, as evidenced at the Heerwald site (Bobalik-Savage 1995), an Antelope Creek site (DeMarcay 1986), and Late Plains Village sites (Quigg 1997; Quigg et al. 1993).

The bison processing strategies at Shepard and Heerwald share similarities but also exhibit key distinctions. Both sites show evidence of systematic butchery, with cutmarks concentrated on meat-rich axial elements and joint surfaces for disarticulation, as well as marrow extraction, indicated by impact scars and spiral fractures on long bones like the humerus, femur, and tibia (Bobalik-Savage 1995:147-150; Brink 1997; Emerson 1990). However, Heerwald demonstrates a more comprehensive approach, with a stronger focus on grease processing. This is evidenced by small bone fragments and burned bone, suggesting bones were further broken and heated for grease

(Bobalik-Savage 1995:152-154). In contrast, Shepard's limited evidence for grease processing—such as few fresh fractures on small fragments—points to a primary focus on marrow extraction, supported by the dominance of appendicular elements like the femur and tibia, which were selectively transported for intensive processing (Brink 1997; Emerson 1990). Together, these sites illustrate the variability of bison processing strategies in Turkey Creek subsistence, highlighting the interconnected roles of meat, marrow, and grease in ancestral Wichita foodways (Brink 1997; Emerson 1990; Morin and Soulier 2017).

Material Roles

Bison provided a wealth of raw materials that were integral to ancestral Wichita daily life, extending beyond dietary contributions to include tool production (Brink 2008; Frison 1991; Hofman 1989). At the Shepard site, bison bones were not only processed for marrow but were also modified into tools, as evidenced by 71 modified bone specimens, 60.56% of which were bison (NISP=43). Polished bone fragments, particularly from scapulas and ribs, highlight their use in crafting and horticultural activities. Scapula hoes (NISP=8) are well-represented, with heavy polishing and cutmarks indicating prolonged use and maintenance. These tools, likely employed for digging and planting, reflect the integration of bison resources into agricultural practices (Bamforth 2021; Bobalik-Savage 1995, 2006, 2014; Hofman 1989; Wedel 1988; Wilson 1987). Similarly, tibia digging sticks (NISP=6) exhibit intentional shaping and varied polishing, suggesting their use in tasks such as tilling soil and extracting tubers (Bamforth 2021; Brink 1997; Hofman 1989). The wear patterns and modifications on both tool types underscore their prolonged use and the importance of bison remains in supporting a long-term, horticulture-based occupation at the Shepard site. Through their transformation into agricultural implements, bison bones actively shaped the site's landscape, illustrating a material manifestation of the dynamic interactions between people, fauna, and landscape.

Similarly, at Heerwald, bison bone tools are extensively documented, with 199 tools identified, including scapula hoes (NISP=81), tibia digging stick bladed (NISP=12), and tibia digging stick handles (NISP=8) (Bobalik-Savage 1995:79-80). Additionally, the presence of tibia and scapula preforms, and manufacturing debris further highlights the importance of bison bones as raw materials. In contrast, McLemore lacks any reported bone tools and Little Deer's Feature 1 faunal assemblage included no bison remains, indicating these sites may have relied less on bison for both subsistence and tool production (Bethke et al. Forthcoming; Pillaert 1963).

At Goodman I, Goodman II, and Goodwin-Baker, bison remains were also used for tool production, though the data is less quantified. Scapula hoes and tibia digging sticks were identified at these sites, mirroring the patterns observed at Shepard and Heerwald. However, the lack of detailed quantification limits our understanding of the scale and intensity of bison bone tool production at these sites (Brighton 1951; Swenson 1951).

The importance of digging tools is also reflected in Wichita ethnography and mythology. In *The Seven Brothers and the Sister*, a young woman uses a "digging stick" to dig for tubers, illustrating the practical use of these tools in day-to-day life (Dorsey 1904:69-81). Ethnographic evidence further supports this through mentions of Wichita women using agricultural hoes made from both bison leg and shoulder bones for tilling and weeding their gardens (TDOT 2021:4).

In addition to their bones, bison hides and skins were a critical resource, used to create shields, clothing, shelter, and robes, as evidenced by the Wichita's gifting of bison robes to French traders (TDOT 2021). At the Shepard site a phalange (NISP=1) with evidence of cut marks is the only indicator of skin removal. Of the contemporaneous sites no similar evidence has been reported on (Bethke et al. Forthcoming; Brighton 1951; Bobalik-Savage 1995; Pillaert 1963; Swenson 1951). However, the chipped stone scrapers, and scapula processing tools present at Heerwald suggest that bison hides were being processed for (Bobalik-Savage 1995:191). Ethnographically, bison hides have also been frequently mentioned as interregional trade items throughout the Southern Plains (Baugh 1982; Bobalik-Savage 1995:95; Creel 1991; Habicht-Mauche 1987; Spielmann 1983). Additionally, bison by-products used throughout the Plains include sinew bowstrings and thread, brains for hide preparation, and horns for cups and spoons (Bobalik-Savage 1995:1 Ewers 1958; McHugh 1972; Speth and Spielmann 1983; Weltfish 1965).

Beyond their material utility, bison held profound cultural significance for the ancestral Wichita (Dorsey 1904). Ethnographic and mythological accounts illustrate how bison were central to myths, rituals, and communal practices, acting as symbols of abundance and resilience (Dorsey 1904; Wedel 1988). For example, in *The Coyote and his Magic Shield and Arrows*, bison are portrayed as providers of life, reflecting their role in sustaining both physical and spiritual wellbeing (Dorsey 1904:36-47). This story details how bison gives “Coyote” a shield and arrows imbued with power, allowing him to hunt successfully. The depiction of bison as sources of assistance mirrors their practical utilization, where bison remains, transformed into tools, were embedded in Wichita subsistence.

The Shepard site assemblage can be interpreted based on this understanding of social narratives and practices. Building on Dr. Maria Nieves Zedeño’s concept of “bundled worlds,” these tools can be understood as more than just utilitarian objects; they were participants in the social and ecological networks of Shepard site inhabitants (Zedeño 2008:362-363). The similar patterns of bison bone tool production at additional Middle Plains Village sites further emphasize how bison resources were integrated into agricultural economies beyond the Shepard site. As "bundled objects," scapula hoes and tibia digging sticks carried meanings beyond their physical form, embodying the labor, knowledge, and relationships involved in their production and use.

This idea is reflected in Wichita oral traditions, where bison were not only hunted but also integrated into broader communal practices. In *The Coyote Who Became a Buffalo*, "Coyote" seeks to transform into a buffalo to gain their strength and independence, only to fail when he attempts to pass this power to others (Dorsey 1904:278-280). This narrative underscores the reciprocal nature of bison-human relationships, where knowledge and materials were passed down. Likewise, the shared knowledge involved in producing and maintaining these bison bone implements would have required skill, labor, and community participation, while their use in horticulture further integrated bison hunting to broader subsistence strategies (Zedeño 2008:364).

By framing these tools as bundled objects, we can better appreciate their role in mediating relationships between humans, animals, and the environment. These objects were not just passive resources but dynamic entities that shaped and reflected the social, cultural, and ecological networks of ancestral Wichita lifeways. The transformation of bison scapulae and tibiae into agricultural tools represents more than a technological product; it reflects a relationship in which the products of hunting were reinvested into land management practices. This integrated approach highlights the multifaceted significance of bison, underscoring their importance as both material and cultural resources in Middle Plains Village period societies.

Interpretations

Socioecological systems theory provides a robust framework for understanding the interconnectedness of human and non-human systems, emphasizing feedback loops, thresholds, and resilience (Gunderson and Holling 2002; Holling 1973). At the Shepard site, the relationship between ancestral Wichita subsistence practices and faunal populations exemplifies these dynamics, revealing a system shaped by seasonal cycles, adaptive strategies, and interspecies interactions. By examining the interplay of seasonal round, communal bison hunting, resource diversification, and horticulture this analysis highlights how the ancestral Wichita during this period created a resilient and robust socioecological system capable of responding to environmental variability.

The interplay between cultural practices and ecological abundance can be understood through both positive and negative feedback loops. Based on ethnographic accounts, ancestral Wichita subsistence was deeply rooted within the seasonal round, which structured hunting, horticulture, and settlement patterns (Wedel 1988:86). Bison hunting, a cornerstone of this system, is described as a seasonal activity, occurring twice a year, once in the summer and again in the late fall, often involving communal efforts, aligning with bison migratory cycles (Wedel 1988:86). This alignment created a positive feedback loop, where successful hunts provided immediate food resources and materials for tools, such as scapula hoes and tibia digging sticks, which in turn supported horticultural activities and broader subsistence practices (Berkes et al. 2003; Gunderson and Holling 2002). The cyclical relationship—where successful hunting led to greater food security, stronger social bonds, and further cooperative efforts—created a self-reinforcing system that enhanced community resilience.

Mythological narratives, such as *The Coyote and the Buffalo*, encode knowledge of bison migration patterns and reflect the co-construction of cultural and ecological systems. In this story bison mysteriously disappear and must be released from a hidden place, symbolizing their periodic absence from the landscape (Dorsey 1904:191-194). Meat preservation fulfills a similar role in

The Coyote and His Magic Shield and Arrows, where an old woman is described building a drying arbor and hanging meats, as well as in accounts where smoking was used as a long-term food preservation method (Dorsey 1904:36-47; Wedel 1988:65). These stories reinforce the idea that bison were not merely resources but active participants in the socioecological system, shaping and being shaped by Wichita cultural practices (Descola 2013; Latour 2005). The seasonal round, therefore, not only ensured the sustainability of bison populations but also embedded ecological knowledge within cultural traditions, contributing to the resilience of the system.

However, the ancestral Wichita did not rely solely on bison. The Shepard site assemblage, as well as the six contemporaneous sites, reveal a diverse range of fauna being exploited during the Middle Plains Village period (Bethke et al. forthcoming; Bobalik-Savage 1995; Brighton 1951; Pillaert 1963; Swenson 1951). The faunal assemblage at the Shepard site reveals a diverse range of species, including deer, canids, small and very small mammals, birds, and aquatic resources, which acted as a negative feedback loop, mitigating the risk of overexploitation and maintaining ecological balance (Gunderson and Holling 2002; Solich and Bradtmoller 2017).

The seasonal round can be seen as structuring the exploitation of these diversified resources, ensuring both food and material goods throughout the year. During the warmer months (April-October), box turtles and other aquatic resources would have been gathered from wetlands and riverbanks, providing food and carapaces (Collins 1974:97-98; Haury 2008:517). In the fall and winter (October-May), migratory birds such as waterfowl and turkeys would have been hunted, supplementing the diet, as evidenced by previously discussed processing on a turkey humerus (Trabert et al. 2024:110-111). Opportunistically hunted mammals, such as rabbits and hares, were available year-round, offering a reliable source of meat and fur during periods of scarcity. Deer, for example, played a supplementary but valuable role. While less abundantly represented than bison, ethnographically deer provided meat, hides, and antlers for tools, reflecting their integration into a diversified subsistence strategy (Stahl 1978; Pratt 1935).

Furthermore, by integrating bison hunting with horticulture and foraging, Shepard site inhabitants build upon this robust subsistence economy. The use of bison and deer bone tools, such as scapula hoes and tibia digging sticks, supported agricultural productivity, while the extraction of in-bone nutrients (marrow and grease) provided high-calorie, storable resources that enhanced food security during periods of scarcity (Holland-Lulewicz 2024; Masson-MacLean et al. 2020).

Moreover, the seasonal round allowed communities to exploit bison herds during periods of abundance while minimizing ecological pressure during other times of the year through opportunistic hunting. This adaptive strategy, combined with the communal nature of bison hunts, ensured that hunting practices were sustainable and aligned with the natural cycles of bison populations. The result was a resilient and robust socioecological system that balanced human needs with ecological constraints, promoting long-term stability (Liu et al. 2007; Van Der Leeuw and Redman 2002).

Conclusion and Further Research

Through the analysis of faunal remains at the Shepard site, this thesis has provided insight into the ways ancestral Wichita communities during the Middle Plains Village period structured their subsistence practices within a broader socioecological system. The faunal assemblage, while including non-bison species, was dominated by bison, reinforcing their significance not just as a food source but as a material and ecological agent embedded in lifeways during this period. Primary and secondary butchery analysis indicates a focus on marrow extraction which in addition to the presence of bison bone tools suggests a strategy which more intensively utilized bison remains both within and beyond consumption. By situating these findings within a comparative framework, this study demonstrates that the subsistence strategies at the Shepard site, align with broader trends in the Middle Plains Village period, balancing seasonal bison hunting with the hunting of other game, collecting of aquatic resources, horticulture, and foraging.

As a whole, these findings illustrate not simply the economic role of bison but also their place within a dynamic, interspecies human-animal relationship—one that shaped and was shaped by ancestral Wichita foodways, technology, and cultural beliefs. These findings contribute to a deeper understanding of the Middle Plains Village period, highlighting the adaptability, resilience, and robustness of ancestral Wichita subsistence during this time.

While this study has provided valuable insights into the subsistence practices, material culture, and ecological dynamics of the ancestral Wichita at the Shepard site, the analysis has been limited to faunal remains and the integration of existing work on the palaeobotanical remains. To build on these findings and develop a more comprehensive understanding of the site and its inhabitants, a detailed study of lithic tools, debitage, and ceramics from the site could provide insights into technological practices, tool production, and trade networks. Furthermore, comparative research of material culture across the Middle Plains Village Period could allow for a broader discussion of Wichita foodways. Additionally, a reanalysis of bison and large mammal specimens from contemporaneous sites using the methods in this thesis would give us a better understanding of the significance of marrow and bone grease during this period.

Finally, expanding radiocarbon dating to include more samples from different features and contexts could refine the site's chronology and clarify its occupation span. This would help determine whether the site was occupied continuously or intermittently during the Middle to Late Plains Village periods. Stable isotope analysis could also be useful in shedding light on seasonal mobility patterns, to help better understand how site inhabitants engaged in seasonal movement to exploit bison (Davies et al. 2019; Krigbaum and Sharpe 2022).

The Shepard site offers a rich opportunity to explore the complex relationships between humans and animals during the Middle Plains Village periods. While salvage excavations and modern land use have posed challenges, the site has yielded valuable insights into subsistence practices and material culture. Future research should build on these findings by expanding into additional material culture as well as further radiocarbon and isotopic testing.

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