FAUNAL EXPLOITATION DURING THE DEPOPULATION OF THE MESA VERDE REGION (A. D. 1300): A CASE STUDY OF GOODMAN POINT PUEBLO (5MT604)

Amy Susan Hoffman, B.A.

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APPROVED:

Lisa Nagaoka, Major Professor
Steve Wolverton, Minor Professor
Reid Ferring, Committee Member
Paul Hudak, Chair of the Department of Geography
James D. Meernik, Acting Dean of the Toulouse Graduate School

This analysis of faunal remains from Goodman Point Pueblo (5MT604), a large village occupied just before the ancestral Puebloans permanently left southwestern Colorado at the end of the thirteenth century, explores the effect of dietary stress during abandonment in the Four Corners region. As archaeologists, we interpret what these former cultures were like and what resources they used through what they left behind. By specifically looking at faunal remains, or remains from food resources, environmental change and dietary stress can be assessed.

Identifications of taxa identified at Goodman Point are made explicit via a systematic paleontology. This is followed by site-level taxonomic abundances and spatial analysis. Then, effects of technological innovations, environmental change, and sample quality are examined as alternate explanations of shifts in foraging efficiency, particularly related to animal hunting.

Analyzing why and if the availability of faunal resources changes over time helps to clarify why the ancestral Puebloans left southwestern Colorado.
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CHAPTER 1
INTRODUCTION

Some of the greatest archaeological mysteries center around why certain societies collapse, such as the Maya of Guatemala and Mexico and the Rapanui on Easter Island. The process of large scale abandonment is complex and is usually preceded by long term trends in resource use, human-environment relations, and cultural change. In cases of collapse human population sizes and densities reach a level above that which can be supported by the surrounding environment. If the availability of resources declines dramatically people may abandon their residences in order to survive (Diamond 2005). A large disappearance of residents could lead to a restructuring of the culture and an abandonment of villages and/or entire regions. For example, this phenomenon can currently be seen in modern cities, such as Detroit, that have been hit by difficult economic times. People and businesses have moved out of the city leaving behind abandoned buildings and homes (Gallagher 2011).

The ancestral Puebloans in the Southwestern United States (around A. D. 1300) was one of the major collapses of a prehistoric culture in North America. Extravagant architecture and decorative pottery created by the ancestral Puebloans is seen within the renowned large aggregated villages of Chaco Canyon and Mesa Verde. The arid environment of this region contributed to the excellent preservation of artifacts, especially seen in faunal remains from villages in the northern San Juan region (e.g., Driver 2000, 2002a; Muir 1999; Muir and Driver 2003; Rawlings 2006). Also, the large amount of decorative pottery found in the Mesa Verde region provides a good basis for examining smaller time scale changes (e.g., Kidder 1927). The Mesa Verde region was the most densely populated area during the thirteenth century in North America just before this society’s collapse (e.g., Duff and Wilshusen 2000; Kohler et al. 2009).
Additional research on faunal remains from archaeological sites preceding depopulation helps to better understand the availability of food resources during societal stress.

Goodman Point Pueblo was one of the last villages occupied in southwestern Colorado before the ancestral Puebloans abandoned the region, inhabited from approximately A. D. 1260 to A. D. 1280 in the central Mesa Verde region (Kuckelman et al. 2009). This pueblo was also in the center of the most densely populated region in the northern San Juan area with approximately 189 sites per square mile (Hovezak et al. 2004; Kuckelman et al. 2004). The village was also one of the first archaeological sites to fall under protection by the federal government in 1889, and as a result of its protected status, the site remains in nearly pristine condition (Connolly 1992).

Although Goodman Point was protected at the end of the nineteenth century, Crow Canyon Archaeological Center, who has excavated in the northern San Juan region for over twenty years, only recently began work on the large village (2005 to 2008) (Kuckelman et al. 2009; Lipe, ed. 1992; Varien and Wilshusen 2002). Goodman Point Pueblo’s large size, well-stratified middens (trash piles), and thousands of well preserved animal bones hold the potential for building more knowledge about why the ancestral Puebloans abandoned the site and the region at the end of the thirteenth century. Also, with this site’s record of rapid development in architecture, expansion in size, and eventual abandonment a unique context exists with which to assess exploitation of animal resources (Kuckelman et al. 2009). Faunal remains at Goodman Point Pueblo have never been analyzed, and their analysis contributes to a better understanding of ancestral Puebloans resource exploitation in the region during the period leading up to abandonment.

In this thesis I report on the analysis of the faunal remains found at Goodman Point. Then I compare the findings with other late Pueblo III archaeological sites in the region to examine dietary stress.
Chapter 2 focuses on the examination of the surrounding environment of the village and ancestral Puebloan culture in the Mesa Verde region. First, environmental settings are explored to illustrate preservation potential of faunal remains and the availability of particular faunal and agricultural resources. This is followed by an exploration into long-term subsistence strategies and settlement patterns to help understand cultural changes and reasons for abandonment. Finally, the chapter concludes with a description of the site history of Goodman Point Pueblo. The information in this chapter assists in setting up research questions and generating expectations about animal exploitation and to help elucidate why the ancestral Puebloans were going after particular taxa during certain time periods.

A systematic paleontology is presented in Chapter 3 to explicate criteria for identifying each of the faunal specimens to particular taxonomic levels. I use a conservative approach, mirroring that of other zooarchaeologists who analyzed faunal remains for Crow Canyon Archaeological Center to allow for consistency (i.e., Driver 1992a). This chapter not only aids in understanding how I obtained my results, but also helps to set qualified methods for working with other scientific disciplines, such as in conservation and management for current animal populations (Lyman 2006; Wolverton et al. 2011). By being explicit during the identification process other scientists can use the information presented here to answer explicit conservation questions (if applicable) or see limitations in these data before their application.

Chapter 4 presents a description of the faunal remains found and analyzed from Goodman Point Pueblo. This chapter focuses on what animals ancestral Puebloans obtained during the occupation of the village. First, general site-level data are examined, including tallies of identified specimens, their percentages within the assemblage, and overall site-level taphonomic (preservation) effects. Taphonomic analysis explores the possibility of specific
factors, cultural and natural, that may have influenced species and skeletal part abundances at Goodman Point. Finally, the faunal assemblage is divided into more precise spatio-temporal sub-assemblages related to distinctive contexts to answer research questions, as ethnographic records from modern tribes in the Southwest show that different activities occur in different parts of villages (e.g., Henderson and Harrington 1914; Lange 1959; White 1932). Therefore, spatio-temporal analysis allows for an assessment of taphonomic trends and analysis of resource use within different areas of the village.

Chapter 5 discusses how Goodman Point Pueblo compares with other nearby Pueblo III sites during the end of the ancestral Puebloan occupation in the Mesa Verde region. In addition, I introduce ecological and zooarchaeological concepts and analytical strategies for examining dietary stress in archaeological contexts. Taxonomic indices are used to examine the use of large and small wild game versus domesticated resources, and to explore overall foraging efficiency. As population densities grow the impact upon surrounding resources increases at a faster rate (Hamilton and Watt 1970). Thus, several sites show decreasing foraging efficiency in the region and a diminishing use of larger wild game during the last period of occupation (e.g., Badenhorst and Driver 2009; Driver 2002b; Kuckelman 2010; Muir and Driver 2002). In this chapter resource use and efficiency changes at Goodman Point Pueblo are compared with patterns from other nearby villages by examining the abundance of low ranked prey, taxonomic richness, and shifts between wild and domestic resource patch use. If foraging efficiency changed it may have related to technological, environmental change, sampling issues, or a combination of these factors; each factor is investigated through analysis of Goodman Point Pueblo fauna. If foraging efficiency declined at Goodman Point then this further supports previous conclusions that dietary
stress occurred in the region (e.g., Badenhorst and Driver 2009; Driver 2002b; Kuckelman 2010; Muir and Driver 2002). Chapter 5 is followed by a short conclusion chapter.

Overall, this thesis explores what faunal resources the ancestral Puebloans used during their last days in the Mesa Verde region at one of the final villages occupied in the most densely populated area of the northern San Juan. The analysis of faunal remains found at Goodman Point helps to add to the overall understanding of depopulation of the American Southwest.
CHAPTER 2
BACKGROUND

This chapter focuses on the environment in southwestern Colorado, discusses the regional history of the ancestral Pueblos, and provides site background on Goodman Point Pueblo (5MT604). Understanding the environmental context of Goodman Point Pueblo elucidates expectations about bone preservation, settlement patterns, and population densities. Consideration of the regional history explicates the development of settlement patterns within the central Mesa Verde region and what processes led up to the abandonment of the region. Finally, setting up environmental and regional expectations aids in explaining how Goodman Point Pueblo connected with other surrounding villages and helps to set up expectations and hypotheses in later chapters.

Environmental Setting

Landscape Patterns

The southwest United States is characterized by diverse microclimates, geological landforms, and habitats, ranging from low elevation deserts to the southern Rocky Mountains (Figure 2.1). The Colorado Plateau encompasses the northern area of the Southwest. It is an area of flat sedimentary rocks (such as sandstone and limestone) cut by the Colorado River (Baars 1995). The Southern Rocky Mountains are to the east of the Plateau, and east of the Rocky Mountains lay the Great Plains. To the south and southwest of the Plateau is the desert. Basin and range environments are both in the southern and western portions of the Southwest United States (Bailey 1980; United States Department of the Interior, United States Geological Survey [USDA, USGS] 2003).
The ancestral Puebloans occupied the northern San Juan region of the Colorado Plateau, a watershed area that drains into the San Juan and expands from the central to north central Southwest (Four Corners region) (Bailey 1980:54-56; Varien 2010). Several rivers, such as the Colorado River, and its tributaries cut deep canyons, creating flat mesas and steep-walled escarpments (Baars 1995). Elevations of the top of plateaus range from 1,500 to 2,100 m (5,000 to 7,000 ft) (Bailey 1980).

**Climate and Weather Patterns**

The northern San Juan area in southwestern Colorado is classified as a semi-arid or steppe environment. The lack of moisture in semi-arid regions provides good preservation of bones, especially when burial is rapid (Ferring 1986). Currently, the city of Cortez, Colorado, near the southern edge of the Goodman Point Pueblo, has only an average of 33.17 cm of rain per year, while weather stations at Yellow Jacket Pueblo, several miles to the north of Goodman Point Pueblo, averages 37.8 cm of rain per year (United States Department of Interior [USDA] 2006). Summer temperatures for the area range from 85°F during the day and drop down to about 50°F during the night, while during the winter the average high is around 50°F, and plummets to around 20°F at night (USDA 2006).

In addition to seasonal variability in temperature, the region is characterized by seasonal fluctuations in rainfall. The wet season occurs during the summer (July through August) and in winter (December through February), while the dry season occurs from April through June. Heat from the ground during the high temperature summers rises and cools rapidly creating nearly daily afternoon thunderstorms from July to August (Bailey 1980).

Long term oscillations of wet and dry periods are known to have occurred during the Holocene from dendrochronological analysis of ancient trees. Specifically in the central Mesa
Verde region (Figure 2.2), the most populated area of the ancestral Puebloan occupation where Goodman Point Pueblo is located, megadroughts (dry periods spanning more than 20 years) are correlated with societal changes and eventually lead to population aggregation around water, while wet periods were periods that brought times of expanding populations and construction (Benson and Berry 2009; Kohler et al. 2009). Droughts between the early eleventh to late thirteenth centuries and a cold spell from the little ice age (mid thirteenth to late nineteenth century) not only impacted the ancestral Puebloans but also the Fremont, Lovelock, and Mississippian prehistoric cultures of surrounding and distant areas in North America (Benson et al. 2007; Petersen 1988).

Droughts, cold spells, and biannual periods of rainfall create uncertain conditions for cultures that are dependent on agriculture, such as the ancestral Puebloans. For example, the length of the frost-free period every year determines what plants will be able to grow. Corn, a major staple of the ancestral Puebloan diet, requires 120 frost free days. Typically, the region near Goodman Point Pueblo has around 130 frost free days (Benson et al. 2007). Also, the frost free days change between years and can vary more than thirty days between consecutive years (Houghton 1959). During drought years if winter storms do not provide enough moisture to the soil then seeds cannot germinate. Under such conditions, no matter how much rainfall occurs during the summer, corn will not grow successfully (Bellorado 2007). Along with limited rainfall elevation plays a role in corn production and agricultural dependence in the Four Corners region (Petersen 1986). The farming potential varies via an elevational band throughout the San Juan region that changes each year in response to particular climatic variability (Petersen 1986). Higher elevations, such as in the nearby Rocky Mountains and mesa tops above 7,000 ft in
elevation, do not frequently provide an adequate growing season because of fewer frost free days. Thus, in higher elevations agriculture is less reliable (Benson 2011).

Not only does the amount of rainfall variety along with the number of frost free days between years the sandy, well-drained soils in the San Juan region are not very conducive for farming and make dryland agriculture risky. The dominance of sandstone parent material along with the climate allows for the formation of sandy soils with faster water filtration (Baars 1995; Boul et al. 2003). Entisols are present along the floodplains and aridisols can be found throughout most of the region including along plateau tops, terraces and alluvial fans (Bailey 1980). Entisols are younger soils formed in steep, rocky settings and are usually sandy and shallow, while aridisols are found in dry climates and are typically not used for agriculture because of the presence of soil crusts and accumulation of cemented deposits of salts or carbonates (Boul et al. 2003; Rapp et al. 2006). Too much accumulation of carbonates and depletion of soil nutrients from agriculture can lead to salinization of the soil (Boul et al. 2003; Homburg et al. 2005). Currently, the presence of saline below fifty centimeters, elevated pH values greater than eight, and low organic nitrogen concentrations make it difficult to grow crops (Benson 2011).

Natural Flora and Fauna

The geological landscape and weather patterns influence what types of plants and fauna can survive in southwestern Colorado. Because of the diverse landscape and steep changes in elevation there is a variety of flora and fauna (Bailey 1980). In this particular environment water is one of the major limiting resources. Because no major geographic nor climatic change has occurred over the last thousand years, it is assumed that the type of flora and fauna were similar in the past.
The restricted amount of rainfall, limited soil depth, and elevational differences controls the types of plants that survive in southwestern Colorado. On the Colorado Plateau there are large areas of exposed bedrock. Pinyon-juniper woodlands, along with sagebrush, rabbitbrush, and diverse grasses dominate this region, especially along the mesa tops and edges of the mesas. Along the canyon bottoms there are cottonwoods, cattails, and willows, and down in the lower elevations (with more xeric conditions) there is yucca along with several species of cacti. In the nearby montane zones in high plateaus and mountains ponderosa pine and Douglas fir dominate the landscape (Bailey 1980).

Animals present in southwestern Colorado tend to be generalists, are widely distributed across the United States, and posses adaptations to arid conditions (Chapman and Feldhamer ed. 1982; Hoffmeister 1986). For example, jackrabbits (Lepus sp.) are phenotypically plastic in terms of thermoregulation, and are able to colonize a wide variety of different habitats (Best 1996; Chapman and Feldhamer ed. 1982; Hoffmeister 1986).

The three most common artiodactyls, or major large game food resources, in southwestern Colorado include Odocoileus hemionus (mule deer), Antilocapra americana (pronghorn), and Ovis canadensis (Rocky Mountain big horn sheep). These artiodactyls tend to prefer particular aspects of landscapes found in this region of the southwest. Typically, mule deer are found along the outskirts of forest areas and less frequently in open landscapes. They prefer oak, pinon, juniper, Douglas fir, ponderosa pine, and their associated understory (Mackie et al. 1982). Pronghorn are found at a variety of elevations and prefer open valleys and avoid rough terrain. They are likely to flee as a response from predators (Kitchen and O’Gara 1982). Big horn sheep require steep rocky terrain, and are relatively rare today except in areas where they have
been reintroduced (Lawson and Johnson 1982). Elk also inhabit the Colorado Plateau in plains and mountainous environments (Peek 1982).

A number of smaller taxa are found on the landscape. This includes several species of *Lepus* sp. (jackrabbits) and *Sylvilagus* sp. (cottontails) and several families of rodents. Rodents are typically confined by elevation (Hoffmeister 1986). Several species of carnivores, including *Puma concolor* (mountain lions), *Lynx* sp. (lynx and bobcats), *Canis* sp. (wolves, coyotes), and *Urocyon* or *Vulpes* (foxes), also inhabit the area, but are rarely encountered in the archaeological record (Gnabasik 1981). Carnivores may not have been an important food source because many carnivores are solitary, nocturnal hunters (Hoffmeister 1986). Larger carnivores are more numerous in the highlands and mountainous regions, while the smaller carnivores, such as foxes and coyotes are more widely distributed throughout lower elevations and arid environments (Chapman and Feldhamer ed. 1982; Hoffmeister 1986).

Several species of birds were used by the ancestral Puebloans for either ceremonial or food resources. *Meleagris gallopavo* (wild turkey) is also currently found in the region and is widely distributed wherever there is sufficient brushy habitat (Sibley 2000). Falconiformes (hawks and eagles), owls, turkey, and migratory waterfowl are typically found in the Southwest. More waterfowl may have been found near areas where water was diverted, such as check dams and reservoirs because these would have expanded wetland habitat (Emslie 1981). Birds were not only used for their meat, but were hunted for their feathers, especially for use in various ceremonial practices by past and modern peoples (Gnabasik 1981; Munro 1994, 2006).

**Regional Culture History**

An overview of the cultural history of the ancestral Puebloans aids in understanding the reasons for dietary change leading up to the abandonment of the region. Ancestral Puebloan
chronological periods were created at the Pecos Conference and were initially distinguished based on changes in pottery types and masonry architecture (Kidder 1927). The following describes the general characteristics of each time period along with subsistence and settlement patterns. These descriptions, especially on dietary resources, focus on the northern San Juan Region where Goodman Point Pueblo is located.

_Paleoindian 11,000 years ago to B. C. 6,000 and Archaic B. C. 6,000- 1,000_

People have occupied North America for over 11,000 years. Data from Archaic sites are limited because the sites are ephemeral, which related to a relatively mobile lifestyle and a low energetic and material investment in architecture. In addition, these peoples were pre-agricultural and thus, did not have pottery, making the archaeological record even more ephemeral. Their main substances were from hunting and gathering using the atlatl and spear (Charles 2006; Kidder 1927).

_Basketmaker II B. C. 1,000 - A. D. 500_

During Basketmaker II, agriculture entered into the Southwest in the forms of corn, squash, and sunflower (Kidder 1927; McGregor 1941). During this period people remained dependent on hunting using atlatls and spears and gathering plant resources to add protein to their diets. Overall, the ancestral Puebloans relied on artiodactyls, such as deer and mountain sheep (Badenhorst and Driver 2009). Small rodents and rabbits were also trapped with various nets, snares, and grooved wooden clubs (rabbit sticks) (Schmidt 1999; Shaffer and Gardner 1995). The ancestral Puebloans of this time also collected a wide variety of seeds and berries (Adams 2002).

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1 These dates have changed since the Pecos Conference. Dates used will reflect modern interpretations from Noble 2006. Pecos Conference Dates: Basketmaker II A.D. 1-500, Basketmaker III A.D. 500-700, Pueblo I A.D. 700-900, Pueblo II A.D. 900-1100, Pueblo III A.D. 1100-1300.
People entered the New World with domesticated dogs; however, it is debated whether or not turkey was domesticated during Basketmaker II times. The relationship of people to dogs in the Southwest is visible in artwork and dog burials (Savolainen 2007; Savolainen et al. 2002). For example, at Mancos Canyon in southwestern Colorado a dog burial dating from approximately 1200 - 850 B. P. was excavated (Emslie 1978). Early evidence of turkey domestication includes turkey burials and butchery marks on turkey bones. During Basketmaker II, it appears that turkeys were being used for ceremonial purposes or just for their feathers based on scarcity of cut marks on bones (Kemp et al. 2010; Munro 1994, 2006).

In addition to agriculture this time period fostered the beginnings of craft specialization in the region through rock art and artifacts such as ornaments, clothing (sandals and feather and fur robes), and skin bags from small animal carcasses (Charles 2006; McGregor 1941). Ornaments include various beads made out of stone, feathers (thought to have been used in a variety of ways), jewelry, pipes, bone dice, bone awls, bone tubes, and bone whistles (often bird bones). However, artifacts made from deer metatarsals are relatively rare (Charles 2006; McGregor 1941).

*Basketmaker III A. D. 500 - 750*

Agriculture and reliance on turkeys became more important in the region during Basketmaker III. The variety of corn changed to a larger ear with variegated colors, and more importantly, beans were introduced into the Southwest, adding a domesticated source of protein to the diet (Jones et al. 1938; Kaplan 1956). A greater emphasis on agriculture tends to leach the available soil nutrients and can sometimes cause salinization (Homburg et al. 2005). Another marker of the Basketmaker III period is the evidence of butchery marks on turkeys as they
became a more important food resource. Several caves show evidence of turkey enclosures with associated piles of manure during this period (McGregor 1941; Munro 1994, 2006).

Atlatls continued to be utilized for hunting, however, sometime near the end of Basketmaker III, the bow and arrow was introduced in the eastern portion of the Southwest, potentially altering the way people hunted (McGregor 1941).

Basketmaker III is often referred to as the “settlement period” due to the evidence for an increase in population density, reaching to approximately 300 households in the central Mesa Verde region, and an increase in isolated pithouse structures (Kidder 1927; Kohler et al. 2009). More efficient hunting tools coupled with increasing human densities may have lead to greater environmental and dietary stress, as more people utilized resources on the landscape faster than before (Hamilton and Watt 1970).

Craft specialization continued to evolve. Pottery with simple designs, coarse paste, and globular forms became important during the latter half of Basketmaker III (Kidder 1927). Feather and fur robes and ornaments are similar to those from the previous period; however, Olivella shells and shell beads become more popular, and more awls are made from split metatarsals of deer and other artiodactyls (Charles 2006; McGregor 1941).

**Pueblo I A.D. 750 - 900**

The Pueblo I period is distinguished by the unique aboveground stone masonry structures that evolved from early pithouses and another increase in population (Kidder 1927; Kohler et al. 2009). Aboveground square and rectangular rooms and underground kivas are formed during Pueblo I (Kidder 1927). Based on ethnographic records from modern Native American tribes, the square shaped rooms were used for storage and everyday uses, such as habitation and cooking. There were usually single rooms or groups of three or four rooms associated with a
larger pit structure, thought to be an early communal structure (protokivas). Kivas are circular, subterranean structures typically used for ritual or domestic activities purposes (Adler 1993; McGregor 1941; Lipe 2006). When individual rooms and kivas were abandoned they were sometimes filled with trash or secondary refuse (e.g., Reid 1974). Middens, or areas of secondary refuse which includes artifacts discarded elsewhere besides their primary use areas (Schiffer 1972), were located close to rooms. The first major peak in population density occurred during Pueblo I, from around 300 to 1,000 households in the central Mesa Verde region. However, populations slowly begin to decline again at the end of Pueblo I (Kohler et al. 2009).

Constituent crops that were farmed remained the same in the Pueblo I period as the Basketmaker III; however, people relied more heavily on domesticates, including staple crops and turkey. Although there is more reliance on domesticated resources hunting with arrowpoints and gathering was prevalent (Badenhorst and Driver 2009; Driver 2002b; McGregor 1941; Wilshusen 2006).

Slipped and vessel neck corrugated pottery and cotton come into use during Pueblo I in the central Mesa Verde region (Kidder 1927). As cotton became more important, new tools such as bone weaving needles came into use, while robes and ornaments from previous times still remained popular (McGregor 1941; Wilshusen 2006).

\textit{Pueblo II A.D. 900 - 1150} 

Pueblo II, the dissemination period, is characterized by a geographical expansion of hamlets and small villages and southward shift of the center of ancestral Puebloan culture to Chaco Canyon south of the San Juan River (Kidder 1927; Lipe 2006) Architecture in this period is characterized by small one-story surface rooms and small, circular pit structures known as kivas with distinctive features, such as ventilation shafts and “sipapu” (Lipe 2006). Great kivas
also became more common, presumably used for communal gatherings (Churchill et al. 1998; Lipe and Ortman 2000; McGregor 1941). Several Pueblo II sites were only occupied for about twenty years (Varien 1999). Population was concentrated around Chaco Canyon, which was at its peak during this period with multistoried rooms and great kivas spanning forty to sixty feet in diameter (McGregor 1941). During Pueblo II, population constantly increased to above the previous peak attained during Pueblo I to approximately 2,000 households in the central Mesa Verde region (Kohler et al. 2009).

Agricultural crops continued to remain as important staples in the ancestral Puebloan diet, and bow, arrows, and rabbit sticks were still used for hunting (Lipe 2006; McGregor 1941; Schmidt 1999; Shaffer and Gardner 1995). However, their reliance on small game, such as cottontail and rodents, increased, as did reliance on domesticated turkey (Badenhorst and Diver 2009; Driver 2002b; Muir and Driver 2002; Szuter 1991a; Szuter and Bayham 1989). Broken and re-healed turkey leg and wing bones, population age structures, turkey pens and eggshell, indicate increased reliance on turkey (Munro 1994, 2006).

Pottery, fabrics, and ornaments slightly changed from previous periods as trade became more widely established across large, expansive populations. Unlike during Pueblo I with neck-banded pottery, corrugation is commonly found over the entire surface of pottery vessels, and elaborate designs including wide lines, flattened triangles and dots on black and white pottery (Kidder 1927). Large woven fabrics became popular and were most likely made with large, vertical looms (Kent 1957). Ornaments made out of turquoise, stone, clay, bone and shell were important during Pueblo II, as well as awls and fleshers (McGregor 1941).
Fewer large, aggregated villages appear during Pueblo III and continue to stand today. Several of the large villages are within rockshelters (cliff dwellings) or located near canyon rims around springs surrounded by enclosing walls and towers (e.g., Haas and Creamer 1993; LeBlanc 1988, 1999; Tuggle and Reid 2001; Wilcox and Haas 1994). Kivas during this period exhibit a distinctive keyhole-shape and are wholly or partially enclosed by rooms and walls. Many buildings are several stories high, and some are multi-walled D-shaped buildings (Adler 1993; Cordell 1984; Kidder 1927; Lipe and Ortman 2000; McGregor 1941). The presence of D-shaped structures may indicate that a change in violence and/or a change in societal function occurred, such as new social hierarchies (Kuckelman et al. 2000; Lipe and Ortman 2000). These large villages are typically occupied for around forty years (Lipe and Ortman 2000; Varien 1999). The end of occupation is thought to have been a time of violence and warfare (e.g., Baker 1994; Billman et al. 2000; Kuckelman et al. 2000, 2002; Turner and Turner 1999; White 1992). Violence is especially evident at villages surrounding Goodman Point Pueblo, such as Sand Canyon Pueblo and Castle Rock during the late A. D. 1270s (Kuckelman et al. 2002). The central Mesa Verde population peaked at this time (around A. D. 1240) to around 3,000 households; however, once it reached its apex it fell until the region was depopulated (Duff and Wilshusen 2000; Kohler et al. 2009).

During Pueblo III bow and arrow were still used to hunt animals, and agriculture continued to be of central importance in subsistence. Rabbit sticks appear to have become more common, as well as the use of snares and nets to capture mammals and birds (McGregor 1941). Cottontail and turkey remains are abundant from Pueblo III archaeological deposits, but deer and jackrabbit remains are no longer common (e.g., Badenhorst and Driver 2009; Driver 2002b; Muir...
and Driver 2002). During mid-Pueblo III cold spells that were followed by drought, warfare and high populations densities in concentrated areas stressed the availability of food resources (e.g., Benson and Berry 2009; Duff and Wilshusen 2000; Kohler et al. 2009; Kuckelman et al. 2002; Mahoney et al. 2000; Varien et al. 2000). Also, because of increasing populations and possible soil salinization (Homburg et al. 2005) some of the larger villages were no longer located near the best agricultural lands (Kohler 2000). Use of domestic turkey declined prior to the depopulation of the Mesa Verde region (Clinton et al. 2011).

During the late Pueblo III ornate polychrome pottery becomes important and there is a decrease in the abundance of corrugated pottery (Kidder 1927). Ornaments were diversified and abundant including a wide variety of jewelry, pendants, inlays, rings, bracelets, and pipes (McGregor 1941). Unlike previous time periods the Mesa Verde region becomes more isolated with decreased long distance trade (Lipe 2006).

**Pueblo IV A. D. 1300 - 1600**

Around A. D. 1300 many areas in the northern San Juan region were abandoned and the Mesa Verde material culture never reappeared (Boyer et al. 2010; Varien 2010). Population decreases in the Northern San Juan/ Mesa Verde Region and the higher population densities shifted to the Rio Grande Valley and other modern day tribal areas, such as the Hopi and Zuni, creating a new intermingling of cultures in the Southwest (Cordell et al. 2007; Ortman 2009).

**Summary**

Understanding the long term regional history, including settlement and subsistence patterns of the ancestral Puebloan society in the central Mesa Verde region helps to generate expectations for faunal remains at Goodman Point Pueblo. Populations existed in the region for over 11,000 years and peaked during the middle of Pueblo III, developing into a highly
specialized society with an estimated 3,000 households in large aggregated villages centered in the central Mesa Verde region (Duff and Wilshusen 2000; Kohler et al. 2009). Over time the ancestral Puebloans shifted from relying on hunting and gathering to agriculture and domesticated resources then at the very end of abandonment back to more hunting and gathering and less emphasis on domesticated resources (e.g., Badenhorst and Driver 2009; Driver 2002b; Kuckelman 2010; Muir and Driver 2002). Larger aggregated populations, especially during Pueblo III, created more stress on dietary resources. Goodman Point Pueblo, a late Pueblo III village, can help to clarify human dietary stress before the regional abandonment.

Site Description

Goodman Point Pueblo (5MT604) is a large, well preserved ancestral Puebloan village in southwestern Colorado. This village was one of the first archaeological sites to fall under protection by the federal government in 1889. As a result of its protected status, the site remains in nearly pristine condition with few of the problems witnessed at many other sites, such as lootings (Connolly 1992). Goodman Point Pueblo is the largest site within the Goodman Point Ruins Group Unit (Figure 2.2) of Hovenweep National Monument in southwestern Colorado, spanning 8.7 acres (Kuckelman et al. 2009). There are several other sites spanning from Basketmaker III to the Pueblo III period in the Goodman Point Pueblo Unit with approximately 189 sites per square mile, making the unit one of the highest recorded densities in the northern San Juan region (Hovezak et al. 2004; Kuckelman et al. 2004). Crow Canyon Archaeological Center has excavated within this region for over twenty years (Lipe, ed. 1992; Varien and Wilshusen 2002).

Goodman Point Pueblo is one of the largest Pueblo III villages in the region spanning 142 acres in southwestern Colorado (Kuckelman et al. 2009). More specifically, the pueblo is located
on the McElmo Dome, which consists of gently rolling plateaus ranging from 2,000 to 2,200 m (6,600 to 7,200 ft) and sagebrush grasslands with strands of pinon-juniper woodlands (Bailey 1980; Kuckelman and Varien 1999). Similar to other Pueblo III sites in the region, Goodman Point Pueblo is located at the head of a canyon with a once perennial spring flowing through the southern portion of the site (Kuckelman et al. 2009). Approximately twenty springs surrounded Goodman Point Pueblo within a 5 km radius, and the nearby Juárez spring is estimated to have yielded around two gallons per minute, which could have adequately supported up to 800 residents (Wright Paleohydrological Institute [WPI] 2011). The sandy entisols and aridisols soil around Goodman Point provided some water-holding capacity and infiltration for somewhat successful but risky dryland farming (Bailey 1980; Varien and Kuckelman 1999; WPI 2011).

The architecture at Goodman Point is similar to that at other Pueblo III multi-storied villages and includes around 450 rooms and over 114 kivas surrounded by an enclosing wall (Kuckelman et al. 2009). At Goodman Point Pueblo there is a D-shaped bi-wall structure, the tallest building at the site located near the center of the village, and a great kiva near the southwestern side of the village (Kuckelman et al. 2009). While the architecture is characteristic of the Pueblo III period, tree ring data and ceramics more precisely date the occupation of the site from A.D. 1260 to 1280 (Kuckelman et al. 2009).

Though the area has been protected for over a hundred years, it was first excavated by the Center in 2005 with field seasons every summer through 2008 (Kuckelman et al. 2009). Crow Canyon excavated 43 structures, including general masonry structures and kivas, 45 middens throughout the village, and areas within and around the D-shape bi-walled structure and great kiva (Figure 2.3) (Kuckelman et al. 2009). Quarter inch screen size was used during excavation, and both random and judgmental units were dug around the site exposing key portions of
structures and middens. In total, approximately one percent of the site was excavated (304m$^2$) (Crow Canyon Archaeological Center [CCAC] 2004; Kuckelman et al. 2009).

Because of its location in a semi-arid environment in southwestern Colorado, excavations at Goodman Point unearthed thousands of artifacts, including animal remains. The fauna is ideal for examining changes in animal exploitation across time, and it represents an excellent context for studying Pueblo III abandonment because it has well-preserved faunal material and stratified midden contexts that are well-dated and well-documented. Sand Canyon Pueblo, another Pueblo III site, located six miles away with a similar site size, has a well-preserved faunal assemblage with 41 different taxonomic groups and 10,852 identified specimens (Muir 2007), so it is expected that Goodman Point Pueblo will exhibit similar patterns in animal exploitation.

**Summary**

Although the American Southwest includes a variety of diverse microhabitats, the arid climate influences the reliance on water and makes it risky to solely depend on agriculture. The ancestral Puebloans utilized both the natural flora and fauna in addition to their dependence on agriculture. As the ancestral Puebloans began to over-exploit nearby large high-ranked game (artiodactyls) they were then forced to go longer distances increasing the cost to capture game. This resulted in a shift to gathering resources closer to the villages. Instead of directly obtaining protein from large game corn is converted to protein through turkeys, which increases dependence on agricultural production. Through increasing reliance on agriculture the population depends on constant suitable climates and hope that crops do not deplete needed soil resources. The growing population in the region also influenced the carrying capacity of the nearby environment and likely altered social structures.
Overall, there is good preservation at Goodman Point Pueblo and a good sample size with a collection of over 14,000 bones to test hypotheses for understanding faunal exploitation at the end of the ancestral Puebloan occupation in the central Mesa Verde region. What kind of fauna does Goodman Point Pueblo have? What were the ancestral Puebloans eating at Goodman Point Pueblo at the end of Pueblo III? What are spatial distributions of these remains at the site? What does foraging efficiency at Goodman Point look like at the end of occupation in the Central Mesa Verde region? Overall, how do the faunal trends found at Goodman Point Pueblo compare with other late Pueblo III sites? These questions are addressed in the following chapters.
Figure 2.1. Map of major Southwest physiographic and climatic regions. 
Note: Figure from Cordell (1984); map by Charles M. Carrillo.
Figure 2.2. The central Mesa Verde region and Goodman Point Pueblo. 
*Note:* Figure from Kuckelman et al. (2009).
Figure 2.3. Goodman Point Pueblo site map.  
*Note:* Figure from Kuckelman et al. (2009).
CHAPTER 3
SYSTEMATIC PALEONTOLOGY

Zooarchaeologists have been criticized by other scientific disciplines for not being explicit in their methods when indentifying animal remains (e.g., Gobalet 2001); therefore, a systematic paleontology was created for this dataset.

Our “unscientific” methodology includes several potential issues. First, identifications are based on access to modern comparative collections and the experience of the analyst (Driver 1992b). Not all modern comparative collections contain every species which could be present within an archaeological assemblage. Because of the lack of some collections, many rely on published anatomical guides. Working on faunal assemblages in specific regions of the world allows analysts to recognize some species better than others, and therefore, identify smaller fragments of certain species. As Gobalet (2001) has noticed, several zooarchaeologists have come up with different species abundances because of these issues. Finally, because of preservation issues specimens sometimes do not retain diagnostic features important for generating more specific identifications. This loss of diagnostic features as well as similarities in skeletal morphology between species means that general classification categories should be used (Driver 1992b).

Explicit classification minimizes error in identifications and helps to explain gaps in knowledge from the quality of the comparative collection, lack of personal experience, and published anatomical guides. Lack of precise criteria can lead to confusion on how researchers created their data set as they have their own specific goals when identifying faunal remains. Also, use of a standardized identification methodology allows different data sets to be more accurately compared and can aid in applying archaeological specimens to current issues for
conservation and management of current species populations (Driver 1992b; Gobalet 2001; Lyman 2006; Wolverton et al. 2011).

Therefore, in this chapter I document the criteria used in identifying specimens (bones or bone fragments) from Goodman Point Pueblo (5MT604). The systematic paleontology presents all identified taxonomic levels present within the faunal assemblage along with a tally of each skeletal element and detailed descriptions of diagnostic features for species who share similar skeletal morphology. Specimen identifications are made with the help of various reference materials, including published guides and modern reference collections.

Methods

Faunal remains from Goodman Point Pueblo were documented according to a recording system developed for Crow Canyon Archaeological Center by Jonathan Driver (1992a). For each specimen, several variables were recorded including the taxonomic identification, skeletal element, side, portion, state of epiphyseal fusion, type of breakage, presence of modifications (such as weathering, carnivore and rodent damage, burning and butcher marks). In addition, measurements of three dimensions (length, mid, and minimum measurement [mm]) was recorded. Specimens less than seven millimeters in length were not measured, as identification decreases with smaller fragment size (Marshall and Pilgram 1993). Zooarchaeological data were then entered into Crow Canyon’s Database using Microsoft Access. This system has also been used for analysis of faunas from other sites excavated by Crow Canyon (e.g., Driver 2000, 2002; Muir 1999, 2007; Muir and Driver 2003), which allows for an easy comparison across all sites Crow Canyon excavates.

Identifications were made using comparative collections at the University of North Texas, Laboratory of Zooarchaeology, the Vertebrate Paleontology Laboratory at the University

Specimens were identified to the finest taxonomic level possible with given experience and the availability of modern comparative materials. As outlined in Driver (1992a, 1992b), identifications of specimens were only made when the element could first be determined. Specimens that could not be identified were classified as “unidentifiable.” Species level identifications were made when specimens could be compared directly with modern individuals to rule out morphologically similar species. I adopted a conservative approach for remains from closely related species that overlap in terms of skeletal morphology. I did not use size as a factor in determining identifications since animal size can vary by sexual dimorphism, age, and resource availability (Purdue 1980; Zeder 2001). Thus, in such cases, identifications were made to genus, family, or order. In addition, I included “small,” “medium,” and “large” size for order or higher taxonomic levels such as for rodents, mammals, and birds.

Identifiable faunal remains from Goodman Point Pueblo were tallied using the number of identified specimens (NISP). NISP is a measure that is easy to calculate and its derivation does not vary between analysts (Grayson 1984; Lyman 2008). Further, other measures of taxonomic abundance, such as the minimum number of individuals (MNI) are derived from NISP and positively correlate with it.

In the systematic paleontology of the Goodman Point fauna, I include their identified taxonomic level, the NISP for each skeletal element, and the criteria used for identification. Large, medium then small mammals are presented first, followed by birds, reptiles, and finally, amphibians. “Skull fragments” include whole craniums and/or skull fragments; it is a sum of all
skull fragments found. Isolated teeth are separated into a distinct category; however, teeth that were found in mandibles and/or maxillae are included in the respected categories. Teeth found in mandibles and maxillae were recorded in the database. A total of 14,414 specimens were recorded at Goodman Point, and out of these 8,817 specimens were identified to element and taxon.

Systematic Paleontology

Class Mammalia (mammals)

Order Artiodactyla (artiodactyls)

Medium Artiodactyl (deer sized)

Identified specimens: 4 skull fragments, 1 first phalanx, 5 second phalanges, 3 astragali, 1 atlas vertebra, 1 cervical vertebra, 2 carpals, 3 femora, 4 humeri, 5 innominates, 3 lumbar vertebrae, 1 mandible, 4 metapodials, 6 metatarsals, 2 patellae, 2 radii, 7 ribs, 2 sacra, 2 scapulae, 1 sternabra, 2 other tarsals, 1 thoracic vertebra, 5 tibiae, 7 permanent teeth, 3 ulnae, 1 permanent premolar tooth

(total NISP: 78)

Remarks: The specimens are from either Antilocapra americana (pronghorn), Ovis canadensis (bighorn sheep), or Odocoileus sp. (deer) and were fragmented such that they have no distinguishing characteristics to further determine which taxon they represent. Several species of ungulates also share similar skeletal morphology, habitats, and overlap in body size (Kitchen and O’Gara 1982; Lawrence 1951; Lawson and Johnson 1982; Mackie et al. 1982; Peek 1982). Therefore, ungulates are notoriously difficult to differentiate skeletally, especially when large portions of elements that often contain multiple diagnostic features are missing.
Family Bovidae (cloven-hooved, horned mammals)

*Antilocapra americana* (pronghorn)

Identified specimens: 2 skull fragments, 3 first phalanges, 1 second phalanx, 1 third phalanx, 1 astragalus, 1 fibula, 2 scapulae, 1 other tarsal (naviculo-cuboid), 4 permanent teeth

(total NISP: 16)

Remarks: Currently, pronghorns are patchily distributed throughout Colorado and the western portion of the United States in shrubs and grasslands (Kitchen and O’Gara 1982; Russell 1964; Yoakum 1974). Fences and other man-made structures along with overgrazing limit the current population size of this species (Kitchen and O’Gara 1982). Pronghorns prefer to live in flat or rolling grasslands in elevations ranging from sea level to 3,350m (11,000ft), thriving in elevations between 1,200m and 1,800m (4,000ft-6,000ft) in the Great Plains and in habitats with an average precipitation of 25 to 35cm per year (Wilson et al. 1999; Yoakum 1974; Yoakum and O’Gara 2000). These identified specimens from Goodman Point Pueblo were identified based on criteria from Lawrence (1951) and through the use of comparative collections.

*Ovis canadensis* (bighorn sheep)

Identified specimens: 2 second phalanges, 2 third phalanges, 3 metatarsals, 1 tarsal (naviculo-cuboid)

(total NISP: 8)

Remarks: Currently, bighorn sheep inhabit remote mountains and desert regions where human populations are low. They are adapted to a wide range of habitats, but prefer drier climates, semi-open terrain with rocky slopes, cliffs, and rugged canyons (Lawson and Johnson 1982; Todd 1972). Bighorn sheep are migratory animals, and inhabit rocky regions with little competition from other ungulates (Geist 1967; McCann 1956). During times of drought, bighorn sheep more
frequently move to different waterholes (McCann 1956). Desert bighorn have adapted to survive with low amounts of water (Krausman and Shackleton 2000). Their preference for high altitudes, rockier terrain, and avoidance of human populations suggest that there would be few remains in the archaeological record at Goodman Point Pueblo because they are a high-cost scarce resource. Even modern hunters find it difficult to approach these animals because of the bighorn’s adaptations to rocky terrain and highly developed auditory and olfactory senses (Lawson and Johnson 1982). The specimens were distinguished using modern comparative collections and characteristics outlined by Lawrence (1951).

*Bos taurus* (domesticated cattle)

Identified specimens: 1 thoracic vertebra (total NISP: 1)

Remarks: The vertebra was historically machine-sawed in half (anterior/posterior). Domesticated cattle were introduced to the Southwest by Spaniards in the 1500’s (Love 1916) and currently the site is located next to several farms. Although it is likely that the vertebra was brought onto the site by a carnivore there is no carnivore damage present.

Family Cervidae (cervids)

Identified specimens: 21 antler fragments

(total NISP: 21)

Remarks: Antler fragments can potentially come from elk (*Cervus* sp.) and several species of deer (*Odocoileus* sp.). These artiodactyls have antlers they shed and replace annually (Hoffmeister 1986:534-548). Several antlers were also modified and moderate to highly weathered, which could hinder the ability to correctly identify the fragments to species.
**Odocoileus sp. (deer)**

Identified specimens: 3 skull fragments, 5 first phalanges, 2 second phalanges, 2 third phalanges, 2 calcanei, 1 femur, 2 humeri, 1 innominate, 2 metacarpals, 2 mandibles, 1 metapodial, 3 metatarsals, 1 maxilla, 1 patella, 5 radii, 2 other tarsals, 4 permanent teeth, 4 teeth, 2 permanent molar teeth

(total NISP: 46)

Remarks: Two species of deer, *Odocoileus hemionus* (mule deer) and *Odocoileus virginianus* (white-tailed deer) might be represented in the assemblage. Mule deer are prominent in the western United States while white-tailed deer are mostly found east of the Rocky Mountains (Mackie et al. 1982). Presently, mule deer are the only deer species in southwestern Colorado.

These two species of deer overlap in their range in the Great Basin; however, white-tailed deer have evolved to be more adapted to mesic, forested areas while mule deer have adapted to dry climates and rugged, rocky terrain (Mackie et al. 1982). Mule deer have evolved in the arid regions of the west and therefore, are well adapted to scarcity of water. Both species, however, are adapted to a broad range of elevations and are tolerant of human activity (Hesselton and Hesselton 1982; Mackie et al. 1982).

Although these two species inhabit different terrains, they are extremely difficult to distinguish skeletally (Lawrence 1951). Post-cranial specimens were distinguished with the aid of Lawrence’s (1951) criteria and other fragments with modern collections. These specimens did not have enough distinguishing characteristics to classify them to species. When particular identified specimens were found with distinguishing characteristics according to Jacobson (2003) they were further classified to species.
*Odocoileus hemionus* (mule deer)

Identified specimens: 1 astragalus, 1 calcaneus, 2 humeri, 3 metatarsals

(total NISP: 7)

Remarks: These identified specimens were distinguished as *Odocoileus hemionus* (mule deer) according to Jacobson’s (2003) criteria. Mule deer have evolved different morphology from their preferred habitat (Mackie et al. 1982). The astragalus does not have a ridge that runs at an angle medially to laterally, while white-tailed deer have a well-defined ridge at an angle medially to laterally (Jacobson 2003:294). The distal end of the humerus has a more confined medial caudal protuberance, while that of the white-tailed deer is blockier and larger (Jacobson 2003:292). The mule deer proximal end of the metatarsal exhibits a larger, more step-like angle at the proximal end while white-tailed deer is smooth and linear or slightly curved (Jacobson 2003:294). The whole calcaneus was present and compared favorably with modern mule deer collections, especially at the proximal articular surface.

Order Carnivora (carnivores)

Family Canidae

*Canis* sp. (dog/ wolf/ coyote)

Identified specimens: 1 first phalanx, 4 second phalanges, 2 third phalanges, 1 astragalus, 1 calcaneus, 5 metatarsals, 1 radius, 2 other tarsals, 6 tibiae, 1 ulna, 1 permanent molar tooth

(total NISP: 25)

Remarks: Two species, *Canis familiaris* (domesticated dog) and *Canis latrans* (coyote), currently occupy southwestern Colorado. In the past *Canis lupus* (gray wolf) was prevalent throughout the United States but was exterminated by the 1930’s by ranchers to protect domestic livestock. Currently, gray wolves live in isolated populations in the United States (Chapman and
Feldhamer 1982; Paradiso and Nowak 1982). These three species were present throughout the entire United States during the occupation of Goodman Point Pueblo and have been reported to successfully interbreed and produce fertile hybrids (Bekoff 1982). Therefore, postcranial remains are difficult to distinguish. The identified specimens assigned to this category are larger than *Urocyon/Vulpes* (fox).

*Urocyon/Vulpes* (gray, red or kit fox)

Identified specimens: 1 tibia

(total NISP: 1)

Remarks: Several species of fox are present in southwestern Colorado. Similar to *Canis* sp., postcranial skeletons of fox are similar with only slight differences in the cranium and overlap in body size (Hoffmeister 1986:469-479). This specimen is smaller than those of *Canis* sp. and culturally modified on the proximal end.

Family Felidae (cats and allies)

*Lynx* sp. (lynx and bobcat)

Identified specimens: 2 first phalanges, 1 third phalanx, 2 femora, 2 permanent canine teeth, 2 metacarpals, 1 mandible, 2 maxillae, 1 radius, 1 scapula, 1 tibia, 1 permanent premolar tooth, 1 permanent incisor tooth

(total NISP: 17)

Remarks: *Lynx canadensis* (Canadian lynx) and *Lynx rufus* (bobcat) can occur in southwestern Colorado (McCord and Cardoza 1982). These two species occupy slightly different habitats and overlap in size and weight; however, the lynx is slightly larger. While the bobcat is found in a variety of habitats, such as swamps, deserts, and mountain ranges, all throughout the United States and into Mexico, the Canadian lynx typically lives in the boreal forests, with rocky
outcrops, and bogs, throughout the northern half of the United States and into Canada (McCord and Cardoza 1982). By the mid-1970’s there were only a few remaining individuals of Canadian lynx; however, in 1999 Canadian lynx were reintroduced into southwestern Colorado (Colorado Division of Wildlife [CDOW] 2002). Their population cycles are dependent on their primary food *Lepus americanus* (snowshoe hare) which has also been found at other sites surrounding Goodman Point Pueblo (Lang et al. 2005; McCord and Cardoza 1982; Wilson and Ruff 1999:233-4). Bobcats are also well-adapted to human influences on the environment (McCord and Cardoza 1982).

The maxillae and teeth likely represent one side of a maxilla and closely resemble modern bobcats based on modern collections of bobcat skulls. However, the comparative collection used does not include *Lynx canadensis*, and both *Lynx rufus* (bobcat) and *Lynx canadensis* (Canadian lynx) have very similar skeletal morphology (McCord and Cardoza 1982).

**Family Mustelidae (mustelids)**

*Mephitis mephitis* (striped skunk)

Identified specimens: 2 mandibles

(totai NISP:2)

Remarks: Spotted (*Spilogale gracilis*) and striped skunk (*Mephitis mephitis*) currently inhabit southwestern Colorado and are found in a variety of habitats (Godin 1982; Howard and Marsh 1982). The mandibles were compared with modern comparative collections and with characteristics outlined by Elbroch (2006). The mandibles were identified as striped skunk because they possess a curved angular process and distinct notch on the ventral surface near the angular process (Elbrock 2006:450-451).
Mustela frenata (long-tailed weasel)

Identified specimens: 1 femur, 1 mandible

(total NISP: 2)

Remarks: Two species of weasels currently occupy southwestern Colorado and include ermine (Mustela ermine) and long-tailed weasel (Mustela frenata) (Svendsen 1982). Historically, the black-footed ferret (Mustela nigripes) was also in the region (Hall and Kelson 1959). The weasels’ favored habitats include grasslands around waterways, open timber and brushland (Svendsen 1982). The long-tailed weasel is the largest in body size of these three (Svendsen 1982). The femur and mandible were identified using modern collections (with the help of R. Lee Lyman) and mandible characteristics outlined by Elbrock (2006).

Taxidea taxus (badger)

Identified specimens: 1 third phalanx, 1 atlas vertebra, 2 innominates, 1 tibia

(total NISP: 5)

Remarks: Badgers are commonly found in the west and central United States on flats and alluvial fans around mountains (Hoffmeister 1986:498-505; Lindzey 1982). They have unique skeletal features, as they are adapted to pursuing fossorial rodents (Lindzey 1982). Specimens have distinctive, more robust morphology compared to other mustelids, and were identified using modern collections.

Order Lagomorpha (hares, rabbits, and pikas)

Identified specimens: 1 skull fragment, 2 mandibles, 4 metapodials

(total NISP: 7)

Remarks: These identified specimens are fragmented in such a way that it does not allow for further identification, but possess characteristics belonging to lagomorphs. Jackrabbits and
cottontails possess similar skeletal morphologically, and can typically only be distinguished based on size. Larger, more robust specimens are identified as *Lepus* sp., while smaller specimens are identified as *Sylvilagus* sp. (Lang et al. 2005; Olsen 1964). In addition, other characteristics distinguish the two genera. For example, the fibula is fused much higher up in the tibiofibula in *Lepus* sp. than in *Sylvilagus* sp. (Olsen 1964).

Family Leporidae (jackrabbits and cottontails)

*Lepus* sp. (jackrabbit or hare)

Identified specimens: 11 skull fragments, 5 first phalanges, 1 second phalanx, 1 astragalus, 7 calcanei, 4 femora, 7 humeri, 8 innominaates, 2 metacarpals, 10 mandibles, 13 metatarsals, 12 radii, 2 sacra, 8 scapulae, 1 other tarsal, 16 tibiofibulae, 5 ulnae

(total NISP: 113)

Remarks: Three species, *Lepus americanus* (snowshoe hare), *Lepus califonicus* (black-tailed jackrabbit), and *Lepus townsendii* (white-tailed jackrabbit), have been found in the region (Bittner and Rongstad 1982; Dunn et al. 1982; Lang et al. 2005). Jackrabbits, especially black-tailed jackrabbits (the most common species in the United States today), are able to survive on little water and are adapted in terms of thermoregulation to the desert (Best 1996). Where these species overlap in range they typically occupy different habitats (Lim 1987). Although jackrabbits thrive in prairie environments, each species has unique adaptations to their specific ranges. Snowshoe hare, with its exceptionally large hind feet, thrives in deep snow and dense forests, while white-tailed jackrabbits are better adapted to colder, grassier climates and higher elevations (Best 1996; Bittner and Rongstad 1982). Black-tailed jackrabbits prefer shrubbier environments in lower elevations, and are not adapted to colder climates (Dunn et al. 1982;
Grayson 1977; Lim 1987). Further distinguishing these species could allow for a more accurate climatic record for the site (Grayson 1977; 1983).

The specimens identified to *Lepus* sp. are larger and more robust than those identified to *Sylvilagus* sp. (Lang et al. 2005; Olsen 1964). Genera are not further distinguished to species because species are notoriously difficult to identify even if entire skulls are preserved. This is the case because there is major overlap in size between all species (Grayson 1977).

*Sylvilagus* sp. (cottontail rabbit)

Identified specimens: 376 skull fragments, 59 first phalanges, 32 second phalanges, 7 third phalanges, 16 astragali, 108 calcanei, 3 clavicles, 11 carpals, 235 femora, 1 fibula, 241 humeri, 304 innominales, 70 metacarpals, 395 mandibles, 2 metapodials, 212 metatarsals, 148 maxillae, 52 premaxillae, 147 radii, 29 sacra, 253 scapulae, 15 tarsals, 358 tibiofibuae, 131 permanent teeth, 158 ulnae, 20 permanent premolar teeth, 17 permanent incisor teeth

(total NISP: 3400)

Remarks: Two species of cottontails, *Sylvilagus audubonii* (desert cottontail) and *Sylvilagus nuttallii* (Nutall’s or mountain cottontail), occupy the region today and are r-selected mammals with extremely high reproduction rates (Chapman et al. 1982). *Sylvilagus* sp., similar to *Lepus* sp., thrives in desert environments because of thermoregulation and only exhibits slight physical differences between species. However, cottontails are more adapted to woodlands and rocky ravines than jackrabbits. Where these two species of *Sylvilagus* are sympatric today they occupy different habitats. While the mountain cottontail prefers rocky areas covered with sagebrush up through alpine and spruce-fir forests, the desert cottontail inhabits areas near desert valleys with shrubby vegetation for cover and grasslands (Chapman et al. 1982; Findley 1964; Orr 1940). These species can be distinguished based on cranial morphology which could be used for
reconstructions of past environments, but are not distinguished further because of a lack of comparative specimens and postcranial similarity (Findley 1964; Findley et al. 1975).

The separation of specimens assigned to *Sylvilagus* sp. from those assigned to *Lepus* sp. is by size, as cottontails are smaller than *Lepus* sp. (Olsen 1964). *Sylvilagus* sp. is the most abundant taxon found at the site. Some complete cottontail skeletons found at Goodman Point Pueblo are likely intrusive, or non-cultural, due to the fact that this species prefers to live in rock crevices, which are abundant across the site from the rubble of collapsed buildings (Chapman et al. 1982; Thomas 1971). However, ethnographic research based on modern Southwestern tribes indicates that whole skeletons could have been culturally deposited for storage and/or religious purposes (Parsons 1918; White 1932). At Goodman Point Pueblo several nearly complete skeletons were found within kivas.

For cottontails, the fourth premolar, and the first, second, and third molars all look similar, and therefore, are classified as isolated teeth when found not associated with maxillae and mandibles. I am unable to distinguish between the forth premolar and molars on the mandible, however, the third premolar can be distinguished on the mandible because of its three distinct ridges. Upper premolars and molars were also not distinguished, and were classified as permanent teeth (Chapman et al. 1982; Olsen 1964).

Order Rodentia (rodents)

Identified specimens: 25 skull fragments, 1 axis vertebra, 3 cervical vertebrae, 2 femora, 1 innominate, 8 lumbar vertebrae, 1 premaxilla, 4 ribs, 2 sacra, 1 scapula, 4 thoracic vertebrae, 10 permanent teeth, 9 vertebrae, 13 permanent incisor teeth

(total NISP: 91)
Small rodent (wood rat or smaller rodent)
Identified specimens: 17 skull fragments, 2 atlas vertebrae, 2 axis vertebrae, 2 cervical vertebrae, 10 femora, 6 humeri, 9 innominates, 34 lumbar vertebrae, 7 mandibles, 1 radius, 1 rib, 2 sacra, 9 scapulae, 3 teeth, 4 thoracic vertebrae, 12 tibiofibulae, 5 permanent teeth, 1 ulna, 2 caudal vertebrae, 4 vertebrae, 5 permanent incisor teeth
(total NISP: 138)

Large rodent (rodent larger than wood rat)
Identified specimens: 7 skull fragments, 1 atlas vertebra, 1 axis vertebra, 4 cervical vertebrae, 2 clavicles, 3 femora, 1 fibula, 3 humeri, 2 innominates, 27 lumbar vertebrae, 3 metacarpals, 2 metatarsals, 1 radii, 50 ribs, 1 sacrum, 1 scapula, 3 sternabrae, 12 thoracic vertebrae, 4 tibiae, 1 permanent tooth, 1 ulna, 3 permanent incisor teeth
(total NISP: 134)

Remarks: Many species of rodents can only be distinguished based on their crania and cannot be distinguished based on postcranial morphology, especially smaller species (Gilbert 1990; Olsen 1964). Therefore, rodents were rarely classified to species level at Goodman Point.

Specimens categorized as rodent are highly fragmented such that it is difficult to estimate size. Small or large rodent specimens are less fragmented, but lack distinguishing characteristics that allow identifications below order. Large rodents include, but are not limited to, Cynomys sp. (prairie dog) and other Sciuridae (squirrels), while small rodents include Eutamias sp. (chipmunk), Microtus sp. (vole), Neotoma sp. (wood rat), Peromyscus sp. (mice), and Thomomys sp. (pocket gopher). All vertebrae and ribs for rodents are included in the large or small rodent category, because of post-cranial similarity among species. Some isolated teeth not associated with maxillae or mandibles were identified to small or large rodent.
Family Heteromyidae (pocket mice, kangaroo rats, kangaroo mice)

*Dipodomys ordii* (Ord’s kangaroo rat)

Identified specimens: 6 skull fragments, 3 femora, 2 humeri, 2 innominates, 5 mandibles, 1 premaxilla, 1 radius, 1 sacrum, 2 scapulae, 2 tibiofibuae, 1 ulna

(total NISP: 26)

Remarks: The Ord’s kangaroo rat (*Dipodomys ordii*) is currently the only kangaroo rat to occur in southwestern Colorado, and is one of the most widely distributed species of kangaroo rats (Hoffmeister 1986:246-318). Kangaroo rats differ from *Perognathus* sp. (pocket mouse) with its larger size, big hind feet, relatively short front feet, and triangle shaped skull (Hoffmeister 1986:298-303). Unlike some kangaroo rats, Ord’s kangaroo rats enjoy a variety of habitats such as semi-arid grasslands, alluvial fans, and sagebrush (Hoffmeister 1986:298-303). The specimens were almost all found in one section of the site, are nearly all complete, represent a wide variety of skeletal elements, and lack cultural modifications. These lines of evidence suggest a natural death assemblage (Thomas 1971; Shotwell 1955; Szuter 1984; 1991b); however, several bones from a kangaroo rat were found in a kiva associated with a large assortment of other faunal remains.

Family Muridae (rats, mice, voles and lemmings)

*Micromus* sp. (vole)

Identified specimens: 15 skull fragments, 18 mandibles, 7 maxillae, 3 premaxillae

(total NISP: 43)

Remarks: These cranial specimens were classified as voles based on teeth and cranial morphology (Gilbert 1990; Johnson and Johnson 1982). Today, four species of voles, *Micromus montanus* (montane vole), *Micromus longicaudus* (long-tailed vole), *Micromus mexicanus*
(Mexican vole), and *Microtus pennsylvanicus* (meadow vole), occupy southwestern Colorado. These species thrive in arid high elevations, in pinyon-juniper woodlands, shrubs, and mesic grasslands. Voles are adapted to a subterranean lifestyle, with nests constructed with dried grasses and placed underneath rocks, logs, or brush piles (Johnson and Johnson 1982).

Remains of these animals are most likely intrusive to the site, as no cultural modifications were found on these bones. However, there have been no whole skeletons located, possibly due to the quarter-inch screen size used during excavation (Shaffer 1992a).

*Neotoma* sp. (wood rat)

Identified specimens: 35 skull fragments, 50 femora, 19 humeri, 37 innominates, 95 mandibles, 31 maxillae, 9 premaxillae, 6 radii, 3 sacra, 18 scapulae, 35 tibiae, 3 permanent teeth, 9 ulnae (total NISP: 350)

Remarks: Three species of wood rats, *Neotoma albigula* (white-throated wood rat), *Neotoma mexicana* (Mexican wood rat), and *Neotoma cinerea* (bushy-tailed wood rat), occupy the region around Goodman Point. White-throated wood rat inhabits areas below the conifer belt, frequently in pinyon-juniper areas and areas with cholla or prickly pear cactus. They collect material, such as bones, discarded cans, and sticks to help build their nests, and can make several underground tunnels. The Mexican wood rat is a high-mountain species, from 1,500 m to 1,900 m (5,000 ft to 6,500 ft), usually living in isolated populations in montane coniferous forests. They often nest in rock crevices, which is common in the region. The bushy-tailed wood rat inhabits juniper-pinyon areas, around pine, spruce, and fur trees, and rocky crevices. They are excellent climbers, and commonly live in man-made structures, such as barns (Hoffmeister 1986:402-431). The wood rats overlap in size, and therefore, are not distinguished further (Hoffmeister 1986:402-431). Although these species occupy rocky crevices (Hoffmeister 1986:402-431) there was only one
complete, nearly articulated skeleton. This skeleton was found within rubble in a masonry surface structure with no cultural modifications, and thus, its presence is assumed to be from a natural death.

Based on ethnographic research, modern Southwestern tribes consume wood rats (White 1962). Other evidence, including burned bones and presence in middens, suggests their use as a food resource at Goodman Point.

*Peromyscus* sp. (mice)

Identified specimens: 22 skull fragments, 23 mandibles, 9 maxillae

(total NISP: 54)

Remarks: Five species of mice, *Peromyscus crinitus* (canyon mouse), *Peromyscus maniculatus* (deer mouse), *Peromyscus boylii* (brush mouse), *Peromyscus trueii* (pinyon mouse), and *Peromyscus difficilis* (rock mouse), occupy the region today. Post-cranially there is little difference between these species; however, they can be distinguished based on tooth morphology (Gilbert 1990; Hoffmeister 1986:325-375). All these species enjoy rocky slopes and cliffs in coniferous forests, and/or juniper-pinyon woodlands. For all species rocks, debris, and buildings provide nesting sites and protection (Hoffmeister 1986:325-375). With the abundance of sandstone rubble and abandoned buildings at the site they are most likely utilizing those areas during and after occupation. Likely, mice were not a major food source for past ancestral Puebloans (Gnabasik 1981). No evidence of cultural modification of their remains was found. There have also been no complete skeletons found, but this could be due to the quarter-inch screen size used for excavation (Shaffer 1992a).
Family Geomyidae

*Thomomys* sp. (pocket gopher)

Identified specimens: 15 skull fragments, 7 femora, 2 humeri, 3 innominates, 70 mandibles, 8 maxillae, 13 premaxillae, 1 radii, 1 sacrum, 1 scapula, 5 tibiofibulae, 1 permanent tooth, 3 ulnae, 2 permanent premolar teeth, 2 permanent molar teeth

(total NISP: 134)

Remarks: Two species of pocket gopher are common in the region today, *Thomomys bottae* (Botta’s pocket gopher) and *Thomomys talpoides* (northern pocket gopher) (Jones and Baxter 2004; Verts and Carraway 1999). These species live in valleys, deserts, agricultural areas, and above the timberline up to 4,200 m (14,000 ft) in elevation (Jones and Baxter 2004). These pocket gophers are fossorial and excellent excavators, as each individual usually maintains around 45 to 60 m of tunnels about 30 to 40 cm below the surface (Tryon 1947). All species are common in the region and are similar in size (Jones and Baxter 2004). Although some specimens may not be related to the occupation of the village, some small rodents, such as pocket gophers, could have been important in prehistoric diet (Du Bois 1940: 14; Shaffer 1992b; Stahl 1982; Yohe et al. 1991). There are few burnt pocket gopher remains and no isolated whole skeletons at Goodman Point. Quarter-inch screen size also could have altered the abundance of elements of this species, similar to other small rodents (Shaffer 1992a). However, complete elements from pocket gophers should have been recovered because of their larger, robust elements (Shaffer 1992a, 1992b).
Family Sciuridae (squirrels)

Identified specimens: 6 skull fragments, 1 third phalanx, 4 femora, 1 fibula, 6 humeri, 3 innominates, 4 mandibles, 1 metapodial, 3 maxillae, 1 premaxilla, 1 radius, 3 scapulae, 1 tarsal, 2 tibiae, 1 ulna, 1 permanent molar tooth

(total NISP: 39)

Remarks: Currently, there are several genera of squirrels in the region, including Spermophilus sp. (ground squirrels), Cynomys sp. (prairie dogs), Sciurus sp. (tree squirrels), and Eutamias sp. (chipmunks), and several of these species overlap in size (Chapman and Feldhamer 1982). The specimens identified to Sciuridae are too fragmented to further classify.

*Eutamias* sp. (chipmunk)

Identified specimens: 2 mandibles

(total NISP: 2)

Remarks: There are three species of chipmunks currently found in and around southwestern Colorado, the least chipmunk (*Tamias minimus*), Colorado chipmunk (*Tamias quadrivittatus*), and possibly Cliff chipmunk (*Tamias dorsalis*) (Hoffmeister 1986:150-164). These species are commonly found among rock outcrops and crevices (Hoffmeister 1986:150-164). No further species identification was made because not all species were present in the comparative collection. These species are most likely not related to human occupation at Goodman Point, and quarter inch screen size could have altered their abundance (Shaffer 1992a). Also, several small rodent species share similar postcranial morphology and were, therefore, classified as small rodent.
*Cynomys gunnisoni* (Gunnison’s prairie dog)

Identified specimens: 5 skull fragments, 6 femora, 2 fibulae, 8 humeri, 9 innominates, 11 mandibles, 4 maxillae, 2 premaxillae, 2 radii, 1 sacrum, 2 scapulae, 2 tibiae, 3 ulnae, 1 permanent molar tooth

(total NISP: 58)

Remarks: *Cynomys gunnisoni* (Gunnison’s Prairie Dog) is the only species of prairie dog currently found in southwestern Colorado (Hoffmeister 1986:193-198). Their behavioral traits are similar to that of the ground squirrels. Plains and desert grasslands are prime habitats for prairie dogs. The distribution of this species centers in the Four Corners region between 1,830 m-3,660 m (6,000 ft - 12,000 ft) in elevation (Pizzimenti and Hoffmann 1973). They build an extensive network of tunnels, similar to other fossorial species. Because of similarities between other Sciuridae, specimens identified to prairie dog are whole or nearly complete elements and identified using modern comparative collections.

*Spermophilus* sp. (ground squirrel)

Identified specimens: 4 mandibles

(total NISP: 4)

Remarks: Several species of *Spermophilus* sp. (ground squirrels) occur in southwestern Colorado and are very similar in size and bone morphology (Tomich 1982). These specimens had characteristics of ground squirrels. Although two specimens were whole mandibles and two were fragmented, only incisors were present. Also, not all squirrels present in southwestern Colorado were in the comparative collection, so species identification was not made.
Spermophilus variegates (rock squirrel)

Identified specimens: 37 skull fragments, 1 astragalus, 2 calcanei, 9 femora, 4 fibulae, 10 humeri, 15 innominates, 27 mandibles, 10 maxillae, 7 premaxillae, 11 radii, 1 sacrum, 10 scapulae, 18 tibiae, 13 ulnae

(total NISP: 175)

Remarks: Rock squirrels are common in the region and inhabit rocky areas at elevations between 500 m and 3,350 m (1,600 ft and 11,000 ft). They are ground dwellers and fossorial creatures who dig short burrows and nests among rocks (Hoffmeister 1986:175-178). Their distribution is controlled by the abundance of rocks, and they are absent from open plains, valleys, deserts and montane forests (Findley et al. 1975; Oaks et al. 1987). The abundance of stone rubble at Goodman Point Pueblo most likely attracts these species, as they often exploit rubble from man-made structures (Bailey 1932). These species, similar to other Sciuridae were likely eaten (Gnabasik 1981; Henderson and Harrington 1914), and although these species prefer to live within rock crevices and around collapsed structures only one whole articulated skeleton was found within the rubble from an aboveground kiva at Goodman Point.

Rock squirrels closely resemble tree squirrels (Sciurus), but are modified for a fossorial life like other ground squirrels and prairie dogs (Oaks et al. 1987). Rock squirrels are the largest ground squirrels, similar in size to prairie dogs (Hoffmeister 1986). Because of similarities between other Sciuridae, specimens identified to rock squirrel are whole or nearly complete, and identified using modern comparative collections.

Small mammal (jackrabbit size or smaller)

Identified specimens: 23 skull fragments, 19 atlas vertebrae, 24 axis vertebrae, 101 cervical vertebrae, 3 femora, 1 humerus, 1 innominate, 305 lumbar vertebrae, 1 metapodial, 1 metatarsal,
1 radius, 169 ribs, 5 scapulae, 5 sternabrae, 138 thoracic vertebrae, 1 tibia, 3 caudal vertebrae, 44 vertebrae

(total NISP:845)

Remarks: The specimens could represent jackrabbits, cottontails, and/or other small mammals. Several identified specimens are too fragmented to further distinguish to family level, while others, such as vertebrae, ribs, and sternabrae are classified as small mammal because they are extremely similar between species. The small mammal specimens are most likely from cottontail, as they are the most abundant small mammal found at the site.

Medium mammal (deer size or smaller)

Identified specimens: 14 skull fragments, 1 axis vertebra, 1 cervical vertebra, 3 carpals, 1 femur, 1 fibula, 2 humeri, 1 innominate, 1 permanent canine tooth, 9 lumbar vertebrae, 1 mandible, 1 metatarsal, 1 radii, 21 ribs, 3 sternabrae, 2 thoracic vertebrae, 5 tibiae, 1 permanent tooth, 1 ulna, 3 caudal vertebrae, 6 vertebrae

(total NISP:79)

Remarks: These identified specimens are too highly fragmented to further determine with great confidence what species they represent. Several medium mammals are present in the region, such as deer, bears, mountain lions, ungulates, foxes, bobcats, and dogs.

Class Aves (birds)

Order Anseriformes (swans, geese, ducks, and allies)

Family Anatidae (swans, geese, and ducks)

Identified specimens: 1 maxilla

(total NISP:1)
Remarks: A fragmented flat, broad bill, similar in size and shape of a duck, was found at Goodman Point. There are several known species of Anatidae found in the region today that overlap in size (Barry et al. 2005; Sibley 2000:70-103). Not only is this specimen fragmented, but the comparative collection does not include all Anatidae currently present in southwestern Colorado.

Order Columbiformes (doves and pigeons)

Family Columbidae (doves and pigeons)

Identified specimens: 3 coracoids, 2 humeri, 1 carpometacarpi, 1 tarsometatarsus, 4 sterna, 1 ulna (total NISP: 12)

Remarks: There are several species of pigeons and doves found in Colorado today that occupy the region during the summer. Some pigeons and doves are wary of people and live in mountainous areas with coniferous trees, while others, such as the Rock Dove (*Columba livia*), are considered city pigeons (Sibley 2000:254-261). Doves often live in small groups and pigeons congregate in larger flocks (Sibley 2000:254-261). Doves are smaller than pigeons but both have very similar skeletal morphology and overlap in size (McCaskie 2005). Although the identified specimens found are complete or nearly complete, the comparative collection used does not include all species currently present in the region.

Order Falconiformes (vultures, hawks, eagles)

Identified specimens: 4 furcula (total NISP: 4)

Remarks: Several species of vultures, hawks, eagles, and falcons are present either year round or during the winter in southwestern Colorado (Sibley 2000:104-133). The furculum within
Falconiformes have a distinct “U” shape and muscle markings; however, not all species present in that region are in the comparative collection.

*Buteo* sp. (hawks)

Identified specimens: 1 tarsometatarsus, 1 scapula

(total NISP: 2)

Remarks: There are at least four species of hawks that overlap in size that currently occupy a variety of habitats in southwestern Colorado (Sibley 2000:114-125). The scapula is whole and the tarsometatarsus is nearly complete. These bones are very similar between different hawk species. Specimens were identified based on criteria from Olsen (1979) and comparative collections that were not extensive enough to accurately identify the specimens to species.

*Falco* sp. (falcons)

Identified specimens: 1 humerus

(total NISP: 1)

Remarks: Almost all *Falco* sp. occupy the western United States, and many overlap in both size and weight (Sibley 2000:129-133). This humerus was nearly complete and matched the size and shape of *Falco* sp. according to criteria from Olsen (1979) and comparative collections. However, comparative collections were not extensive enough to categorize it to species.

Order Galliformes (grouse, quails, and allies)

Family Phasianidae (grouse, ptarmigan, turkey, and quails)

Identified specimens: 1 furculum, 1 humerus, 1 innominate, 1 scapula, 2 sterna, 4 tibiotarsi, 3 ulnae

(total NISP: 13)
Remarks: *Dendragapus obscurus* (blue grouse), *Lagopus leucurus* (white-tailed ptarmigan), *Meleagris gallopavo* (wild turkey), *Callipepla* sp. (quails), *Phasianus colchicus* (ring-necked pheasant), and *Alectoris chukar* (chukar) all currently inhabit southwestern Colorado (Sibley 2000:134-149). Several of these species overlap in size (Sibley 2000:34-149). These specimens were too fragmented to further classify.

*Meleagris gallopavo* (turkey)

Identified specimens: 77 skull fragments, 86 coracoids, 47 carpals, 75 femora, 32 fibulae, 43 furcula, 134 humeri, 75 innominates, 104 carpometacarpi, 68 mandibles, 176 tarsometatarsi, 36 maxillae, 21 ossified cartilage, 184 first phalanges, 132 second phalanges, 54 third phalanges, 55 terminal (fourth) phalanges, 10 phalanges, 6 pygostyles, 30 quadrates, 78 radii, 98 scapulae, 93 sterna, 2 tarsals, 233 tibiotarsi, 138 ulnae, 66 wing phalanges

(total NISP: 2153)

Remarks: *Meleagris gallopavo* (turkey) is the largest game bird in North America (Wood 2005) and the most abundant bird found at Goodman Point Pueblo. Wild turkeys are often smaller than modern domesticated turkeys and several introductions of subspecies over time along with interbreeding makes it difficult to distinguish their phylogeny in the region (Wood 2005). Turkeys inhabit intermountain regions between 1,800 m to 3,050 m (6,000 ft to 10,000 ft) and enjoy forested environments with pinyon, pine and oak trees. Water limits their ability to survive, as they need 500 ml to 1 litre (1/2 to 1 qt) of water a day making a dependable water source needed year round (Schorger 1966).

Evidence for domestication of turkey by the Anasazi includes population age structures, presence of butcher marks, eggshell, turkey enclosures with manure, and healed breaks (Munro 1994, 2006). Turkeys were not only used for their meat, but their bones were used to make
jewelry and whistles, and feathers were used for robes and religious activities (Munro 1994, 2006).

Turkey is the largest Phasianidae found in the region, and therefore, their bones are quite distinctive. The only bird with similar skeletal morphology, size and weight is *Grus canadensis* (sandhill crane) (Hargrave and Emslie 1979). Thus, specimens classified as turkey were compared to modern collections.

Sub-family Tetraonidae (grouse)

Identified specimens: 1 coracoid, 2 femora, 1 humerus, 1 innominate, 1 mandible, 7 tarsometatarsi, 1 phalanx, 3 scapulae, 3 sterna, 5 tibiotarsi, 1 ulna

(total NISP: 26)

Remarks: Several species of grouse and similar sized Phasianidae are present in southwestern Colorado in a variety of habitats (Sibley 2000:141-148). Since all species are not present in the comparative collection these specimens were only classified to grouse.

*Callipepla* sp. (quail)

Identified specimens: 1 coracoid, 1 femur, 1 mandible, 1 tarsometatarsus, 1 sternum, 3 tibiotarsi

(total NISP: 8)

Remarks: Gambel’s quail (*Callipepla gambelii*) and scaled quail (*Callipepla squamata*) are currently found around southwestern Colorado in brush and open areas (Sibley 2000:136-140). Although they have different plumage they overlap in size and weight (Sibley 2000:136-140). Because of similar skeletal morphology and limited species in the comparative collection these specimens were only identified to quail.
Order Gaviiformes

*Gavia* sp. (loon)

Identified specimens: 1 tibiotarsus

(total NISP: 1)

Remarks: There are several species of loons who overlap in body size and are present with spotted distributions throughout the western United States during migration (Sibley 2000:23-25). Similar to ducks, they are attracted to water sources (Sibley 2000:23-25). Loons have a unique skeletal structure. For instance, their tibiotarsus has a distinct extended cnemial process with deep groves and crests on the proximal end (Olsen 1979:129). This specimen was identified based on the previous criteria and with modern comparative collections.

Order Gruiformes (cranes, etc.)

Identified specimens: 2 tibiotarsi

(total NISP: 2)

Remarks: Several species of Gruiformes, including the large sandhill crane (*Grus canadensis*), occupy marshy wetland habitats in southwestern Colorado at some point during the year (Sibley 2000:150-157). These specimens are fragmented; however, their size and shape are similar to modern sandhill crane. Because of fragmentation the specimens were not classified further.

*Fulica americana* (American coot)

Identified specimens: 1 tibiotarsus

(total NISP: 1)

Remarks: The American coot is a duck-like bird occupying wetland habitats year round in southwestern Colorado (Sibley 2000:151). The tibiotarsus possesses a distinctive curve and well
formed bridge on the distal end (Olsen 1979:133) and was also compared with modern comparative collections.

*Grus canadensis* (sandhill crane)

Identified specimens: 1 humerus

(total NISP: 1)

Remarks: Sandhill cranes occupy southwestern Colorado during their migration and are commonly found in open fields and meadows (Sibley 2000:157). Although sandhill crane and turkey have similar skeletal morphology and overlap in size (Hargrave and Emslie 1979) the proximal end of the humerus is fairly distinctive. This specimen was identified using criteria outlined by Olsen (1979) and Gilbert et al. (1996) and against modern comparative collections.

Order Passeriformes (perching birds)

Identified specimens: 2 sterna

(total NISP: 2)

Remarks: Passeriformes include the largest order of birds present in southwestern Colorado (Sibley 2000). These specimens have common characteristics of some Passeriformes, however, the specimens are too fragmented to further classify. Also, not all species of Passeriformes present in the region are in the comparative collection.

*Corvus corax* (raven)

Identified specimens: 1 femur

(total NISP: 1)

Remarks: Ravens are commonly found year round in the western United States (Sibley 2000:359). Raven femurs have a unique shape on their distal end (Olsen 1979: 128) and are larger than the American crow (*Corvus brachyrhynchos*) which is a close relative also present in
the region (Sibley 2000:359-360). The specimen was identified using the previous criteria and with comparative collections.

Family Hirundinidae (swallows)

Identified specimens: 1 coracoid, 1 ulna

(total NISP: 2)

Remarks: Several species of swallows inhabit southwestern Colorado in a variety of habitats during the summer (Sibley 2000:364-370). Both specimens were compared using criteria from Olsen (1979) and using modern comparative collections. Not all swallow species were in the comparative collection; therefore, no further species identifications were made.

Family Mimidae (mockingbirds and thrashers)

Identified specimens: 1 humerus, 1 tarsometatarsus

(total NISP: 2)

Remarks: A few species of mockingbirds and thrashers are currently present year round or during the summer in southwestern Colorado (Sibley 2000:411-415). These species overlap in size and inhabit dense bushes and a variety of desert habitats with scattered vegetation (Sibley 2000:411-415). These specimens were identified using criteria outlined in Olsen (1979) and modern comparative collections, of which not all species were present.

Order Piciformes (woodpeckers)

Identified specimens: 1 mandible, 1 ulna

(total NISP: 2)

Remarks: Several species of woodpeckers occupy the Four Corners region either year round or seasonally, and are found individually in wooded areas (Sibley 2000:306-319). Their bill, made for penetrating wood, is distinctive with a long, flattened, triangle shape (Elbrock 2006:664;
Olsen 1979: 83). Specimens were also compared with other criteria in Olsen (1979) and comparative collections. Not all woodpeckers present in southwestern Colorado were present in the comparative collections.

Order Strigiformes (owls)
Identified specimens: 2 skull fragments, 2 innominates, 1 carpometacarpus, 1 radius, 1 sternum, 2 tibiotarsi, 1 ulna
(total NISP: 10)
Remarks: One species from the Family Tytonidae, Tyto alba (barn owl), and nine species from the Family Strigidae (typical owls) currently live in southwestern Colorado (Sibley 2000:271-283). Owls are nocturnal animals. They inhabit grasslands and forests from sea level to 4,300 m (14,000 ft) in elevation, and nest in natural or human made structures (Quady 2005).

Specimens identified were complete to nearly complete elements; however, not all species are present in the comparative collection. Some owls also overlap in size (Sibley 2000:271-283). Therefore, the specimens are only classified to order.

Large birds (birds larger than mallard)
Identified specimens: 2 skull fragments, 1 atlas vertebra, 7 axis vertebrae, 16 cervical vertebrae, 2 coracoids, 1 furculum, 6 humeri, 3 innominates, 43 lumbar vertebrae, 2 tarsometatarsi, 6 ossified cartilage, 5 first phalanges, 5 second phalanges, 1 third phalanx, 1 terminal (fourth) phalanx, 7 phalanges, 2 radii, 203 ribs, 3 scapulae, 91 sternal ribs, 37 synsacra, 7 sterna, 89 thoracic vertebrae, 3 tibiotarsi, 3 ulnae, 25 caudal vertebrae
(total NISP: 571)
Remarks: Several of these specimens are too fragmented to further distinguish. The specimens could represent a number of large birds, such as Gaviiformes (loons), Ciconiiformes (herons),
Falconiformes (vultures, hawks, and eagles), Gruiformes (cranes), and *Meleagris gallopavo* (turkey) (Sibley 2000). Because of the similar morphology between species ribs and vertebrae from large birds are included in this count. Many of the ribs and other identified specimens are most likely turkey as they are the most abundant large bird at Goodman Point Pueblo.

Medium birds (mallard size and smaller)

Identified specimens: 1 femur, 2 humeri, 1 innominate, 1 lumbar vertebra, 2 second phalanges, 3 radii, 7 ribs, 3 sternal ribs, 7 synsacra, 4 sterna, 12 thoracic vertebrae, 1 tibiotarsus, 1 ulna

(total NISP: 45)

Remarks: These specimens could represent a large number of medium sized birds that are present in the region (Sibley 2000). Several identified specimens are too fragmented to further distinguish. All ribs and vertebrae from medium sized birds are included into this category because these elements are extremely similar between species.

Small bird (robin size and smaller)

Identified specimens: 1 synsacrum

(total NISP: 1)

Remarks: Synsacra are very similar between smaller bird species and this specimen was too fragmented to be further distinguished.

Class Reptilia (reptiles)

Order Squamata (lizards and snakes)

Suborder Iguanidae (Iguanids)

Identified specimens: 1 skull fragment

(total NISP: 1)
Remarks: Currently, numerous species of lizards inhabit southwestern Colorado including Crotaphytidae (collared and leopard lizards), Phrynosomatidae (Phrynosomatids), Teiidae (whiptails), and Scincidae (skinks) (Hammerson 1999). Several species present in southwestern Colorado live in a wide variety of habitats including canyon bottoms, mesa tops, juniper woodlands, and conifer forests. To thermoregulate lizards often bask in the sun during the day; however, during hibernation, at night, and/or during extreme hot or cold temperatures they hide under rocks, crevices, and in small mammal burrows (Hammerson 1999). Their behavior to hide underground could explain the presence of the specimen; however, this specimen was found in a midden. Quarter-inch screen size could have also influenced collection of other elements (Shaffer 1992a).

Only one cranial specimen was found from a lizard at Goodman Point Pueblo. It compared favorably to the collared lizard (*Crotaphytus collaris*); however, not all species present in southwestern Colorado were represented in the comparative collection.

**Suborder Serpentes (snakes)**

Identified specimens: 10 vertebrae

(total NISP: 10)

Remarks: Species in two families, Viperidae (vipers and rattlesnakes) and Colubridae (typical snakes), are present in the region today (Hammerson 1999; Stebbins 1966). Typical snakes and rattlesnakes usually exploit a wide variety of landscapes including woodlands, forests, grasslands, and rocky terrain. When inactive snakes burrow underground occupying rodent burrows, hide under rocks, and/or less commonly dig their own burrows (such as *Pituophis catenifer* -Bullsnake/ Gopher Snake). Some snakes even hibernate underground with other species (Hammerson 1999).
Ten whole vertebrae were found but were not further distinguished for this study. These specimens were found in masonry structures at Goodman Point and are not commonly eaten by modern Southwestern tribes (Gnabasik 1981).

Class Amphibia (amphibians)

Order Anura (frogs and toads)

Identified specimens: 4 skull fragments, 1 coracoid, 3 femora, 2 humeri, 7 innominates, 2 radioulnae, 5 tibiofibulae, 1 urostyle, 1 vertebra

(total NISP: 26)

Remarks: There are a number of species of frogs and toads present today in the region including Pelobatidae (spadefoot toads), Hylidae (tree frogs), Ranidae (true frogs), and Bufonidae (toads) (Hammerson 1999; Stebbins 1966). All species are attracted to places near permanent water sources, such as floodplains or intermittent streams. During the winter and/or in the hot midday sun frogs and toads will hide and hibernate in crevices, rodent burrows, under rocks, or at the bottom of a body of water (Hammerson 1999).

Hibernating behavior could explain the presence of several frog or toad skull fragments and long bones; however many were found in midden and kiva contexts. These bones are difficult to further distinguish to family level. For example, distinctive ends are absent from the specimens and many species share similar skeletal morphology. Also, the comparative collection does not include all species found in southwestern Colorado.

Summary

As in other scientific disciplines it is important to explicitly state the methodology. The above explicit criteria allows for control in variations between different analysts by assessing
such issues as the quality of comparative collections and degree of personal experience. Now, specimens from Goodman Point Pueblo can be more accurately compared with other datasets.

Overall, I identified specimens at Goodman Point Pueblo using a conservative approach. Some specimens were not identified to species based on lack of experience, fragmentation issues, lack of modern comparative collections, and/or similarities in skeletal morphology between species. Due to the extensive bird collection at the University of North Texas several bird remains could be identified accurately to families and below.

Species presented in the systematic paleontology are commonly found in southwestern Colorado. Several water birds are present at the site. Approximately twenty springs surrounded Goodman Point Pueblo within a five kilometer radius at the time of village occupation (WPI 2011). Evidence of more rare species, such as bighorn sheep (Ovis canadensis) and long-tailed weasel (Mustela frenata) suggests long distance travel to more montane environments (Lawson and Johnson 1982; Svendsen 1982). The large amount of turkey, likely domesticated, and cottontail also shows reliance on local food resources. Several of these dietary trends are further investigated in later chapters.
CHAPTER 4

DESCRIPTION AND SPATIAL ANALYSIS OF THE GOODMAN POINT PUEBLO
(5MT604) FAUNAL ASSEMBLAGE

This chapter presents a basic summary of taxonomic abundance and taphonomic analysis at the site level then focuses on intra-site spatial analysis across different contexts at Goodman Point Pueblo. First, a description of site level faunal summaries shows the diversity and abundances of fauna utilized as well as which environments were exploited by the ancestral Puebloans. The presence and absence of particular species allows investigation into what was available on the landscape as food resources before the central Mesa Verde region was abandoned. Species found within Goodman Point could represent different uses. For example, animal remains and feathers could be used for religious reasons, food resources, clothing, tools, or any combination of these as they are in current Southwestern tribal communities (e.g., Gnasaskik 1981; White 1932, 1962). The way animals were used within an archaeological site alters how they might have survived within the archaeological record; therefore, taphonomic analysis follows to explore how various cultural and natural factors affected the preservation of bones. Finally, intra-site spatial analysis allows for insight on specific taphonomic and resource use throughout different areas of the village.

Basic Summary of Taxonomic Abundance

I expect to see certain trends in taxonomic abundances within the Goodman Point Pueblo fauna because faunal analysis has been done around other terminal Pueblo III villages in the nearby vicinity (e.g., Driver 2000, 2002b; Muir 1999, 2007; Muir and Driver 2003). For example, several villages during the terminal Pueblo III period in the Central Mesa Verde Region show limited use of artiodactyls and jackrabbits and higher abundances of resources
produced and obtained around villages, such as turkey and cottontail (e.g., Badenhorst and Driver 2009; Driver 2002b; Driver and Woiderski 2008; Muir 2007; Muir and Driver 2002).

Methods

In order to address overall site taxonomic abundances I use NISP (the Number of Identified Specimens). As introduced in Chapter 3, NISP is at best an ordinal scale measurement calculated by tallying identified specimens represented at the site. Its relative abundance typically mirrors other taxonomic measurements (Grayson 1984; Lyman 2008); therefore, NISP is used again in this chapter. Percentages of each taxon both within class level and overall site percentage is also presented. Criteria for identifications to taxon level are made explicit in Chapter 3.

Results

The Goodman Point Pueblo faunal assemblage is large. At Goodman Point Pueblo there are 38 taxa across 14,414 specimens and of these 8,817 (61 percent) specimens were identified as mammals, birds, reptiles, or amphibians. Relative abundance of the Goodman Point Pueblo fauna by class is reported in Table 4.1.

Mammals. Mammal remains dominate the Goodman Point fauna comprising 67 percent of the total assemblage and representing 20 taxonomic groups, mainly from four orders—artiodactyls, lagomorphs, rodents, and carnivores (Table 4.2).

Artiodactyls represent around three percent of mammals and two percent of the total Goodman Point faunal assemblage. Species found include pronghorn (Antilocapra americana), deer (Odocoileus sp.), and bighorn sheep (Ovis canadensis). Deer represents the most prevalent artiodactyl taxon. Most of the artiodactyl specimens were only identifiable to medium artiodactyl rather than to family, genus or species because of minimal diagnostic characteristics. Generally,
low numbers of artiodactyls are common during the decline in population of the ancestral Puebloans in the San Juan region, and part of a long term regional decrease (e.g., Badenhorst and Driver 2009; Driver 2002b; Muir and Driver 2002).

Carnivores are represented by less than one percent of identified mammalian remains. Both dog/wolf/coyote (*Canis* sp.) and bobcat/lynx (*Lynx* sp.) represent 81 percent of the carnivores. Several of the Canids could be from domesticated dogs; evidence from dog burials and other images at several ancestral Puebloan sites in the Southwest shows their cultural importance (Emslie 1978; Savolainen 2007). Other carnivores are represented in small numbers including striped skunk (*Mephitis mephitis*), long-tailed weasel (*Mustela frenata*), badger (*Taxidea taxus*), and fox (*Urocyon* or *Vulpes*).

Lagomorphs (jackrabbits and cottontails) were the most commonly found taxon at Goodman Point Pueblo. The specimens were identified to two genera: cottontails (*Sylvilagus* spp.) and jackrabbits (*Lepus* spp.) and represent approximately 60 percent of mammals and around 40 percent of all taxa identified. However, jackrabbits only constitute two percent of mammals and one percent of the total identified taxa. The dominance of cottontails relative to jackrabbits during Pueblo III is commonly found at other ancestral Puebloan villages in the northern San Juan region (e.g., Badenhorst and Driver 2009; Driver 2002b; Muir and Driver 2002). As larger game in the region decreased there was and increasing reliance on smaller game to make up for loss in protein (Szuter 1991a).

Rodents comprise approximately 21 percent of all mammal remains and were identified to eight genera: prairie dog (*Cynomys* sp.), Ord’s kangaroo rat (*Dipodomys ordii*), chipmunk (*Eutamias* sp.), vole (*Microtus* sp.), wood rat (*Neotoma* sp.), mice (*Peromyscus* sp.), ground squirrel (*Spermophilus* sp.), and pocket gopher (*Thomomys* sp.). Most of the rodent remains were
identified to family or genus level, as rodent bones are identifiable to species only with crania with teeth. There is also the possibility that the NISP may be underrepresented since rodent bones could have been lost when screened with quarter-inch mesh (Shaffer 1992a). However, the completeness of the skeletons represented by several crania, whole long bones along with complete or nearly complete skeletons suggests that some of the assemblage may represent natural die-offs rather than a reflection of diet. Rodents burrow and can live under rubble (Chapman et al. 1982; Hoffmeister 1986); therefore, some of the smaller rodent remains may be intrusive to the site and not related to the village occupation (Shotwell 1955; Szuter 1984, 1991b; Thomas 1971). Larger rodents, such as squirrels (Sciuridae) and wood rats (Neotoma spp.), were more likely eaten (Gnabasik 1981; Henderson and Harrington 1914; White 1932, 1962).

**Birds**. Birds represent 32 percent of the faunal assemblage and 15 taxonomic groups (Table 4.3). The most common bird in the assemblage is turkey representing 78 percent of bird bones and a quarter of all identified taxa. “Large bird” is probably from turkeys, as they are one of the few larger common birds in the region. Both turkey (Meleagris gallopavo) and “large bird” represent 95 percent of the bird remains.

Turkeys were commonly used as a domesticated resource by the ancestral Puebloans (Driver 2002b; Munro 1994, 2006). Over time the ancestral Puebloans became increasingly reliant on turkey (e.g., Badenhorst and Driver 2009; Driver 2002b; Muir and Driver 2002). Broken and re-healed turkey bones on legs and wings, population age structures, along with turkey pens, gizzard stones, and eggshell, show increased reliance on turkey in their diet (Munro 1994, 2006). However, during the end of Pueblo III when populations at the Sand Canyon Pueblo, nearby Goodman Point, began to decrease turkey domestication also seemed to decline (Kuckelman 2010). Also, there is little evidence around this region during the very end of Pueblo
III that turkeys continued to be domesticated (e.g., Clinton et al. 2011). For example, there are eggshell and gizzard stones at Goodman Point Pueblo; however, there is no evidence of turkey pens (Kuckelman et al. 2009).

Identified specimens from nine other orders compose the remaining percentage of bird specimens, and many are only represented by one or two identified specimens. Some of the more common orders include Columbiformes (pigeons and doves), Falconiformes (Birds of prey), Tetraonidae (grouse), Stringiformes (owls), and Passiformes (perching birds). Several bird specimens were only identified to family level because of similar skeletal morphology, lack of particular specimens in the comparative collection, and overlapping size and weight (Cohen et al. 1996; Gilbert et al. 1996; Sibley 2000). Numerous bird species are present in southwestern Colorado throughout the year and/or migrate through the region (Sibley 2000).

Reptiles and amphibians. Reptile and amphibian remains account for less than one percent of all identified specimens (Table 4.4). The specimens were identified to three taxonomic groups: iguanas, snakes, and frog/toads. The iguana specimen is part of a cranial bone. Frogs were represented by several elements, and all snake specimens were whole vertebra. As these animals are likely not related to the occupation of the site and altered in taxonomic abundance by screen size, similar to rodents, little effort was made to identify them further (Shaffer 1992a; Shaffer and Neely 1992).

Summary

Goodman Point Pueblo consists of high abundances of cottontail and turkey and low percentages of artiodactyls and jackrabbits. The taxa found at Goodman Point Pueblo also show that three environmental “patches” were utilized by the ancestral Puebloans. First, the presence of a few specimens from montane species, big horn sheep (*Ovis canadensis*) and long-tailed
weasel (Mustela frenata), show evidence of obtaining food from distances as close as 50 to 80 km in the rugged, high elevations of the southern Rocky Mountains. Big horn sheep has been found at several sites in the region such as Castle Rock (Driver 2000), Shields (Rawlings 2006), Yellow Jacket (Muir and Driver 2003), and Sand Canyon Pueblos (Muir 1999, 2007). In contrast, long-tailed weasel is rarely found with only one or two specimens recovered from villages at Shields (Rawlings 2006), Yellow Jacket (Muir and Driver 2003), and Sand Canyon Pueblos (Muir 1999, 2007). The second patch the ancestral Puebloans used frequently was the domesticated patch. Turkey domestication was a common practice before late Pueblo III and after the depopulation of the northern San Juan area (Clinton 2011; Munro 1994, 2006). Even if the ancestral Puebloans did not domesticate turkey at Goodman Point Pueblo turkey still played an important role in their diet and where a different type of allocated resource. Canids were also likely domesticated within the village and could have been eaten (e.g., Ganbasik 1981; Savolainen 2007; Savolainen et al. 2002). Finally, the third patch consists of other nearby small wild resources, such as cottontails and large rodents. Both of these latter two patches suggest the use of closer “localized” patches. This “localness” could reflect other cultural and environmental stressors, such as drought, warfare, and defensive aggregated settlements during late Pueblo III (e.g., Benson and Berry 2009; Duff and Wilshusen 2000; Kohler et al. 2009; Kuckelman et al. 2002; LeBlanc 1988, 1999; Mahoney et al. 2000; Varien et al. 2000).

Site Level Taphonomic Analysis

Although I expect good overall site preservation because of the semi-arid climate in southwestern Colorado and limited presence of taphonomic factors on other faunal remains found in the central Mesa Verde region, such as at nearby Sand Canyon Pueblo (e.g., Muir 1999, 2007), it is important to understand the impact of cultural and natural taphonomic factors
specifically at Goodman Point. Taphonomy, originally defined by paleontologist I.A. Efremov (1940:85), is “the study of the transition (in all its details) of animal remains from the biosphere into the lithosphere.” It is important to understand both cultural and natural influences to help investigate the loss of information over time, aid in examining new information about what occurred in a particular location, and assist in correctly evaluating archaeological trends (Behrensmeyer and Kidwell 1985). For instance, ancestral Puebloans used particular types of bones from certain species for making tools and jewelry (e.g., Charles 2006; Kidder 1927; McGregor 1941; Munro 1994). Weathering, perhaps attributed to deposition within particular structure units, and rate of sedimentation, could also influence how faunal remains could be identified and preserved in the archaeological record (Behrensmeyer 1978; Behrensmeyer and Kidwell 1985; Ferring 1986). Thus, if these factors are not accounted for their influences could potentially affect faunal analysis.

Also, intrusive remains, or faunal remains from animals not related to the occupation of the village, are also investigated. Modern animals can enter onto sites and die naturally in burrows especially in crevices near collapsed rubble (e.g., Chapman and Feldhamer 1982; Hoffmeister 1986). These animals, including rodents, reptiles and amphibians, need to be mentioned, especially isolated nearly complete skeletons of those taxa which were commonly eaten, such as cottontails, wood rats and squirrels. Not removing these species could influence further interpretations.

**Methods**

Natural and cultural taphonomic variables are evaluated to examine overall site level preservation. The variables examined include weathering, pathological conditions, carnivore and rodent gnawing, modification for artifacts, cut marks, and burning. Each of these variables will
be examined to determine how they could potentially affect the taxonomic and skeletal representation of the fauna at Goodman Point.

In addition when discussing natural variables I determine if particular faunal remains are related to modern intrusions not related to the ancestral Puebloan occupation of the village. First, I examine skeletal element representation because isolated relatively whole articulated skeletons would suggest natural deaths. If these remains are also found within an area nearby collapsed rubble, this would strengthen that argument. I also look for an absence of cultural evidence, explore ethnographic use, plus, investigate excavation notes and examine screen size, which could affect the ability to collect specimens from smaller taxa (Shaffer 1992a; Shotwell 1955; Szuter 1984, 1991b; Thomas 1971). With all of this evidence remains unable to be ruled out as not related to village occupation are excluded from further analysis.

Results

Several taphonomic factors that could have affected the preservation of specimens from Goodman Point Pueblo were documented. In general, the faunal remains at Goodman Point Pueblo are well preserved with little natural and/or cultural modifications similar to surrounding Pueblo III villages such as at Yellow Jacket (Muir and Driver 2003) and Sand Canyon Pueblos (Muir 1999, 2007).

Weathering. Weathering causes bones to dry out and splinter reducing the likelihood of preservation and hindering identification (Behrensmeyer 1978). All weathered bone exhibiting both minimal and high weathering is presented by taxon in Table 4.5. Weathered bone was not commonly found at Goodman Point Pueblo. Faunal remains were classified using Behrensmeyer’s (1978) five stages of weathering then were further simplified into weathered and very weathered bones (stages 4-5). As expected, moderately weathered bones were easier to
identify to taxon, while only forty percent of the highly weathered bones were identifiable to taxon or class. Moderate and high weathering is more common in artiodactyls, lagomorphs, and other medium sized mammals. Also, jackrabbits are more commonly weathered than cottontails. The structural context of these specimens, whether it was found in a midden versus a masonry structure, could have influenced their exposure to weathering and explain why particular taxa are more highly weathered. Taphonomic factors within different structural contexts are further investigated later in this chapter.

**Pathological conditions.** Pathological conditions occur from breakage and re-healing of bones while an animal is alive. If not set correctly misalignment and remodeling are likely to occur (Ortner and Putschar 1981). The abnormal shape of bone growth with these bones could potential cause them to be preserved differently. For example, spherical bones preserve better because of their round structure (Lyman 1994). Few, natural pathological conditions were found (Table 4.6). The most common bones with pathological conditions were on four turkey (*Meleagris gallopavo*) foot phalanges, a common natural phenomenon (Robin Lyle pers. comm. 2010/11). These phalanges had ossified growth patterns, perhaps from breakage and re-healing. Ancestral Puebloans commonly broke turkey wings and legs when they domesticated turkey (Munro 1994, 2006). However, during the terminal Pueblo III period this pattern diminishes, suggesting a decrease in the residents’ reliance on turkey domestication (Clinton 2011).

**Carnivore damage.** Carnivores, such as dogs, can damage bones, as they can digest small elements and chew off diagnostic epiphyses, typically affecting the ability to identify specimens to species level (Haynes 1983; Marean and Spencer 1991). However, only five bones in the entire Goodman Point assemblage showed evidence of carnivore damage (Table 4.7). Although the damage was most likely from dogs because they were commonly domesticated, other
carnivores such as coyotes or wolves found around the site could have produced the markings. Two specimens were from deer (*Odocoileus* sp.), one from medium artiodactyl, and one from turkey (*Meleagris gallopavo*). The limited amount of carnivore damage is likely related to restricted access to deer remains. For example, the Zia, a modern Southwestern tribe, do not permit their dogs to gnaw on deer bones (White 1962).

*Rodent damage.* Rodents tend to gnaw on the densest skeletal parts of elements; thus, if rodents gnaw enough they are able to wear down identifiable characteristics of bones so that bones can no longer easily be identified to finer taxonomic levels, such as to species (Brain 1980; Morlan 1980). Rodent damage was the most significant natural modification but only represents two percent of the entire faunal assemblage (Table 4.8). Several species of rodents were present within the village, shown by their high abundance within mammal remains (Table 4.2). Varying degrees of rodent damage were present at Goodman Point. Specimens with little damage were still able to be identified to genus or species level, while other bones had enough damage to remove most or all distinguishing characteristics of the bone. Damage is present in all orders of mammals and in Galliformes, the most prominent order of birds but 67 percent were able to be identified to element. The higher percentages of rodent damage were on mammal bones from larger animals, mostly artiodactyls. Although rodent damage is a more commonly found taphonomic factor at Goodman Point it did not significantly alter the ability to identify taxa because many bones showed only minimal gnawing.

*Intrusive animals.* Although Goodman Point Pueblo is fenced off from surrounding areas animals not related to the village occupation can easily travel into the site. For example, rodents and other small mammals usually seek shelter under fallen rubble or burrow into the ground (Chapman et al. 1982; Hoffmeister 1986). Several issues could potentially complicate
determining which faunal remains come from intrusive animals, such as recovery, preservation, and the ability to identify particular elements to genus. Also, the storage of whole animal carcasses is a common practice in modern Puebloan societies, especially with wood rats \((\textit{Neotoma} \text{ spp.})\) and cottontails \((\textit{Sylvilagus} \text{ spp.})\) (Gnabasik 1981; White 1932, 1962).

Several isolated whole articulated skeletons were found at Goodman Point, including one cottontail \((\textit{Sylvilagus} \text{ sp.})\), a wood rat \((\textit{Neotoma} \text{ sp.})\), a rock squirrel \((\textit{Spermophilus variegates})\), and one frog/toad (Table 4.12a,b). These skeletons are assumed to be intrusive, because they are found as relatively whole isolated skeletons, possess a wide range of elements, and no evidence of cultural modification (Shotwell 1955; Szuter 1984, 1991b; Thomas 1971). The skeletal elements of these specimens are presented in Table 4.12. It is more common for Puebloans to eat larger rodents and cottontails, which could have been stored whole (Gnabasik 1981; White 1932, 1962). Several other whole bones and craniums of small rodents were found at Goodman Point, including mice \((\textit{Peromyscus} \text{ spp.})\), voles \((\textit{Microtus} \text{ spp.})\), and chipmunks \((\textit{Eutamias} \text{ spp.})\) along with other whole elements of small rodents, reptiles, and amphibians. These animals were most likely not consumed by occupants. It is difficult to determine if people ate small animals in the archaeological record because if small animals were eaten people likely broke the small bones or ate them whole (Gnabasik 1981; Shaffer and Neely 1992; Swanton 1946). Bone fragments and whole elements are more prone to loss when quarter inch screen are used during excavation (Shaffer 1992). Because I am unable to rule out these animals are not intrusive, especially the cottontail, wood rat, and rock squirrel, I exclude them from further analysis.

\textit{Culturally modified bone}. The ancestral Puebloans commonly made scrapers, jewelry, awls, weaving needles, and other tools out of bone (McGregor 1941). Many of these types of tools and decorations are represented. Bones were categorized as artifacts when they showed
significant modification including high polishing and designs cut into the bone. Bone artifacts were made from larger and medium sized mammals and several species of large birds and approximately 50 percent of all modified specimens found within the village were able to be identified to element (Table 4.9). Some of the specimens from rarer birds represented at the site were made into artifacts. For example, 50 percent of hawk (Buteo sp.) and 100 percent of sandhill crane (Grus canadensis) bones were modified. This illustrates the importance of skeletons from the rarer, large birds, as not only a subsistence item but perhaps also for ritual contexts. The percentages, however, are likely influenced by sample size. Turkey bone was the most commonly modified based on the number of modified bone likely due to its hollow structure and its abundance as a domesticated resource. Common elements that were made into tools at Goodman Point Pueblo include: the humerus, radius, tarsometatarsus, tibiotarsus, and ulna. The presence of different types of bone tools and artifacts, including pendants, scrapers, awls, and other jewelry, suggests specialization is also present at Goodman Point Pueblo, common during Pueblo III (McGregor 1941).

Cut marks. Cut marks in this category were thin parallel lacerations usually near major disarticulation areas (most likely butcher marks) (Binford 1978, 1981; Driver 1992a; Lang and Harris 1984; Lyman 1979). These marks were not very common at Goodman Point Pueblo and were only present on 40 specimens throughout the site (Table 4.10). The little lacerations on the bone allowed 80 percent of bones with cut marks to be identified to element. Cut marks are more common on turkey (Meleagris gallopavo) leg bones, for example, the distal end of the tibiotarsus. It is common to see butcher marks on these bones when residents consume more turkey (Lang and Harris 1984; Munro 1994; Kemp et al. 2010). Several artiodactyl bones also
showed evidence of cut marks. Larger game is commonly butchered, which helps to easily bring back meat to villages and for preparation in cooking (Binford 1978).

A recently sawed vertebra from a domesticated cow (*Bos taurus*) was found on the outer edges of Goodman Point Pueblo. Domesticated cattle were introduced to the Southwest by Spaniards in the 1500’s (Love 1916). Although there are no carnivore marks on the bone it was mostly likely carried by an animal from the nearby farms. This bone is not related to the ancestral Puebloan occupation; therefore, I exclude it from further analysis.

_Burning_. Localized burning on the ends of bones is typical of cooking, while bones possessing higher stages of burning (i.e., black (carbonized) and white (calcined)) were exposed to more intense heat typically from a hearth and/or other naturally or culturally produced fires. More intense degrees of burning alter the chemical structure of bones. This makes bones more brittle; thus, increasing the chance of breakage (Johnson 1989; Knight 1985). When bones become more fragile they are more likely to slip through small screen sizes and identifiable characteristics usually present on bones usually disappear.

To understand if burning affected the preservation of bones at Goodman Point Pueblo three different stages of burning were recorded: localized, black (carbonized), and white (calcined). Only six percent of all specimens found at Goodman Point were burned to some degree (Table 4.11). Burnt bones were commonly found in features, such as hearths. At Goodman Point Pueblo as the degree of burning increased the fragments became more numerous, and thus, fewer taxa were identified with calcined specimens. While 40 percent of localized bones were identified to element, 70 percent of carbonized and 80 percent of calcined bones were too destroyed to be identified to element. With more breakage the ability to accurately identify specimens becomes more difficult. Specimens carbonized and calcined were
proportionally less identifiable to taxon, as seen by the taxonomic and site totals in Table 4.11. Several smaller mammal specimens were burnt white more often than other animals. Even though some have high NISP for the burnt white category they were fragments and not nearly as compete of an element as other bones with localized burning. The species identified to higher degrees of weathering were fragmented in such a way that one or more diagnostic features were still present on the bone (i.e. areas near the ends of bones). The presence of localized burning on nearly all mammalian taxonomic categories and two commonly found species of Galliformes suggest their use as food resources.

**Summary**

Faunal remains found at Goodman Point Pueblo are well-preserved. There are minimal site level modifications caused natural and cultural taphonomic factors. Two of the prominent natural taphonomic processes that effected bones within the village include weathering and rodent damage. As expected from the semi-arid climate few specimens were weathered in such a way that they were no longer able to be identified to element. Rodent gnaw marks on bones are likely related to the presence of small rodents who commonly hide in the crevices of collapsed rubble after the depopulation of the village (Chapman and Feldhamer 1982; Hoffmeister 1986). Animals, including several smaller rodents, reptiles and amphibians found at Goodman Point are considered not related to the village occupation and thus, are removed from further analysis.

Several cultural interpretations can be made from the presence and lack of naturally and culturally modified bone. For example, the lack of carnivore marks is commonly seen in modern villages and is likely related to cultural practices of restricting access to remains, especially with deer bones (White 1962). Burned bone was one of the more commonly found cultural modifications and did hinder the ability for identifications to element, however, it only included
six percent of the entire assemblage. Burned bone along with butcher marks show the importance of both mammals, especially cottontails, and turkey in the diet of the ancestral Puebloans. Although the presence of butcher marks shows that turkey was a dietary resource there is little evidence of domestication. Goodman Point lacks a turkey pen; however, there are eggshells and gizzard stones found within the site (Kuckelman et al. 2009). In earlier time periods and then again during Pueblo IV, the ancestral Puebloans would break wings and legs of turkeys when keeping them in the village (Munro 1994, 2006). These breaks are not present on other wild birds (Clinton 2011). The turkey breaks at Goodman Point were only present on foot phalanges and are more apt to happen naturally. Turkeys could easily survive in the wild with these breaks (Robin Lyle pers. comm. 2010/11). Because of the late occupation of the site raising domesticated turkey could have been stressful because of already limited resources, such as corn (Benson and Berry 2009; Clinton 2011; Kuckelman 2010; Petersen 1988).

Intra-site Spatial Analysis

Ethnographic records from modern pueblos show that different areas of villages were used for different activities; therefore, there could be differential representation of fauna across space (e.g., Henderson and Harrington 1914; Lange 1959; White 1932). People deposit artifacts, including faunal remains, in specific places, typically related to use (Schiffer 1972, 1983). At Goodman Point Pueblo spatial variability was classified into four general types of features: kivas, masonry structures, D-shaped bi-walled structures, and middens. For instance, square shaped masonry structures were used for everyday activities, such as for storage habitation, and cooking. Middens were typically on the southern edge of room blocks and were deposits of everyday secondary refuse (Schiffer 1972, 1983). Kivas and great kivas were either used for religious or domestic activities, different from the everyday activities in other masonry structures.
and middens (Adler 1993; Lipe 2006; McGregor 1941; Smith 1952). When masonry structures and kivas were abandoned they were typically used as trash dumps (e.g., Reid 1974). D-shaped bi-walled structures were also thought to be socially distinctive perhaps as political centers and/or ceremonial areas (Lipe and Ortman 2000). For example, at Sand Canyon kivas surrounding the D-shaped bi-walled structure had large floor vaults along with several species of bird remains indicating ritual use (Muir 1999; Wilshusen 1989). Because of the different uses of these three types of contexts (middens, masonry surface structures, and kivas) each will be analyzed independently. Based on ethnographic records I expect different use areas throughout the village, and perhaps different species, species abundances, and taphonomic signatures.

**Methods**

Variability within and between three major spatial contexts (middens, masonry surface structures, and kivas) is examined. Faunal data is examined by the spatial categories that were assigned by Crow Canyon Archaeological Center during excavation (Crow Canyon Archaeological Center [CCAC] 2001). General taxonomic abundances and taphonomic modifications are examined to see if there are similarities within these groups. NTAXA, or the number of taxa, is tallied for each context using the finest taxonomic levels (species level) when possible. Because of different sample sizes between these three contexts the presence and absence of particular species could be due to sample size issues. Therefore, NISP and NTAXA are examined within each context to see overall trends. As sample size increases the number of species increases (Grayson 1984; Lyman 2008); therefore larger samples from units at Goodman Point Pueblo should possess a more diverse assemblage. NISP and NTAXA are used to see if the rate of change in species richness across sample size is similar for each context. If one context
shows a steeper slope and/or high intercept value then more taxa are represented at any given sample size than a sample with a gradual slope and low intercept value.

Finally, to examine if there are significant differences between species between the three major contexts a chi-squared test of independence is used. The non-parametric chi-squared test is used because of low sample sizes. For this test the four main southwest taxa are analyzed: cottontails (Sylvilagus spp.), jackrabbits (Lepus spp.), artiodactyls (includes all artiodactyls found at Goodman Point Pueblo), and turkey (Meleagris gallopavo). For this comparison general categories, such as “large bird” and “small mammal” were not included even though several “large bird” most likely belongs to turkey and “small mammal” to cottontail. The taxa were chosen because they are commonly found food sources during the ancestral Puebloan occupation in the central Mesa Verde region and are frequently used to show dietary change between different occupational periods in the Southwest (e.g., Badenhorst and Driver 2009; Driver 2002a, 2002b; Driver and Woiderski 2008; Muir 1999, 2007; Muir and Driver 2002; Szuter and Bayhem 1989).

*Results*

As different activities likely occurred in special areas of the village (e.g., Henderson and Harrington 1914; Lange 1959; White 1932) different major spatial contexts were separated within Goodman Point Pueblo. NTAXA, NISP, and percent unidentified remains for each taxon within each spatial category are presented in Table 4.13. Different kiva types possess similar species diversity. As expected, categories with higher sample sizes show higher taxonomic diversity.

*Middens.* A total of 45 middens primarily located near the southern edge of roomblocks were excavated and approximately 47 percent of the total faunal remains found at the village are
from middens (Tables 4.13 and 4.14). Roughly fifty percent of the faunal remains found in middens were unidentifiable. The four most common taxa (cottontails, jackrabbits, artiodactyls, and turkey) represent 75 percent of identified taxa within middens (Table 4.14). Turkey is the most common taxon, representing approximately 40 percent of all identified specimens from middens. Cottontails are the second common taxon. The “large bird” category, which likely represents turkey, is the next most abundant. Jackrabbit and artiodactyl are present in small amounts. Rodents are the fourth most common taxon, representing six percent.

When different midden units were compared with best fit lines against NISP and NTAXA larger middens showed more taxonomic diversity and two significant outliers (beyond two standard deviations) were found, Midden 908 and Midden 1217 (Figure 4.2). Midden 908 had significantly more species represented than expected according to its sample size, and is located next to the large D-shaped bi-wall structure. These structures are thought to be political or ceremonial areas for the village (Lipe and Ortman 2000). The larger diversity of species could indicate that this structure was also politically or socially important during the occupation of Goodman Point Pueblo. Several different species are commonly used for various special village level gatherings by modern day Pueblo peoples (e.g., Gnabasik 1981; Lange 1959; White 1932).

Midden 1217, located next to the single great kiva, had fewer numbers of taxa than expected given its sample size. Great kivas are used as large village level gathering places (Churchill et al. 1998; Lipe and Ortman 2000; McGregor 1941). This midden may be associated with the activities within the great kiva, and more use of this midden likely equals less ability to accurately identify particular remains.

*Masonry structures.* Twenty masonry structures were excavated and classified into two types: masonry surface structures and other masonry structures. “Masonry surface structure” is
defined as any aboveground masonry structure (this includes rooms), and “masonry structure, type unknown” could be a kiva, room, tower, or any other type of masonry structure that could not be further defined (Kuckelman et al. 2009; Kristin Kuckelman pers. comm. 2011). Eighteen of the structures were identified as masonry surface structures, while two were unknown masonry structures (Table 4.13). The sample of 46 NISP from the two unknown structures is too small to make a comparison to the surface structures (Table 4.15). Thus, the data for the two types of masonry structures are combined together for further analysis (Table 4.14).

Cottontail is the most common taxa and represents approximately forty percent of the fauna found in these structures, which is comparable to the abundances for the site as a whole. Rodents are the second most common taxonomic group with approximately 27 percent. The next most abundant taxon is turkey with less than ten percent, followed by small amounts of artiodactyls then jackrabbits.

When the rate of change of NISP to NTAXA was compared across all masonry structures there was one significant outlier beyond two standard deviations, Masonry Surface Structure 1215 (Figure 4.3). This structure is adjacent to the great kiva and the Midden 1217 outlier. Structure 1215 has a significantly higher number of taxa compared to its sample size. Like Midden 1217 which was an outlier among the midden assemblage, this structure is adjacent to the great kiva. Typically, rooms surrounding great kivas have an extensive amount of storage space for ceremonial and/or village gatherings (Lipe and Ortman 2000). Finding more species than expected may possibly reflect its function as a special use area related to the great kiva.

*Kivas.* Twenty-three kivas were excavated at Goodman Point Pueblo and grouped into three different types of kivas: subterranean kivas, aboveground kivas, and unknown type kivas. For kivas, “aboveground kiva” refers to a kiva constructed aboveground within a type of
masonry structure. Usually aboveground kivas rest on top of bedrock. “Subterranean kivas” are below or mostly below ground kivas. Several kivas at Goodman Point Pueblo are aboveground or slightly below ground because of little soil depth. The last group of kivas, “kiva, type unknown,” are structures thought to be kivas, but lack evidence to further classify into aboveground or subterranean (Kuckelman et al. 2009; Kristin Kuckelman pers. comm. 2011).

The four main taxa represent between 50 to 60 percent of identified taxa in all three kivas and cottontail dominates the assemblage across all kiva types (Figure 4.1 and Tables 4.13-14). Specifically, aboveground kivas have approximately 35 percent cottontails, followed by rodents (30 percent), then turkey (16 percent). Aboveground kivas are similar to masonry structures in its percentage of rodents perhaps because both are aboveground structures and rodents tend to live in collapsed rubble (Chapman and Feldhamer 1982; Hoffmeister 1986). Subterranean kivas have over 50 percent cottontails and small mammal (30 percent) compared with all other contexts at Goodman Point Pueblo and has less unidentifiable remains (10 percent) compared to the other kivas (35 to 38 percent) (Table 4.14). Unknown kiva types are dominated by cottontail (50 percent) with the next most abundant species being rodents (11 percent) and small mammals (11 percent). Although there are slight differences in taxonomic abundances between kivas, specifically subterranean kivas, they are more similar to each other compared to masonry structures and middens.

Compared with other kivas, one subterranean kiva (Kiva 107) had the greatest diversity in taxa and highest sample size. First, Kiva 107 had the highest abundance of cottontail (600 NISP) and small mammal remains within any one structural and non-structural context excavated at Goodman Point Pueblo. Several of these cottontails were well preserved with a large proportion of different types of whole elements represented across the skeleton, leading to the
belief they were deposited as relatively whole carcasses of cottontails. These cottontails are likely related to the village occupation because of their depositional context and association with other species. Perhaps this kiva was one of the first to be abandoned at Goodman Point. Also, some animal carcasses, such as cottontails and wood rats are commonly stored within masonry structures in current Southwestern tribal communities (Gnabasik 1981; White 1932, 1962). This could explain the presence of more articulated small mammal skeletons in some contexts. This kiva also possesses similar species diversity and sample size to the largest midden found at the site. If masonry structures or kivas were abandoned, trash would be thrown away in the unoccupied structures (Reid 1974); this could be one explanation for the abundance of animal remains. If Kiva 107 is excluded there are still the same relative abundances of all major taxa. Also, although Kiva 107 stands out as the highest NISP and large species diversity, when all kiva units were graphed along a best fit line major significant outliers were present (Figure 4.4).

Based on similarities shown in Tables 4.13-16 and Figures 4.1-4 different types of kivas are combined together as “kivas” and the separate masonry structures are combined as “masonry structures” for further analysis. Faunal remains from these three major structural types (middens, masonry structures, and kivas) are further analyzed.

Variation between the three main spatial contexts. Similar to the entire site, taphonomic factors played little role in the three structure types (approximately 14 percent of remains in kivas, 8 percent in masonry structures, and 10 percent in middens) and there are slight differences in taphonomic factors between these contexts (Figure 4.5). The most prevalent taphonomic factor is the calcination of bones in kivas (7.25 percent). Several kivas excavated at Goodman Point had partly charred roofs (Kuckelman et al. 2009). Kivas are commonly burned when they are abandoned (Walker 1999). Only six percent of calcined bones in aboveground
kivas were able to be identified to element, while the other kiva types ranged between 17 and 19 percent. Altogether kivas have a lower rate (14.5 percent) of identified calcined bones compared to the site average (approximately 20 percent). Both middens and kivas have higher concentrations of bone tools, and carbonized and calcined bones. This is possibly due to more hearths and a higher consumption of animals in these contexts. Localized burning is common across all contexts, but is slightly more common in middens. Kivas and masonry structures have slightly higher instances of rodent damage, and both contexts have higher percentages of rodent remains most likely due to more intrusive animals occupying tight spaces within the collapsed structures (Chapman et al. 1982; Hoffmeister 1986). Weathered bone and carnivore damage is also slightly more common in masonry structures possibly from exposure when walls collapsed.

Although these contexts have similar trends within each major context I next investigate whether there is variation in faunal remains between middens, masonry structures, and kivas. All contexts show similar distributions in species richness, or number of taxa represented, when compared to sample size (NISP) (Figures 4.6 - 10). Areas at Goodman Point Pueblo with higher sample sizes show more diversity. NTAXA and NISP were compared within each unit, log transformed, and then linear regressions were calculated. Although there are similar trends this figure also demonstrates three distinct lines between the three contexts. These linear trends show that the curve along masonry structures and middens are similar and linear regression lines more predictable when outliers are removed (Figures 4.6 - 9). Kivas, however, have little change in richness across sample size, suggesting that fewer taxa were found in kivas than in other contexts (Figure 4.10).

Next, a chi-squared test of independence was run in order to determine if there is a significant difference among the four main Southwestern taxa and the three spatial contexts
(masonry structures, kivas, and middens). There is a significant difference in the distribution of taxa across spatial contexts at Goodman Point Pueblo \( (\chi^2 (6) = 1028.973, p = .000) \). A Cramer’s V value of .315 demonstrates that the significant results are not being driven simply by the large sample size. The statistical analysis demonstrates that the four dominant taxa are differentially distributed across the three contexts (Figure 4.11). Cottontails were common in all contexts (ranging from approximately 30 percent and 50 percent). Although there was still a high percentage of a cottontail in middens (31 percent), it was the lowest percentage of cottontails across all structure types. However, middens were dominated by turkey (41 percent) and have a slightly higher percentage of jackrabbits compared to other contexts. Masonry structures contain the highest percentage of artiodactyls followed closely by kivas. Even excluding the three outliers (including Midden 908, Midden 1217, and Masonry Surface Structure 1215) similar significant results were found \( (\chi^2 (6) = 1013.346, p = .000, \text{ Cramer’s V value of } .316) \).

**Summary**

The three main spatial contexts within Goodman Point Pueblo each show unique trends. Middens had a significantly higher percentage of turkey compared to the other contexts, while cottontail and artiodactyl remains were slightly more abundant within structures. However, cottontails were highly abundant in all three contexts. The distribution of these taxa is also commonly seen in other nearby Pueblo III villages and continues to show the importance of turkey and cottontail as dietary resources (e.g., Driver 2000, 2002b; Muir 1999; Muir and Driver 2003). Significant outliers were present within both the great kiva, with two significant outliers, and the D-shaped bi-walled structures. These structures are known to be centers of political and religious village level activity (Lipe and Ortman 2000), and their importance can also be seen within Goodman Point. Even though Kiva 107 was not an outlier when comparing NISP to
NTAXA, its extremely high NISP and species diversity mirror that of the larger middens excavated within Goodman Point Pueblo. This kiva was likely abandoned and used as an area to store secondary refuse and/or food such as whole carcasses (e.g., Gnabasik 1981; Muir 1999; Reid 1974; White 1932, 1962). Even though these explanations are plausible no other kivas show as much refuse as what was found in Kiva 107. The high abundance of nearly complete cottontail skeletons in this kiva remains a mystery. Finally, with no significant outliers when comparing NISP to NTAXA, kivas as a whole possess fewer taxa than the other two contexts, while rooms and middens have closer regression slopes. A possible explanation could be the similar everyday activities that occurred in the rooms and middens, while kivas were typically reserved for ceremonial or special use areas (Adler 1993; Lipe 2006; McGregor 1941; Schiffer 1972, 1983; Smith 1952). Also, the higher rate of fragmented calcined bones likely increased the NISP without increasing NTAXA, especially in the aboveground kivas where only six percent of calcined bones could be identified to element. The significantly high numbers of species, or the outliers, however, were always found around the larger village level gathering places rather than the smaller ceremonial areas.

Conclusion

Taphonomic factors, taxonomic abundances, and intra-site spatial analysis illustrate subsistence practices at Goodman Point Pueblo that compare favorably to other late Pueblo III villages surrounding Goodman Point Pueblo. First, Goodman Point Pueblo is a large well-preserved village. With the help of the semi-arid climate there are minimal numbers of naturally modified bone within the village. Seven percent of all bones found within kivas were burned white, likely caused from a common ritual abandonment practice (Walker 1999). Calcined bones found especially in the aboveground kivas significantly altered the ability to identify specimens
to element, likely causing the lower level of taxonomic variability within kivas when compared to its sample size. Some taphonomic factors, such as weathering, rodent damage, and burning, did hinder the ability for identifications to finer taxonomic levels and even to element. These factors, however, all represented low percentages of the specimens within the village.

Next, taxonomic abundances mirror those of nearby sites, including Sand Canyon (Muir 1999, 2007), Yellow Jacket (Muir and Driver 2003), Woods Pueblo (Driver 2002a), and Castle Rock (Driver 2000) (locations shown in Figure 4.12) and correlate with long term regional trends. For example, Sand Canyon Pueblo, with a similar site size and occupation period to Goodman Point, has 41 taxa across 17,628 specimens, out of which 62 percent (10,852) were identified to a specific taxonomic level (Muir 1999). Cottontail and turkey dominate the dietary resources, unlike larger game such as artiodactyls and jackrabbits. Cultural and environmental stressors, including drought, cold spells, and violence (e.g., Benson and Berry 2009; Kuckelman et al. 2002; LeBlanc 1988, 1999; Petersen 1988) during the late Pueblo III period throughout the region could have made it more profitable to go after localized and domesticated resources. Inclusion of minimal percentages of montane taxa, such as big horn sheep (Ovis canadensis) and long-tailed weasel (Mustela frenata), gives some evidence of long distance travel from the site. Also, it is likely that Goodman Point Pueblo is part of the long term trend of declining larger game popular during Pueblo III in the northern San Juan area (e.g., Badenhorst and Driver 2009; Driver 2002b; Muir and Driver 2002).

Although turkey is an abundant dietary resource at Goodman Point Pueblo the village lacks evidence for turkey domestication. There are no culturally broken legs and wings of birds and an absence of turkey pens within the village. The abundance of turkey in secondary refuse
also leads to the idea of clearing out domesticated resources before the abandonment of the village.

Spatial variation, perhaps altered by cultural taphonomic factors within the kivas, is likely related to different disposal practices and/or religious or other functions of different spatial contexts. For example, some roomblocks were used to collect hunted animals, process animals, and/or store food, such as whole wood rats and cottontails (Gnabasik 1981; Muir 1999; White 1932, 1962). Outliers surrounding the great kiva and D-shaped bi-walled building indicate the importance of village level activities at Goodman Point Pueblo.
Table 4.1. Frequency of Identified Faunal Remains, Goodman Point Pueblo.

<table>
<thead>
<tr>
<th>Class</th>
<th>Common Name</th>
<th>NISP</th>
<th>% of Identified Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amphibia</td>
<td>amphibians</td>
<td>26</td>
<td>.29</td>
</tr>
<tr>
<td>Aves</td>
<td>birds</td>
<td>2861</td>
<td>32.44</td>
</tr>
<tr>
<td>Mammalia</td>
<td>mammals</td>
<td>5921</td>
<td>67.14</td>
</tr>
<tr>
<td>Reptilia</td>
<td>reptiles</td>
<td>11</td>
<td>.12</td>
</tr>
<tr>
<td>Total Identified</td>
<td></td>
<td>8819</td>
<td>100.00</td>
</tr>
<tr>
<td>Total Unidentified</td>
<td></td>
<td>5595</td>
<td></td>
</tr>
<tr>
<td>Grand Total</td>
<td></td>
<td>14414</td>
<td></td>
</tr>
</tbody>
</table>
Table 4.2. Frequency of Mammal Remains, Goodman Point Pueblo.

<table>
<thead>
<tr>
<th>Order</th>
<th>Taxon</th>
<th>Common Name or Description</th>
<th>NISP</th>
<th>% of Mammal</th>
<th>% of All Taxa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artiodactyla</td>
<td><em>Antilocapra americana</em></td>
<td>pronghorn</td>
<td>16</td>
<td>.27</td>
<td>.18</td>
</tr>
<tr>
<td></td>
<td>Cervidae</td>
<td>cervids</td>
<td>21</td>
<td>.35</td>
<td>.24</td>
</tr>
<tr>
<td></td>
<td><em>Odocoileus hemionus</em></td>
<td>mule deer</td>
<td>7</td>
<td>.12</td>
<td>.08</td>
</tr>
<tr>
<td></td>
<td><em>Odocoileus</em> sp.</td>
<td>deer</td>
<td>46</td>
<td>.78</td>
<td>.52</td>
</tr>
<tr>
<td></td>
<td><em>Ovis canadensis</em></td>
<td>bighorn sheep</td>
<td>8</td>
<td>.14</td>
<td>.09</td>
</tr>
<tr>
<td></td>
<td><em>Bos taurus</em></td>
<td>domesticated cattle</td>
<td>1</td>
<td>.02</td>
<td>.01</td>
</tr>
<tr>
<td>Medium artiodactyl</td>
<td></td>
<td></td>
<td>78</td>
<td>1.32</td>
<td>.88</td>
</tr>
<tr>
<td>Carnivora</td>
<td><em>Canis</em> sp.</td>
<td>dog, wolf, coyote</td>
<td>25</td>
<td>.42</td>
<td>.28</td>
</tr>
<tr>
<td></td>
<td><em>Lynx</em> sp.</td>
<td>lynx/bobcat</td>
<td>17</td>
<td>.29</td>
<td>.19</td>
</tr>
<tr>
<td></td>
<td><em>Mephitis mephitis</em></td>
<td>striped skunk</td>
<td>2</td>
<td>.03</td>
<td>.02</td>
</tr>
<tr>
<td></td>
<td><em>Mustela fennata</em></td>
<td>long-tailed weasel</td>
<td>2</td>
<td>.03</td>
<td>.02</td>
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<tr>
<td></td>
<td><em>Taxidea taxus</em></td>
<td>badger</td>
<td>5</td>
<td>.08</td>
<td>.06</td>
</tr>
<tr>
<td></td>
<td><em>Urocyon</em> or <em>Vulpes</em></td>
<td>fox</td>
<td>1</td>
<td>.02</td>
<td>.01</td>
</tr>
<tr>
<td>Lagomorpha</td>
<td>Lagomorpha</td>
<td>rabbits and hares</td>
<td>7</td>
<td>.12</td>
<td>.08</td>
</tr>
<tr>
<td></td>
<td><em>Lepus</em> sp.</td>
<td>jackrabbit or hare</td>
<td>113</td>
<td>1.91</td>
<td>1.28</td>
</tr>
<tr>
<td></td>
<td><em>Sylvilagus</em> sp.</td>
<td>cottontail</td>
<td>3400</td>
<td>57.42</td>
<td>38.55</td>
</tr>
<tr>
<td>Rodentia</td>
<td><em>Cynomys</em> sp.</td>
<td>prairie dog</td>
<td>58</td>
<td>.98</td>
<td>.66</td>
</tr>
<tr>
<td></td>
<td><em>Dipodomys ordii</em></td>
<td>Ord's kangaroo rat</td>
<td>26</td>
<td>.44</td>
<td>.29</td>
</tr>
<tr>
<td></td>
<td><em>Eutamias</em> sp.</td>
<td>chipmunk</td>
<td>2</td>
<td>.03</td>
<td>.02</td>
</tr>
<tr>
<td></td>
<td><em>Microtus</em> sp.</td>
<td>vole</td>
<td>43</td>
<td>.73</td>
<td>.49</td>
</tr>
<tr>
<td></td>
<td><em>Neotoma</em> sp.</td>
<td>wood rat</td>
<td>350</td>
<td>5.91</td>
<td>3.97</td>
</tr>
<tr>
<td></td>
<td><em>Peromyscus</em> sp.</td>
<td>mice</td>
<td>54</td>
<td>.91</td>
<td>.61</td>
</tr>
<tr>
<td>Sciuridae</td>
<td></td>
<td>squirrels</td>
<td>39</td>
<td>.66</td>
<td>.44</td>
</tr>
<tr>
<td></td>
<td><em>Spermophilus</em> sp.</td>
<td>ground squirrel</td>
<td>4</td>
<td>.07</td>
<td>.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>---------------------</td>
<td>-------</td>
<td>-----</td>
<td>-----</td>
<td></td>
</tr>
<tr>
<td>Spermophilus</td>
<td>rock squirrel</td>
<td>175</td>
<td>2.96</td>
<td>1.98</td>
<td></td>
</tr>
<tr>
<td>variegatus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thomomys sp.</td>
<td>pocket gopher</td>
<td>134</td>
<td>2.26</td>
<td>1.52</td>
<td></td>
</tr>
<tr>
<td>Rodentia</td>
<td>rodents</td>
<td>91</td>
<td>1.54</td>
<td>1.03</td>
<td></td>
</tr>
<tr>
<td>Large rodent</td>
<td>larger than wood rat</td>
<td>134</td>
<td>2.26</td>
<td>1.52</td>
<td></td>
</tr>
<tr>
<td>Small rodent</td>
<td>wood rat size or</td>
<td>138</td>
<td>2.33</td>
<td>1.56</td>
<td></td>
</tr>
<tr>
<td></td>
<td>smaller</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>medium mammal</td>
<td>79</td>
<td>1.33</td>
<td>.90</td>
<td></td>
</tr>
<tr>
<td></td>
<td>deer size or smaller</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>small mammal</td>
<td>845</td>
<td>14.27</td>
<td>9.58</td>
<td></td>
</tr>
<tr>
<td></td>
<td>jackrabbit size or</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>smaller</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>5921</strong></td>
<td><strong>100.00</strong></td>
<td><strong>67.14</strong></td>
<td></td>
</tr>
</tbody>
</table>
Table 4.3. Frequency of Bird (Aves) Remains, Goodman Point Pueblo.

<table>
<thead>
<tr>
<th>Order</th>
<th>Taxon</th>
<th>Common Name or Description</th>
<th>NISP</th>
<th>% of Bird</th>
<th>% of All Taxa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anseriformes</td>
<td>Anatini</td>
<td>surface feeding ducks</td>
<td>1</td>
<td>.03</td>
<td>.01</td>
</tr>
<tr>
<td>Columbiformes</td>
<td>Columbiformes</td>
<td>pigeons and doves</td>
<td>12</td>
<td>.42</td>
<td>.14</td>
</tr>
<tr>
<td>Falconiformes</td>
<td>Falconiformes</td>
<td>vultures, hawks, eagles</td>
<td>4</td>
<td>.14</td>
<td>.05</td>
</tr>
<tr>
<td></td>
<td><em>Buteo sp.</em></td>
<td>hawks</td>
<td>2</td>
<td>.07</td>
<td>.02</td>
</tr>
<tr>
<td></td>
<td><em>Falco sp.</em></td>
<td>falcons</td>
<td>1</td>
<td>.03</td>
<td>.01</td>
</tr>
<tr>
<td>Galliformes</td>
<td>Galliformes</td>
<td>grouse, etc.</td>
<td>13</td>
<td>.45</td>
<td>.15</td>
</tr>
<tr>
<td></td>
<td><em>Meleagris gallopavo</em></td>
<td>turkey</td>
<td>2153</td>
<td>75.25</td>
<td>24.41</td>
</tr>
<tr>
<td></td>
<td><em>Callipepla sp.</em></td>
<td>quail</td>
<td>8</td>
<td>.28</td>
<td>.09</td>
</tr>
<tr>
<td></td>
<td>Tetraonidae</td>
<td>grouse</td>
<td>26</td>
<td>.91</td>
<td>.29</td>
</tr>
<tr>
<td>Gaviiformes</td>
<td><em>Gavia sp.</em></td>
<td>loon</td>
<td>1</td>
<td>.03</td>
<td>.01</td>
</tr>
<tr>
<td>Gruiformes</td>
<td>Gruiformes</td>
<td>cranes, etc.</td>
<td>2</td>
<td>.07</td>
<td>.02</td>
</tr>
<tr>
<td></td>
<td><em>Fulica americana</em></td>
<td>American coot</td>
<td>1</td>
<td>.03</td>
<td>.01</td>
</tr>
<tr>
<td></td>
<td><em>Grus canadensis</em></td>
<td>sandhill crane</td>
<td>1</td>
<td>.03</td>
<td>.01</td>
</tr>
<tr>
<td>Passeriformes</td>
<td>Passeriformes</td>
<td>perching birds</td>
<td>2</td>
<td>.07</td>
<td>.02</td>
</tr>
<tr>
<td></td>
<td><em>Corvus corax</em></td>
<td>raven</td>
<td>1</td>
<td>.03</td>
<td>.01</td>
</tr>
<tr>
<td></td>
<td>Hirundinidae</td>
<td>swallows</td>
<td>2</td>
<td>.07</td>
<td>.02</td>
</tr>
<tr>
<td></td>
<td>Mimidae</td>
<td>mockingbirds and thrashers</td>
<td>2</td>
<td>.07</td>
<td>.02</td>
</tr>
<tr>
<td>Piciformes</td>
<td>Piciformes</td>
<td>woodpeckers</td>
<td>2</td>
<td>.07</td>
<td>.02</td>
</tr>
<tr>
<td>Strigiformes</td>
<td>Strigiformes</td>
<td>owls</td>
<td>10</td>
<td>.35</td>
<td>.11</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>large bird</td>
<td>birds larger than mallard</td>
<td>571</td>
<td>19.96</td>
<td>6.47</td>
</tr>
<tr>
<td></td>
<td>medium bird</td>
<td>mallard size and smaller</td>
<td>45</td>
<td>1.57</td>
<td>.51</td>
</tr>
<tr>
<td></td>
<td>small bird</td>
<td>robin size and smaller</td>
<td>1</td>
<td>.03</td>
<td>.01</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>2861</strong></td>
<td><strong>100.00</strong></td>
<td><strong>32.44</strong></td>
</tr>
</tbody>
</table>
Table 4.4. Frequency of Amphibian and Reptile Remains, Goodman Point Pueblo.

<table>
<thead>
<tr>
<th>Order</th>
<th>Taxon</th>
<th>NISP</th>
<th>% of All Taxa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anura</td>
<td>Frog/Toad</td>
<td>26</td>
<td>.29</td>
</tr>
<tr>
<td>Squamata</td>
<td>Iguanidae</td>
<td>1</td>
<td>.01</td>
</tr>
<tr>
<td></td>
<td>Snakes</td>
<td>10</td>
<td>.11</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>37</td>
<td>.42</td>
</tr>
</tbody>
</table>
Table 4.5. Frequency of Weathering, Goodman Point Pueblo.

<table>
<thead>
<tr>
<th>Order</th>
<th>Taxon</th>
<th>Common Name or Description</th>
<th>NISP</th>
<th>Weathered</th>
<th>Highly Weathered</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Number</td>
<td>Percent</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Number</td>
<td>Percent</td>
</tr>
<tr>
<td>Artiodactyla</td>
<td>Cervidae</td>
<td>cervids</td>
<td>21</td>
<td>2</td>
<td>9.52</td>
</tr>
<tr>
<td></td>
<td><em>Odocoileus</em></td>
<td>deer</td>
<td>46</td>
<td>3</td>
<td>6.52</td>
</tr>
<tr>
<td></td>
<td><em>Ovis canadensis</em></td>
<td>bighorn sheep</td>
<td>8</td>
<td>1</td>
<td>12.50</td>
</tr>
<tr>
<td>Carnivora</td>
<td><em>Canis</em> sp.</td>
<td>dog, wolf, coyote</td>
<td>25</td>
<td>2</td>
<td>8.00</td>
</tr>
<tr>
<td></td>
<td><em>Lynx</em> sp.</td>
<td>lynx/bobcat</td>
<td>17</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td><em>Mephitis</em></td>
<td>striped skunk</td>
<td>2</td>
<td>1</td>
<td>50.00</td>
</tr>
<tr>
<td></td>
<td><em>Taxidea</em></td>
<td>badger</td>
<td>5</td>
<td>1</td>
<td>20.00</td>
</tr>
<tr>
<td></td>
<td><em>Urocyon</em> or</td>
<td>fox</td>
<td>1</td>
<td>1</td>
<td>100.00</td>
</tr>
<tr>
<td>Lagomorpha</td>
<td><em>Lepus</em> sp.</td>
<td>jackrabbit or hare</td>
<td>113</td>
<td>4</td>
<td>3.54</td>
</tr>
<tr>
<td></td>
<td><em>Sylvilagus</em></td>
<td>cottontail</td>
<td>3400</td>
<td>20</td>
<td>.59</td>
</tr>
<tr>
<td>Rodentia</td>
<td><em>Neotoma</em> sp.</td>
<td>wood rat</td>
<td>350</td>
<td>7</td>
<td>2.00</td>
</tr>
<tr>
<td></td>
<td>Small rodent</td>
<td>wood rat size or smaller</td>
<td>138</td>
<td>3</td>
<td>2.17</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>medium mammal</td>
<td>deer size or smaller</td>
<td>79</td>
<td>5</td>
<td>6.33</td>
</tr>
<tr>
<td>Galliformes</td>
<td><em>Meleagris</em></td>
<td>turkey</td>
<td>2153</td>
<td>26</td>
<td>1.21</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>large bird</td>
<td>birds larger than mallard</td>
<td>571</td>
<td>2</td>
<td>.35</td>
</tr>
<tr>
<td><strong>Total NISP</strong></td>
<td></td>
<td></td>
<td>89</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Site Total</strong></td>
<td></td>
<td></td>
<td>162</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 4.6. Frequency of Pathological Conditions, Goodman Point Pueblo.

<table>
<thead>
<tr>
<th>Order</th>
<th>Taxon</th>
<th>Common Name or Description</th>
<th>NISP</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artiodactyla</td>
<td><em>Odocoileus</em> sp.</td>
<td>deer</td>
<td>46</td>
<td>1</td>
<td>2.17</td>
</tr>
<tr>
<td>Lagomorpha</td>
<td><em>Sylvilagus</em> sp.</td>
<td>cottontail</td>
<td>3400</td>
<td>1</td>
<td>.03</td>
</tr>
<tr>
<td>Galliformes</td>
<td><em>Meleagris gallopavo</em></td>
<td>turkey</td>
<td>2153</td>
<td>4</td>
<td>.19</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.7. Frequency of Carnivore Damage, Goodman Point Pueblo.

<table>
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<th>Taxon</th>
<th>Common Name or Description</th>
<th>NISP</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artiodactyla</td>
<td><em>Odocoileus</em> sp.</td>
<td>deer</td>
<td>46</td>
<td>2</td>
<td>4.35</td>
</tr>
<tr>
<td></td>
<td>Medium artiodactyl</td>
<td>deer size</td>
<td>78</td>
<td>1</td>
<td>1.28</td>
</tr>
<tr>
<td>Galliformes</td>
<td><em>Meleagris gallopavo</em></td>
<td>turkey</td>
<td>2153</td>
<td>1</td>
<td>.05</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>Site Total</strong></td>
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<td></td>
<td></td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>
Table 4.8. Frequency of Rodent Damage, Goodman Point Pueblo.

<table>
<thead>
<tr>
<th>Order</th>
<th>Taxon</th>
<th>Common Name or Description</th>
<th>NISP</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artiodactyla</td>
<td>Antilocapra americana</td>
<td>pronghorn</td>
<td>16</td>
<td>3</td>
<td>18.75</td>
</tr>
<tr>
<td></td>
<td>Odocoileus hemionus</td>
<td>mule deer</td>
<td>7</td>
<td>1</td>
<td>14.29</td>
</tr>
<tr>
<td></td>
<td>Odocoileus sp.</td>
<td>deer</td>
<td>46</td>
<td>5</td>
<td>10.87</td>
</tr>
<tr>
<td></td>
<td>Ovis canadensis</td>
<td>bighorn sheep</td>
<td>8</td>
<td>1</td>
<td>12.50</td>
</tr>
<tr>
<td></td>
<td>Medium artiodactyl</td>
<td>deer size</td>
<td>78</td>
<td>16</td>
<td>20.51</td>
</tr>
<tr>
<td>Carnivora</td>
<td>Canis sp.</td>
<td>dog, wolf, coyote</td>
<td>25</td>
<td>1</td>
<td>4.00</td>
</tr>
<tr>
<td>Lagomorpha</td>
<td>Lepus sp.</td>
<td>jackrabbit or hare</td>
<td>113</td>
<td>3</td>
<td>2.65</td>
</tr>
<tr>
<td></td>
<td>Sylvilagus sp.</td>
<td>cottontail</td>
<td>3400</td>
<td>46</td>
<td>1.35</td>
</tr>
<tr>
<td>Rodentia</td>
<td>Sciuridae</td>
<td>squirrels</td>
<td>39</td>
<td>1</td>
<td>2.56</td>
</tr>
<tr>
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<td>Spermophilus variegatus</td>
<td>rock squirrel</td>
<td>175</td>
<td>5</td>
<td>2.86</td>
</tr>
<tr>
<td></td>
<td>Small rodent</td>
<td>wood rat size or smaller</td>
<td>138</td>
<td>1</td>
<td>.72</td>
</tr>
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<td>medium mammal</td>
<td>deer size or smaller</td>
<td>79</td>
<td>1</td>
<td>1.27</td>
</tr>
<tr>
<td></td>
<td>small mammal</td>
<td>jackrabbit size or smaller</td>
<td>845</td>
<td>1</td>
<td>.12</td>
</tr>
<tr>
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<td>Galliformes</td>
<td>grouse, etc.</td>
<td>13</td>
<td>1</td>
<td>7.69</td>
</tr>
<tr>
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<td>turkey</td>
<td>2153</td>
<td>70</td>
<td>3.25</td>
</tr>
<tr>
<td></td>
<td>Tetraonidae</td>
<td>grouse</td>
<td>26</td>
<td>2</td>
<td>7.69</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>large bird</td>
<td>birds larger than mallard</td>
<td>571</td>
<td>1</td>
<td>.18</td>
</tr>
</tbody>
</table>

**Total**                                            **159**

**Site Total**                                       **238**
Table 4.9. Frequency of Modified Bone, Goodman Point Pueblo.

<table>
<thead>
<tr>
<th>Order</th>
<th>Taxon</th>
<th>Common Name or Description</th>
<th>NISP</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artiodactyla</td>
<td>Cervidae</td>
<td>cervids</td>
<td>21</td>
<td>2</td>
<td>9.52</td>
</tr>
<tr>
<td></td>
<td>Odocoileus hemionus</td>
<td>mule deer</td>
<td>7</td>
<td>1</td>
<td>14.29</td>
</tr>
<tr>
<td></td>
<td>Odocoileus sp.</td>
<td>deer</td>
<td>46</td>
<td>2</td>
<td>4.35</td>
</tr>
<tr>
<td></td>
<td>Medium artiodactyl</td>
<td>deer size</td>
<td>78</td>
<td>4</td>
<td>5.13</td>
</tr>
<tr>
<td>Carnivora</td>
<td>Canis sp.</td>
<td>dog, wolf, coyote</td>
<td>25</td>
<td>2</td>
<td>8.00</td>
</tr>
<tr>
<td></td>
<td>Lynx sp.</td>
<td>lynx/bobcat</td>
<td>17</td>
<td>3</td>
<td>17.65</td>
</tr>
<tr>
<td></td>
<td>Urocyon or Vulpes</td>
<td>fox</td>
<td>1</td>
<td>1</td>
<td>100.00</td>
</tr>
<tr>
<td>Lagomorpha</td>
<td>Lepus sp.</td>
<td>jackrabbit or hare</td>
<td>113</td>
<td>1</td>
<td>.88</td>
</tr>
<tr>
<td></td>
<td>Sylvilagus sp.</td>
<td>cottontail</td>
<td>3400</td>
<td>6</td>
<td>.18</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>medium mammal</td>
<td>deer size or smaller</td>
<td>79</td>
<td>1</td>
<td>1.27</td>
</tr>
<tr>
<td>Falconiformes</td>
<td>Buteo sp.</td>
<td>hawks</td>
<td>2</td>
<td>1</td>
<td>50.00</td>
</tr>
<tr>
<td>Galliformes</td>
<td>Meleagris gallopavo</td>
<td>turkey</td>
<td>2153</td>
<td>25</td>
<td>4.60</td>
</tr>
<tr>
<td>Gruiformes</td>
<td>Grus canadensis</td>
<td>sandhill crane</td>
<td>1</td>
<td>1</td>
<td>100.00</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>large bird</td>
<td>birds larger than mallard</td>
<td>571</td>
<td>2</td>
<td>.35</td>
</tr>
<tr>
<td></td>
<td>medium bird</td>
<td>mallard size and smaller</td>
<td>45</td>
<td>1</td>
<td>2.22</td>
</tr>
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<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td>127</td>
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<tr>
<td><strong>Site Total</strong></td>
<td></td>
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<td>242</td>
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Table 4.10. Frequency of Cut Marks, Goodman Point Pueblo.

<table>
<thead>
<tr>
<th>Order</th>
<th>Taxon</th>
<th>Common Name or Description</th>
<th>NISP</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artiodactyla</td>
<td>Antilocapra americana</td>
<td>pronghorn</td>
<td>16</td>
<td>1</td>
<td>6.25</td>
</tr>
<tr>
<td></td>
<td>Odocoileus hemionus</td>
<td>mule deer</td>
<td>7</td>
<td>1</td>
<td>14.29</td>
</tr>
<tr>
<td>Lagomorpha</td>
<td>Sylvilagus sp.</td>
<td>cottontail</td>
<td>3400</td>
<td>2</td>
<td>.06</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>medium mammal</td>
<td>deer size or smaller</td>
<td>79</td>
<td>1</td>
<td>1.27</td>
</tr>
<tr>
<td>Galliformes</td>
<td>Meleagris gallopavo</td>
<td>turkey</td>
<td>2153</td>
<td>25</td>
<td>1.16</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>large bird</td>
<td>birds larger than mallard</td>
<td>571</td>
<td>2</td>
<td>.35</td>
</tr>
<tr>
<td><strong>Total</strong></td>
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<td><strong>Site Total</strong></td>
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Table 4.11. Frequency of Burning, Goodman Point Pueblo.

<table>
<thead>
<tr>
<th>Order</th>
<th>Taxon</th>
<th>Common Name or Description</th>
<th>NISP</th>
<th>Localized Burning</th>
<th>Burnt Black</th>
<th>Burnt White</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Number</td>
<td>Percent</td>
<td>Number</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Number</td>
<td>Percent</td>
<td>Number</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Number</td>
<td>Percent</td>
<td>Number</td>
</tr>
<tr>
<td>Artiodactyla</td>
<td><em>Antilocapra americana</em></td>
<td>pronghorn</td>
<td>16</td>
<td>1</td>
<td>6.25</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td><em>Odocoileus sp.</em></td>
<td>deer</td>
<td>46</td>
<td>2</td>
<td>4.35</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Medium artiodactyl</td>
<td>deer size</td>
<td>78</td>
<td>4</td>
<td>5.13</td>
<td>2</td>
</tr>
<tr>
<td>Carnivora</td>
<td><em>Canis sp.</em></td>
<td>dog, wolf, coyote</td>
<td>25</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Lagomorpha</td>
<td><em>Lepus sp.</em></td>
<td>jackrabbit or hare</td>
<td>113</td>
<td>2</td>
<td>1.77</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><em>Sylvilagus sp.</em></td>
<td>cottontail</td>
<td>3400</td>
<td>20</td>
<td>.59</td>
<td>29</td>
</tr>
<tr>
<td>Rodentia</td>
<td><em>Cynomys sp.</em></td>
<td>prairie dog</td>
<td>58</td>
<td>1</td>
<td>1.72</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td><em>Neotoma sp.</em></td>
<td>wood rat</td>
<td>350</td>
<td>1</td>
<td>.29</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Sciuridae</td>
<td>squirrels</td>
<td>39</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><em>Spermophilus variegatus</em></td>
<td>rock squirrel</td>
<td>175</td>
<td>1</td>
<td>.57</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><em>Thomomys sp.</em></td>
<td>pocket gopher</td>
<td>134</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Rodentia</td>
<td>rodents</td>
<td></td>
<td>91</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Large rodent</td>
<td>larger than wood rat</td>
<td>134</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>medium mammal</td>
<td>deer size or smaller</td>
<td>79</td>
<td>1</td>
<td>1.27</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>small mammal</td>
<td>jackrabbit size or smaller</td>
<td>845</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Galliformes</td>
<td><em>Meleagris gallopavo</em></td>
<td>turkey</td>
<td>2153</td>
<td>39</td>
<td>1.81</td>
<td>47</td>
</tr>
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<td></td>
<td>Tetraonidae</td>
<td>grouse</td>
<td>26</td>
<td>1</td>
<td>3.85</td>
<td>-</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>large bird</td>
<td>birds larger than mallard</td>
<td>571</td>
<td>3</td>
<td>.53</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>76</td>
<td>99</td>
<td>91</td>
<td>416</td>
</tr>
<tr>
<td>Site Total</td>
<td></td>
<td></td>
<td>129</td>
<td>334</td>
<td>416</td>
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</tbody>
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96
Table 4.12a. Skeletal Representation of some Intrusive Animals, Including Cranial, and Upper and Lower Forelimbs, Goodman Point Pueblo.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Mandible</th>
<th>Upper Forelimb</th>
<th>Lower Forelimb</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L R L R L R</td>
<td>L R L R</td>
<td>L R L R</td>
</tr>
<tr>
<td>Rock squirrel</td>
<td>1 1 1 2 1 1 1 1 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wood rat</td>
<td>1 1 1 1</td>
<td>1 2</td>
<td></td>
</tr>
<tr>
<td>Cottontail</td>
<td>1 1 1 1 1 1 1 1 1 4 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frog/Toad</td>
<td>1 1 1 1</td>
<td>1*</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.12b. Skeletal Representation of some Intrusive Animals, Including Pelvis Areas, and Upper and Lower Hind Limbs, Goodman Point Pueblo.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Sacrum</th>
<th>Innominate</th>
<th>Upper Hind Limb</th>
<th>Lower Hind Limb</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L R L R</td>
<td>L R L R</td>
<td>L R</td>
<td>L R</td>
</tr>
<tr>
<td>Rock squirrel</td>
<td>1 2 2 1 2 2 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wood rat</td>
<td>1 1 1 2 1 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cottontail</td>
<td>1 1 1 1 1 1 1 1 8 8 15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frog/Toad</td>
<td>1 2* 2* 1*</td>
<td></td>
<td></td>
<td></td>
</tr>
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</table>

Table 4.13. Description of Spatial Categories, Goodman Point Pueblo.

<table>
<thead>
<tr>
<th>Type</th>
<th>Number Excavated</th>
<th>Total NISP</th>
<th>Total UNI</th>
<th>% unidentified</th>
<th>Total NTAXA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midden</td>
<td>45</td>
<td>4118</td>
<td>4106</td>
<td>49.93</td>
<td>26</td>
</tr>
<tr>
<td>Masonry surface structure</td>
<td>18</td>
<td>1472</td>
<td>414</td>
<td>21.95</td>
<td>19</td>
</tr>
<tr>
<td>Masonry structure, type unknown</td>
<td>2</td>
<td>31</td>
<td>14</td>
<td>31.11</td>
<td>6</td>
</tr>
<tr>
<td>Aboveground kiva</td>
<td>12</td>
<td>453</td>
<td>300</td>
<td>39.84</td>
<td>12</td>
</tr>
<tr>
<td>Subterranean kivas</td>
<td>4</td>
<td>1164</td>
<td>136</td>
<td>10.46</td>
<td>11</td>
</tr>
<tr>
<td>Kiva, type unknown</td>
<td>7</td>
<td>348</td>
<td>223</td>
<td>39.05</td>
<td>14</td>
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</table>
Table 4.14. NISP and Percentages of Major Taxa within and between Three Major Spatial Contexts, Goodman Point Pueblo.

<table>
<thead>
<tr>
<th>Major Taxon</th>
<th>Midden NISP</th>
<th>Midden Percent</th>
<th>Percent in Total Identified Assemblage</th>
<th>Masonry Structure NISP</th>
<th>Masonry Structure Percent</th>
<th>Percent of Total Assemblage</th>
<th>Kiva NISP</th>
<th>Kiva Percent</th>
<th>Percent of Total Assemblage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cottontail</td>
<td>1294</td>
<td>31.42%</td>
<td>14.67%</td>
<td>674</td>
<td>44.84%</td>
<td>7.64%</td>
<td>1001</td>
<td>50.94%</td>
<td>11.35%</td>
</tr>
<tr>
<td>Jackrabbit</td>
<td>73</td>
<td>1.77%</td>
<td>0.83%</td>
<td>14</td>
<td>0.93%</td>
<td>0.16%</td>
<td>10</td>
<td>0.51%</td>
<td>0.11%</td>
</tr>
<tr>
<td>Artiodactyl</td>
<td>36</td>
<td>0.87%</td>
<td>0.41%</td>
<td>66</td>
<td>4.39%</td>
<td>0.75%</td>
<td>46</td>
<td>2.34%</td>
<td>0.52%</td>
</tr>
<tr>
<td>Turkey</td>
<td>1712</td>
<td>41.57%</td>
<td>19.41%</td>
<td>123</td>
<td>8.18%</td>
<td>1.39%</td>
<td>145</td>
<td>7.38%</td>
<td>1.64%</td>
</tr>
<tr>
<td>Carnivores</td>
<td>18</td>
<td>0.44%</td>
<td>0.20%</td>
<td>7</td>
<td>0.47%</td>
<td>0.08%</td>
<td>26</td>
<td>1.32%</td>
<td>0.29%</td>
</tr>
<tr>
<td>Rodents</td>
<td>273</td>
<td>6.63%</td>
<td>3.10%</td>
<td>378</td>
<td>25.15%</td>
<td>4.29%</td>
<td>219</td>
<td>11.15%</td>
<td>2.48%</td>
</tr>
<tr>
<td>Small Mammal</td>
<td>119</td>
<td>2.89%</td>
<td>1.35%</td>
<td>162</td>
<td>10.78%</td>
<td>1.84%</td>
<td>461</td>
<td>23.46%</td>
<td>5.23%</td>
</tr>
<tr>
<td>Medium Mammal</td>
<td>54</td>
<td>1.31%</td>
<td>0.61%</td>
<td>12</td>
<td>0.80%</td>
<td>0.14%</td>
<td>6</td>
<td>0.31%</td>
<td>0.07%</td>
</tr>
<tr>
<td>Large Bird</td>
<td>471</td>
<td>11.44%</td>
<td>5.34%</td>
<td>32</td>
<td>2.13%</td>
<td>0.36%</td>
<td>37</td>
<td>1.88%</td>
<td>0.42%</td>
</tr>
<tr>
<td>Other Birds</td>
<td>68</td>
<td>1.65%</td>
<td>0.77%</td>
<td>35</td>
<td>2.33%</td>
<td>0.40%</td>
<td>14</td>
<td>0.71%</td>
<td>0.16%</td>
</tr>
<tr>
<td>Total</td>
<td>4118</td>
<td>100.00%</td>
<td>46.69%</td>
<td>1503</td>
<td>100.00%</td>
<td>17.04%</td>
<td>1965</td>
<td>100.00%</td>
<td>22.28%</td>
</tr>
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</table>
Table 4.15. NISP between Different Types of Masonry Structures, Goodman Point Pueblo.

<table>
<thead>
<tr>
<th>Order</th>
<th>Taxon</th>
<th>Common Name or Description</th>
<th>Masonry Surface Structure</th>
<th>Masonry Structure, Type Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artiodactyla</td>
<td><em>Antilocapra americana</em></td>
<td>pronghorn</td>
<td>9</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Cervidae</td>
<td>cervids</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td><em>Odocoileus hemionus</em></td>
<td>mule deer</td>
<td>6</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td><em>Odocoileus</em> sp.</td>
<td>deer</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><em>Ovis canadensis</em></td>
<td>bighorn sheep</td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Medium artiodactyl</td>
<td>deer size</td>
<td>31</td>
<td>1</td>
</tr>
<tr>
<td>Carnivora</td>
<td><em>Canis</em> sp.</td>
<td>dog, wolf, coyote</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td><em>Lynx</em> sp.</td>
<td>lynx/bobcat</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td><em>Taxidea taxus</em></td>
<td>badger</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Lagomorpha</td>
<td>Lagomorpha</td>
<td>rabbits and hares</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td><em>Lepus</em> sp.</td>
<td>jackrabbit or hare</td>
<td>14</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td><em>Sylvilagus</em> sp.</td>
<td>cottontail</td>
<td>665</td>
<td>9</td>
</tr>
<tr>
<td>Rodentia</td>
<td><em>Cynomys</em> sp.</td>
<td>prairie dog</td>
<td>21</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><em>Neotoma</em> sp.</td>
<td>wood rat</td>
<td>130</td>
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</tr>
<tr>
<td></td>
<td>Rodentia</td>
<td>rodents</td>
<td>48</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Sciuridae</td>
<td>squirrels</td>
<td>26</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td><em>Spermophilus</em> sp.</td>
<td>ground squirrel</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td><em>Spermophilus variegatus</em></td>
<td>rock squirrel</td>
<td>60</td>
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<tr>
<td></td>
<td><em>Thomomys</em> sp.</td>
<td>pocket gopher</td>
<td>20</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Large rodent</td>
<td>larger than woodrat</td>
<td>24</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Small rodent</td>
<td>wood rat size or smaller</td>
<td>44</td>
<td>-</td>
</tr>
<tr>
<td>Miscellaneous Mammals</td>
<td>medium mammal</td>
<td>deer size or smaller</td>
<td>12</td>
<td>-</td>
</tr>
<tr>
<td>-----------------------</td>
<td>---------------</td>
<td>----------------------</td>
<td>----</td>
<td>---</td>
</tr>
<tr>
<td>small mammal</td>
<td>jackrabbit size or smaller</td>
<td>161</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Columbiformes</td>
<td>Columbiformes</td>
<td>pigeons and doves</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>Galliformes</td>
<td>Galliformes</td>
<td>grouse, etc.</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Meleagris gallopavo</td>
<td>turkey</td>
<td>111</td>
<td>12</td>
<td>-</td>
</tr>
<tr>
<td>Phasianidae</td>
<td>quail</td>
<td>2</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Tetraonidae</td>
<td>grouse</td>
<td>2</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Gruiformes</td>
<td>Gruiformes</td>
<td>cranes, etc.</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Mimidae</td>
<td>mockingbirds and thrashers</td>
<td>2</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Strigiformes</td>
<td>Strigiformes</td>
<td>owls</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>Miscellaneous Birds</td>
<td>large bird</td>
<td>birds larger than mallard</td>
<td>30</td>
<td>2</td>
</tr>
<tr>
<td>medium bird</td>
<td>mallard size and smaller</td>
<td>16</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>small bird</td>
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<td>414</td>
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<td></td>
<td><strong>1886</strong></td>
<td><strong>45</strong></td>
<td></td>
</tr>
</tbody>
</table>
Table 4.16. NISP between Different Kiva Types, Goodman Point Pueblo.

<table>
<thead>
<tr>
<th>Order</th>
<th>Taxon</th>
<th>Common Name or Description</th>
<th>Aboveground Kiva</th>
<th>Subterranean Kiva</th>
<th>Kiva, Type Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artiodactyla</td>
<td><em>Antilocapra americana</em></td>
<td>pronghorn</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Cervidae</td>
<td>cervids</td>
<td>-</td>
<td>14</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><em>Odocoileus hemionus</em></td>
<td>mule deer</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><em>Odocoileus</em> sp.</td>
<td>deer</td>
<td>1</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Medium artiodactyl</td>
<td>deer size</td>
<td>7</td>
<td>-</td>
<td>6</td>
</tr>
<tr>
<td>Carnivora</td>
<td><em>Canis</em> sp.</td>
<td>dog, wolf, coyote</td>
<td>2</td>
<td>-</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td><em>Lynx</em> sp.</td>
<td>lynx/bobcat</td>
<td>5</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><em>Taxidea</em> taxus</td>
<td>badger</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Lagomorpha</td>
<td>Lagomorpha</td>
<td>rabbits and hares</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><em>Lepus</em> sp.</td>
<td>jackrabbit or hare</td>
<td>2</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td><em>Sylvilagus</em> sp.</td>
<td>cottontail</td>
<td>198</td>
<td>623</td>
<td>180</td>
</tr>
<tr>
<td>Rodentia</td>
<td><em>Cynomys</em> sp.</td>
<td>prairie dog</td>
<td>3</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><em>Neotoma</em> sp.</td>
<td>wood rat</td>
<td>13</td>
<td>49</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Rodentia</td>
<td>rodents</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Sciuridae</td>
<td>squirrels</td>
<td>2</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><em>Spermophilus variegatus</em></td>
<td>rock squirrel</td>
<td>16</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td><em>Thomomys</em> sp.</td>
<td>pocket gopher</td>
<td>7</td>
<td>14</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Large rodent</td>
<td>larger than woodrat</td>
<td>11</td>
<td>22</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Small rodent</td>
<td>wood rat size or smaller</td>
<td>13</td>
<td>18</td>
<td>7</td>
</tr>
<tr>
<td>Miscellaneous Mammals</td>
<td>medium mammal</td>
<td>deer size or smaller</td>
<td>4</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>small mammal</td>
<td>jackrabbit size or smaller</td>
<td>44</td>
<td>374</td>
<td>41</td>
</tr>
<tr>
<td>Columbiformes</td>
<td>Columbiformes pigeons and doves</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>---------------------------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>Falconiformes</td>
<td>Falconiformes vultures, hawks, eagles</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Galliformes</td>
<td>Meleagris gallopavo turkey</td>
<td>89</td>
<td>27</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>Phasianidae</td>
<td>quail</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Tetraonidae</td>
<td>grouse</td>
<td>4</td>
<td>-</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Passeriformes</td>
<td>Hirundinidae swallows</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Strigiformes</td>
<td>Strigiformes owls</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>Birds</td>
<td>27</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Birds</td>
<td>birds larger than mallard</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Unidentified</td>
<td></td>
<td>300</td>
<td>136</td>
<td>223</td>
<td></td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td></td>
<td>753</td>
<td>1300</td>
<td>571</td>
<td></td>
</tr>
</tbody>
</table>
Figure 4.1. Site level percentages between three major spatial contexts.
Figure 4.2. Best tit line through midden units, Goodman Point Pueblo.
Figure 4.3. Best fit line through masonry units, Goodman Point Pueblo.
Figure 4.4. Best fit line through kiva units, Goodman Point Pueblo.
Figure 4.5. Percentage of taphonomic effects within each structural context among three major spatial contexts.

Figure 4.6. Relationship between NTAXA and NISP between midden units, Goodman Point Pueblo.

\[ y = -0.0142 \text{ NISP}^{0.4181} \]
\[ r = 0.938, R^2 = 0.8795, p = 0.000 \]
Figure 4.7. Relationship between NTAXA and NISP between midden units excluding outliers, Goodman Point Pueblo.

Figure 4.8. Relationship between NTAXA and NISP between masonry structure units, Goodman Point Pueblo.
Figure 4.9. Relationship between NTAXA and NISP between masonry structure units excluding outlier, Goodman Point Pueblo.

\[ y = 0.0629 \text{NISP}^{-0.4008} \]
\[ r = 0.952, R^2 = 0.9059, p = 0.000 \]

Figure 4.10. Relationship between NTAXA and NISP between kiva units, Goodman Point Pueblo.

\[ y = 0.1467 \text{NISP}^{0.3273} \]
\[ r = 0.827, R^2 = 0.6842, p = 0.000 \]
Figure 4.11. Distribution of four common southwestern taxa across three spatial contexts, Goodman Point Pueblo.
Figure 4.12. The location of Goodman Point Pueblo and other surrounding Pueblo III villages. 
Note: Figure given to author by Crow Canyon Archaeological Center 2010.
CHAPTER 5

GOODMAN POINT PUEBLO AND THE ABANDONMENT OF THE CENTRAL MESA VERDE REGION

To examine whether the abandonment of Goodman Point Pueblo is linked to a change in the exploitation of faunal resources I use a combination of ecological prey and patch choice models. Archaeologists use foraging theory models, originally derived from ecological models used with animals, to help explain relationships between humans and their prey. Prey and patch choice models make predictions about which kinds of animals should be pursued by foragers given particular conditions, and how foragers should exploit prey across different environmental habitats (Charnov 1976; Kaplan and Hill 1992; MacArthur and Pianka 1966; Stephens and Krebs 1986). If resource exploitation patterns changed significantly during the late Pueblo III period, these models could help explain why the ancestral Puebloans abandoned specific villages such as Goodman Point Pueblo.

Prey Choice

The prey choice model concentrates on whether a forager will pursue or ignore a prey item when it is encountered on the landscape (Stephens and Krebs 1986). The forager ranks prey based on energetic or caloric return. Diet breadth, or the range of taxa taken into the forager’s diet, will expand to incorporate high-ranked resources first then the next resource in ranking until a point of diminishing returns is reached and adding more lower-ranked species would produce lower return rates than the mean foraging return rate (Kaplan and Hill 1992). The number of species incorporated and abundances of those species also depends on the encounter rate with high ranked prey (Stephens and Krebs 1986). Therefore, when high-ranked prey are abundant on the landscape they should be a major part of the diet, then the mean foraging return rate should be high, and diet breadth will be relatively narrow. In this situation, foraging efficiency is higher.
as foragers concentrate on high-ranked taxa because of higher caloric return with relatively little effort. If high-ranked prey are rare, then the mean foraging return rate will be lower. If that mean return rate is significantly lower, then diet breadth should be broader, incorporating more lower-ranked prey. Foraging efficiency will be lower since more effort has to be put into obtaining the same net caloric returns (MacArthur and Pianka 1966; Nagaoka 2002; Stephens and Krebs 1986).

At Goodman Point I examine how changes in foraging efficiency may have played a role in the abandonment of the village and of the region. If abandonment was related to reduced food resource availability, then I expect that foraging efficiency declined, which should be reflected in a decrease in the abundance of high-ranked taxa relative to low-ranked ones. To measure foraging efficiency I use the artiodactyl index, which compares the abundance of artiodactyls as a representative of the large/high-ranked taxon relative to lagomorphs, which are the small/low-ranked taxon (Bayham 1979). All artiodactyls found at Goodman Point are included in this index, which varies between zero and one. Artiodactyls become more common as the index moves closer to one. In addition, if foraging efficiency declined significantly then diet breadth may have expanded to include more low-ranked taxa. If foraging efficiency declined significantly the diet breadth may have expanded. For example, if the artiodactyl index is closer to zero more lower-ranked prey are incorporated into the diet and diet breadth expanded to make up for the loss of higher-ranked prey (Szuter and Bayham 1989; Wolverton 2002). Diet breadth is measured by richness of the number of taxa (NTAXA) exploited. An increase in NTAXA would indicate a broader diet. Since sample size is known to have an effect on richness (Grayson 1984; Lyman 2008) I evaluate if any patterns in the data are related to sample size or actually reflect changes in diet breadth.
The cause for the decline in foraging efficiency is generally assumed to be caused by harvest pressure or resource depression. The argument is that they large- to small-bodied prey index decreased because large-bodied taxa declined as a result of human hunting pressure. However, the decline in the index could also be caused by shifts from large to small prey that are related to decreased availability of prey on the landscape and/or environmental change (Charnov et al. 1976). For example, the index value may be low because the low-ranked taxon (e.g., lagomorphs) increased as a result of environmental conditions that favored an increase in the abundance of this taxon. Prey could also develop a change in behavior, such as increased alertness or changes in the microhabitat could alter prey abundances (Charnov et al. 1976). To evaluate these possibilities, evidence for more favorable environmental conditions for rabbits is examined by examining trends from dendrochronological data from the central Mesa Verde region and human landscape alteration.

A low index value can also be due to a technological innovation that allowed more small-bodied prey to be harvested efficiently. An example of this is mass capture techniques that increase the harvest unit from one individual to a group of individuals, such as jackrabbit corralling popular with the Hohokom (Schmidt 1999). I examine if there is evidence for mass capture of lagomorphs at Goodman Point Pueblo.

Finally, there are several assumptions that need to be kept in mind when using the prey choice model. This model assumes that foragers always maximize their foraging efficiency and that calories correlate with fitness (Nagaoka 2002; Stephens and Krebs 1986). Also, the prey choice model states that prey is randomly distributed on a homogenous landscape, and therefore, there is equal probability of encountering specific species (Smith 1991; Stephens and Krebs...
Thus, the patch choice model was created to divide the landscape into smaller units across space.

Patch Choice

When prey are not randomly distributed across space, the clusters of prey are treated as separate patches and the prey choice model is applied to each patch separately. Patch choice models build on the assumptions of the prey choice model and examine how foragers select patches to exploit and how much time they spend within a specific patch.

Similar to prey, patches are ranked on the basis of net returns (MacArthur and Pianka 1966). The number of patches increases until the optimum number of patches is reached or there are no further gains in adding more lower-ranked patches (same as adding species to diet). Because the MacArthur and Pianka (1966) model does not take into account resource depression, the decrease in the availability of a particular resource, the Marginal Value Theorem (MVT) was developed (Charnov 1976).

MVT addresses how long a forager should remain inside a particular patch given that net returns are declining as the forager exploits the patch. The model predicts that a forager will leave when the net rate for that patch is lower than the average return rate (Charnov 1976). If a patch is depleted a forager will go to the next ranked patch keeping in mind traveling costs. Because MVT assumes that encounter rates within patches decreases as a forager moves through a patch MVT can be used to predict how patches are added as foraging efficiency declines. If there is resource depression there may not be enough regeneration time within a particular patch then exploitation within patches becomes more intensive with more time and effort spent within the patch (Broughton 1999; Cannon 2000).
To examine if there is a shift in patch time allocation two indices are used. First, the lagomorph index is used to show if there is a shift between utilizing jackrabbits or cottontails. The index compares the ratio of cottontails to lagomorphs (cottontails and jackrabbits), and is often used to illustrate differences in environment (Szuter and Bayham 1989). Jackrabbits are adapted to open prairies, whereas cottontails have developed adaptations to forested environments (Best 1996; Chapman et al. 1982; Findley 1964; Orr 1940). If this index shows a ratio of one then all lagomorphs are cottontail, while zero would mean all lagomorphs are jackrabbits. Foragers should exploit the jackrabbit patch first because it is the highest-ranked patch. If jackrabbits decline their patch drops in rank to one lower than what the cottontails are in. Thus, if this occurs more time would be spent collecting cottontails. However, using this index I have to assume cottontails and jackrabbits cannot be encountered within the same environmental areas and that both taxa are the highest ranked taxon in their patches. A shift in patch use could also be related to environmental change; therefore, long-term environmental trends are examined.

The turkey index examines time allocated to extracting resources from the environment versus producing food via domestication (Spielman and Angstadt-Leto 1996: 90). Domesticating turkey uses a different investment cost; there is extra investment into raising turkeys but low pursuit cost. Driver (2002a) included all LBI (fragments from large birds) into this index and this has become standard practice (e.g., Badenhorst and Driver 2009; Driver 2002b; Kuckelman 2010; Muir and Driver 2002; Szuter and Bayhem 1989). If the index is one then turkey is present and there are no lagomorphs in the sample and if the index is zero there is no turkey present in the assemblage. It is also assumed that turkeys are domesticated, as there is eggshell and gizzard stones, but no turkey pens and few broken bones are present at Goodman Point Pueblo.
Similar to the lagomorph index, environmental changes are investigated because they could alter the ability to successfully invest in raising turkey.

**Goodman Point Pueblo Faunal Assemblage**

Within prey and patch choice models I first examine trends at Goodman Point Pueblo, followed by an analysis of long term trends in particular faunal resources within the San Juan region. Examining long term trends aids in understanding how Goodman Point Pueblo compares with other villages in the region. After long term trends are examined temporal change within Goodman Point and nearby Sand Canyon Pueblos are analyzed by comparing secondary (midden deposits) and abandonment (de facto) refuse, or refuse left behind during the abandonment process within structural contexts (Schiffer 1972). The sample size at both villages between these two contexts is adequate. Sand Canyon has a total of 3,968 remains from secondary refuse and 2,674 from abandonment refuse (Kuckelman 2010), while Goodman Point has an estimated 4,169 from secondary refuse and 3,441 from abandonment. Within the pueblos counts for both types of refuse exclude intrusive remains, including small rodents, reptiles, amphibians, and other taxa not related to human occupation discussed in Chapter 4. Also, although different activities occur in different areas of villages (e.g., White 1932, 1962) taphonomic factors are minimal within each context and similar between these two contexts, as can be seen at Goodman Point Pueblo (Tables 5.1-5.2). In abandonment contexts there is more weathering, rodent, and carnivore damage to the remains, whereas within secondary refuse there are more localized and burnt black bones. Bones found within the abandonment context are more likely weathered and/or gnawed on by animals because these remains are typically related to collapsed structures where falling rocks could expose bones to the elements and rodents could hide and gnaw on bones within crevices (Chapman and Feldhamer 1982; Hoffmeister 1986). Burned bones are
more common within secondary refuse because this refuse is more likely related to consumption of animals. I also assume when examining short term trends at the site level that de facto refuse was not used at the same time as areas where secondary refuse was deposited. One issue with this assumption is that some buildings within the village were abandoned before others and therefore, accumulated secondary refuse (e.g., Reid 1974).

Prey Choice at Goodman Point

From the prey choice model I expected that foraging efficiency should be relatively low if subsistence changes played a role in abandonment at Goodman Point. The artiodactyl index is extremely small (.04), indicating that artiodactyls are relatively rare at the village and on the landscape. Thus, foraging efficiency is quite low.

The low foraging efficiency at Goodman Point Pueblo appears to be part of a long term trend in artiodactyl depopulation in the San Juan region. Badenhorst and Driver (2009) analyzed 559 faunal assemblages spanning from Basketmaker II to Pueblo III in the San Juan region. The artiodactyl index gradually decreased over time (Figures 5.1 - 3). During Pueblo III (Figure 5.3) there is the largest difference in index groupings, where nearly 80 percent have an artiodactyl index between .0 and .2. Goodman Point also compares favorably to other nearby villages, however it is slightly higher than the late Pueblo III average, calculated from 13 small Pueblo III sites in the vicinity of Sand Canyon Pueblo (Table 5.3) (Muir and Driver 2002). Driver (2002a) and Schollmeyer and Driver (2010) show that the large clusters of villages around the McElmo region usually posses low artiodactyl indices, while Pueblo III villages around Mesa Verde with denser woodlands and lower population densities have higher artiodactyl indices. Schollmeyer and Driver (2010) believe this trend stems from the ability for deer to live in higher elevations in woodlands away from large concentrations of people. These are considered “source” populations
for deer, and when source areas produced a surplus deer would move into “sink” areas closer to
heavily hunted and densely populated areas of the landscape (Schollmeyer and Driver 2010).
Villages closer to the “source” populations had greater access to deer, and therefore show higher
artiodactyl indices (Schollmeyer and Driver 2010).

Examining in closer detail just before the total abandonment of the region at Goodman
Point and nearby Sand Canyon Pueblo (Figure 5.4) the artiodactyl index slightly increases from
.03 to .06. Sand Canyon shows a slightly higher jump in their artiodactyl index, perhaps because
of artiodactyl remains being left within the multiple tower complexes of the village (Muir 1999,
2007). The long term regional decrease in artiodactyls leads up to a tipping point during
abandonment times. When people begin to slowly abandon the villages artiodactyl populations
are less likely impacted and rebound (e.g. Schollmeyer and Driver 2010).

While sustained hunting pressure on artiodactyls may be the reason for the low foraging
efficiency the artiodactyl index could have decreased at Goodman Point Pueblo for a number of
reasons. Artiodactyls could have decreased on the landscape because of overexploitation,
behavioral change, and/or changes in the microhabitat (Charnov et al. 1976). Deer prefer to live
along forest edges (Hanley 1983). An increase in population and aggregated villages during
Pueblo III resulted in more land clearing (Duff and Wilshusen 2000; Kohler and Matthews 1988;
Kohler et al. 2009; Mahoney et al. 2000; Varien et al. 2000), and larger villages with dense
human populations tend to have a wider impact on the landscape (Hamilton and Watt 1970).
Finally, taphonomic effects do not appear to be a significant factor in the abundance of deer
remains, as there is limited natural modification, such as little weathering and few instances of
cultural modifications found on faunal remains at Goodman Point. Overall, there are few remains
of artiodactyls found at Goodman Point Pueblo. At the end of Pueblo III, artiodactyls only
account for typically less than five percent of the identified faunal remains in villages around Goodman Point (Muir and Driver 2002).

The low artiodactyl index could also have been caused by factors that increased the abundance and/or harvest rate of lagomorphs. Rabbits could change in abundance within the village because of environmental change, technological innovations, and/or taphonomic factors. First, natural environmental conditions vary overtime. During the end of Pueblo III the region was in a cold spell from the little ice age and under a several year drought (Benson and Berry 2009; Petersen 1988). Rabbits and deer live in a variety of habitats (Best 1996; Chapman et al. 1982; Hesselton and Hesselton 1982; Mackie et al. 1982); therefore, their abundances were likely not significantly changed because of natural climatic variation. However, deforestation caused by increased human populations could have allowed more lagomorphs and less deer to inhabit the region, as deer prefer to live along forest edges, jackrabbits prefer open landscapes, and cottontails can survive in areas with large population densities (Adams and Bowyer 2002; Best 1996; Kohler and Matthews 1988). Secondly, it is known that the Hohokom in the Southwest used nets to mass capture jackrabbits (Schmidt 1999; Shaffer and Gardner 1995). Unfortunately, because of the netting material, as well as exposed open air sites, few large nets have been found in the region (McGregor 1941). However, hunting technology did not seem to significantly change throughout the Pueblo III time period in the region (McGregor 1941; Shaffer and Gardner 1995). Thus, there is no evidence that rabbit procurement increased relative to artiodactyls because of improved technology. Finally, taphonomic effects do not appear to be a significant factor in the abundance of either deer or rabbit remains. The faunal material from the site is relatively well-preserved with little carnivore damage that may remove artiodactyls from the assemblage and little weathering that may preferentially affect rabbits.
So, foraging efficiency declined significantly from Pueblo I to Pueblo III, and the artiodactyl index was quite low during the late Pueblo III period as seen at Goodman Point Pueblo. If the decline in foraging efficiency was significant, diet breadth may have increased. To evaluate this expectation, diet breadth from samples deposited before abandonment and from abandonment contexts are compared (Table 5.4). Abandonment and secondary refuse share 19 of the same genera. There are minimal amounts of each unique species between the different contexts. Within the abandonment context there are mockingbirds and swallows, while secondary refuse has American coot, fox, long-tailed weasel, raven, duck, and woodpecker. The difference between these two contexts could be due to sample size, as higher sample sizes tend to have more species (Grayson 1984; Lyman 2008). These spatial contexts also represent different activities, as secondary refuse results from long term accumulation and abandonment, and de facto refuse results in effects of the abandonment process (Schiffer 1972, 1983). Along with slight differences between these two contexts when comparing NISP to NTAXA, the artiodactyl index is also slightly higher during abandonment than in secondary refuse. In this case, diet breadth may not have changed as much as abundances in particular taxa. Perhaps, the ancestral Puebloans ate everything they could and when there was no long enough food to support them they abandoned the village.

Patch Choice at Goodman Point

Since it appears that there is a significant decline in foraging efficiency in the San Juan region over time as seen in the choice of prey taken, changes in patch choice are also expected. Not only is there a change in the San Juan region in prey choice over time, but there is also a shift in patch use on the landscape according to the lagomorph and turkey indices. The indices
indicate the use of both low-ranked cottontail prey and domesticated resources by the ancestral Puebloans during Pueblo III.

In the entire San Juan region the lagomorph index gradually increased across time (Figures 5.5 - 7) according to the faunal assemblages examined by Badenhorst and Driver (2009) and is slightly higher in more northern villages because of the more mesic landscape (Badenhorst and Driver 2009; Chapman et al. 1982). From Basketmaker II to Pueblo I (Figure 5.5) jackrabbits and cottontails are typically taken in nearly even amounts, then during Pueblo II there is a fairly even distribution across different index values (Figure 5.6). It isn’t until Pueblo III that 50 percent of villages begin to show indices between .9 and 1 (Figure 5.7). The variation and evenness of this index is likely from the variation in microhabitats, as cottontail tend to prefer the mesic northern San Juan area and jackrabbits proliferate more in the southern San Juan area where there are more open landscapes (Best 1996; Chapman et al. 1982; Findley 1964; Orr 1940).

This long term trend of increasing lagomorph indices continues throughout Pueblo III in villages nearby Goodman Point Pueblo and is especially high at Goodman Point Pueblo (.96) (Table 5.3). Examining in closer detail just before the abandonment of the region between Sand Canyon and Goodman Point the lagomorph index continues to increase (Figure 5.8). At Goodman Point the index rises to .99. This trend suggests the continued use and dependence on the cottontail patch during the depopulation of the region.

While a shift in patch allocation may be the reason for the abundance of cottontails, the lagomorph index could be high because of a change in the environment. Jackrabbits tend to thrive in more arid southern regions and open landscapes of the southern Southwest, while cottontails prefer higher rainfall and mesic vegetation common in the northern San Juan region.
(Best 1996; Chapman et al. 1982; Findley 1964; Orr 1940). There were cooler temperatures along with a multi year drought during the occupation of Goodman Point Pueblo (Benson and Berry 2009; Petersen 1988). Jackrabbits long ears do aid in thermoregulation in drier climate; however, the cyclical nature of the droughts over time likely did not alter the abundance of either animal as they are adapted to a variety of temperatures (Best 1996; Chapman et al. 1982). Also, several authors state that a high abundance of cottontails is related to the use of “garden hunting” around the villages (Linares 1976; Rea 1979). Agriculture was practiced at Goodman Point Pueblo; however, several species (even deer) are attracted to garden settings not just cottontails (Schollmeyer and Coltrain 2009).

Since it appears that there is a significant decline in foraging efficiency in the San Juan region over time as seen in the choice of prey taken and with the lagomorph index, changes between wild and domesticated patches are expected.

The turkey index gradually increased through time in the San Juan region, and is more widely distributed than other indices during Pueblo III (Figures 5.9 - 11). Approximately 80 percent of sites in the San Juan region had turkey indices between .0 to .2 from Basketmaker II and Pueblo I (Figure 5.9). Turkeys were rarer on the landscape and typically only used for ritual purposes until Basketmaker III when evidence of turkey domestication appeared (Munro 1994, 2006). During Pueblo II (Figure 5.10) populations began to increase and turkey became more popular as a food source (Kohler et al. 2009; Munro 1994, 2006). Villages during Pueblo III show a wide range in turkey domestication (Figure 5.11) likely related to various microclimates within the Southwest (Schorger 1966). Goodman Point, located in the northern San Juan region, a better dry land farming location than other southern areas, shows nearly even use of turkey domestication and wild resources (.48) (Benson 2011). Typically, villagers will not solely rely on
domesticated resources, but will continue to use wild mammals, especially small mammals as larger, high-ranked game decreases in abundance on the landscape (Szuter 1991a). Also, larger villages with higher population densities increase the ability of specialization and can more easily allocate resources towards domestication (McGregor 1941). Specialization within larger villages along with a decline in high-ranked taxa increased the use of turkeys in many, but not all areas, of the Southwest (Badenhorst and Driver 2009; Driver 2002b; Muir and Driver 2002).

During Pueblo III at the villages surrounding Goodman Point Pueblo the turkey index continued to increase through time (Table 5.3). Goodman Point, however, shows a decrease in the use of domesticated turkey perhaps because of its late occupation (approx. A. D. 1260 - 1280). Further evidence at Goodman Point Pueblo includes the lack of re-healed breaks on the wings and legs of turkey also show the decline in domestication. Within the villages of Sand Canyon and Goodman Point during abandonment the turkey index dramatically decreased (Figure 5.12). Likely, the decrease in available corn and in manpower as people began to leave the village did not allow occupants to continue to keep up with the demands of domestication.

Similar to the lagomorph index, the turkey index could change throughout time because of environmental change. Cold spells along with drought during Pueblo III diminished the ability to grow corn with dryland farming in an already semi-arid climate (Benson and Berry 2009; Peterson 1988). If crops were no longer growing, turkey, which feed on crops, could no longer be as supported (Rawlings and Driver 2010). Turkeys not only need food but need 500ml to 1 litre (1/2 to 1 qt) of water a day and thrive in intermountain regions between 1,800 m to 3,050 m (6,000ft to 10,000 ft) in elevation (Schorger 1966). Water was nearby Goodman Point Pueblo and nearly always available, but not nearly as available in the same abundances as during wet cycles (WPI 2011). Also, in general the northern San Juan area held the most potential for
dryland farming, along with the soil type, cooler climate, and tolerable elevations to grow crops (Benson 2011). Although the drought during this time could have altered the availability of water and food to feed turkeys there were no previous cyclical shifts in turkey domestication associated with cyclical droughts throughout the ancestral Pueblan occupation of the region.

Discussion

Goodman Point is the end point of a long trend of declining foraging efficiency in the northern San Juan region. Artiodactyls as well as jackrabbits decline over time as cottontails and turkeys become more popular in the ancestral Pueblan diet in the San Juan region (e.g., Badenhorst and Driver 2009; Driver 2002b; Muir and Driver 2002). Although all instances of environmental changes, technological innovations, and other issues cannot be completely ruled out at Goodman Point the long-term trends in prey choice suggest that resource depression occurred on the landscape. It appears that as human populations increased and settled into more aggregated settings their effects on the landscape radiated out and altered the habitat around the villages, the effects of which included a major decline in artiodactyl populations in the region (e.g., Badenhorst and Driver 2009; Driver 2002b; Hamilton and Watt 1970; Muir and Driver 2002; Schollmeyer and Driver 2010). For example, deforestation resulting from land clearing for villages and the use of agriculture decreased the forest edge that deer prefer and likely degraded soil nutrients (Benson 2011; Hanley 1983; Kohler and Matthews 1988). Not only artiodactyls, but jackrabbits were likely influenced by human alteration of the landscape. Cottontails hide within shrubs and if these habitats were left behind they could have remained in higher populations relative to jackrabbits, who prefer open landscapes to flee from predators (Adams and Bowyer 2002; Chapman et al. 1982; Driver and Woiderski 2008). Jackrabbits could also have been disturbed by large human villages, while cottontails are more suited to live close to
villages (Driver and Woiderski 2008). For example, in areas with the highest populations
densities (the northern San Juan) 85 percent of villages have a lagomorph index greater than .80
(Driver and Woiderski 2008). As these high-ranked resources were depleted lower-ranked
resources such as rabbits became more important and were added into the diet of the ancestral
Puebloans. Even increased capture of cottontails, weighing only one to 3 lbs (Chapman et al.
1982), and turkey versus deer, averaging 76 lbs in live weight (Mackie et al. 1982), likely did not
make up for the drastic loss in the caloric return of large game animals. The focus on nearby
game during Pueblo III could also be related to decreasing food resources, climate and
environmental change, overpopulation, and violence during Pueblo III (e.g., Benson and Berry
2009; Duff and Wilshusen 2000; Kohler et al. 2009; Kuckelman et al. 2002; Mahoney et al.

Then, as the final abandonment loomed the last occupied villages showed a decrease in
the use of domesticated resources, likely from the loss of manpower, and began to revert back to
capturing wild resources, focusing on capturing cottontails (Kuckelman 2010). Specialization
allocated to specific resources, more popular at the beginning of Pueblo III with denser human
populations, likely decreased during the depopulation of the northern San Juan area. Also, some
wild populations could have rebounded, such as deer, when human populations began to
decrease (Schollmeyer and Driver 2010).

Conclusion

Prey and patch choice models illustrate that trends found at Goodman Point
Pueblo are typical of the region and relate to resource depression and other long term changes
throughout the San Juan region. Faunal remains from Goodman Point Pueblo are well preserved,
however, both natural and human induced environmental changes, and perhaps changes in
technological innovations, could have influenced the abundances of some game over time. However, the most likely explanation is resource depression in artiodactyls and perhaps jackrabbits, which caused an increasing use of cottontails and turkey on the landscape close to the villages in the northern San Juan area (e.g., Badenhorst and Driver 2009; Driver 2002b; Muir and Driver 2002). It appears that large human populations altered the landscape, radiating out and using more resources at a faster pace than before, thus, decreasing the abundance of high-ranked resources and shifting patch allocation (Hamilton and Watt 1970). The data suggests that at the very end of the ancestral Puebloan occupation in the central Mesa Verde region they transition again back to hunting and gathering rather than continue to rely on domesticated resources.
Table 5.1. Total (NISP + UNI) of Natural Modifications between Abandonment and Secondary Refuse, Goodman Point Pueblo.

<table>
<thead>
<tr>
<th></th>
<th>Moderate Weathering</th>
<th>Highly Weathered</th>
<th>Pathological</th>
<th>Rodent Damage</th>
<th>Carnivore Damage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abandonment</td>
<td>76</td>
<td>16</td>
<td>2</td>
<td>113</td>
<td>4</td>
</tr>
<tr>
<td>Secondary</td>
<td>45</td>
<td>8</td>
<td>2</td>
<td>96</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 5.2. Total (NISP + UNI) of Cultural Modifications between Abandonment and Secondary Refuse, Goodman Point Pueblo.

<table>
<thead>
<tr>
<th></th>
<th>Modified Bone</th>
<th>Cut Marks</th>
<th>Localized Burning</th>
<th>Burnt Black</th>
<th>Burnt White</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abandonment</td>
<td>51</td>
<td>15</td>
<td>31</td>
<td>53</td>
<td>216</td>
</tr>
<tr>
<td>Secondary</td>
<td>165</td>
<td>30</td>
<td>77</td>
<td>264</td>
<td>178</td>
</tr>
</tbody>
</table>

Table 5.3. A Comparison of Pueblo III Indices around the Sand Canyon Area and at Goodman Point Pueblo. Early, Mid and Late Pueblo III.

*Note:* Data from Muir and Diver (2002).

<table>
<thead>
<tr>
<th></th>
<th>Early Pueblo III</th>
<th>Mid Pueblo III</th>
<th>Late Pueblo III</th>
<th>Goodman Point Pueblo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artiodactyl Index</td>
<td>.07</td>
<td>.06</td>
<td>.01</td>
<td>.04</td>
</tr>
<tr>
<td>Lagomorph Index</td>
<td>.86</td>
<td>.86</td>
<td>.93</td>
<td>.96</td>
</tr>
<tr>
<td>Turkey Index</td>
<td>.4</td>
<td>.56</td>
<td>.69</td>
<td>.48</td>
</tr>
</tbody>
</table>

*Note:* Data from Muir and Diver (2002).

Table 5.4. NISP and NTAXA for Abandonment and Secondary Refuse, Goodman Point Pueblo.

<table>
<thead>
<tr>
<th></th>
<th>NISP</th>
<th>NTAXA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abandonment</td>
<td>3490</td>
<td>21</td>
</tr>
<tr>
<td>Secondary Refuse</td>
<td>4239</td>
<td>25</td>
</tr>
</tbody>
</table>
Figure 5.1. Artiodactyl indices from the San Juan Region from Basketmaker II to Pueblo I. 
*Note:* Data from Badenhorst and Driver (2009); represents 66 sites.

Figure 5.2. Artiodactyl indices from the San Juan region during Pueblo II. 
*Note:* Data from Badenhorst and Driver (2009); represents 85 sites.
Figure 5.3. Artiodactyl indices from the San Juan region during Pueblo III.  
Note: Data from Badenhorst and Driver (2009); represents 91 sites.
Figure 5.4. Artiodactyl indices for secondary and abandonment refuse at Goodman Point and Sand Canyon Pueblos. 

*Note:* Sand Canyon Data from Kuckelman (2010).

![Figure 5.4](image)

Figure 5.5. Lagomorph indices from the San Juan region from Basketmaker II to Pueblo I. 

*Note:* Data from Badenhorst and Driver (2009); represents 52 sites.

![Figure 5.5](image)
Figure 5.6. Lagomorph indices from the San Juan region during Pueblo II. 
Note: Data from Badenhorst and Driver (2009); represents 72 sites.

Figure 5.7. Lagomorph indices from the San Juan region during Pueblo III. 
Note: Data from Badenhorst and Driver (2009); represents 80 sites.
Figure 5.8. Lagomorph indices for secondary and abandonment refuse at Goodman Point and Sand Canyon Pueblos.

*Note:* Sand Canyon Data from Kuckelman (2010).
Figure 5.9. Turkey indices from the San Juan region from Basketmaker II to Pueblo I. 
*Note:* Data from Badenhorst and Driver (2009); represents 59 sites.
Figure 5.10. Turkey indices from the San Juan region during Pueblo II. 
Note: Data from Badenhorst and Driver (2009); represents 89 sites.
Figure 5.11. Turkey indices from the San Juan region during Pueblo III. 
*Note:* Data from Badenhorst and Driver (2009); represents 97 sites.
Figure 5.12. Turkey indices for secondary and abandonment refuse at Goodman Point and Sand Canyon Pueblos.

*Note:* Sand Canyon Data from Kuckelman (2010).
The collapse of societies is a multidimensional, complex process. In the central Mesa Verde region during Pueblo III human occupation peaked along with violence, climatic stress, and diminishing food resources (e.g., Benson and Berry 2009; Driver 2002b; Duff and Wilshusen 2000; Kohler et al. 2009; Kuckelman et al. 2002; Mahoney et al. 2000; Varien et al. 2000). Analysis of faunal remains from Goodman Point Pueblo, in the center of the central Mesa Verde region and one of the last villages to be occupied, allows for more insight on dietary stress before the region was completely abandoned.

When identifying faunal remains from Goodman Point Pueblo I used a conservative approach, mirroring that of other zooarchaeologists who analyzed faunal remains for Crow Canyon Archaeological Center to allow for consistency (i.e. Driver 1992a). It is important to explicitly state why I identified specimens because of potential issues related to lack of experience and differences in both modern comparative collections and identification manuals (Driver 1992a; Gobalet 2001). Also, being explicit allows for a better understanding of my research intentions for this project as well as allowing for setting standardized methods for working with other scientific disciplines (Lyman 2006; Wolverton et al. 2011).

Faunal distributions and trends found at Goodman Point Pueblo are similar to other nearby Pueblo III villages in the central Mesa Verde region, including Sand Canyon (Muir 1999; 2007), Yellow Jacket (Muir and Driver 2003), Woods Pueblo (Driver 2002a), and Castle Rock (Driver 2000). For example, the semi-arid environment allowed for excellent preservation of faunal material from Goodman Point Pueblo. 14,414 specimens were identified at Goodman Point and of these approximately 60 percent were identified as mammals, birds, reptiles, or
amphibians. Species represented at Goodman Point Pueblo are commonly found in southwestern Colorado. Overall, the ancestral Pueblos at Goodman Point Pueblo concentrated on nearby local food resources, obtaining a large amount of turkey and cottontail and few artiodactyls and jackrabbits. Evidence of more rare species, such as bighorn sheep (*Ovis canadensis*) and long-tailed weasel (*Mustela frenata*) suggests long distance travel to more montane environments (Lawson and Johnson 1982; Svendsen 1982).

Overall, faunal remains at Goodman Point are well-preserved throughout the village. Weathered bone and carnivore damage is slightly more common in masonry structures. Rodent damage is one of the most common natural taphonomic effects and is more common in masonry structures where most rodent remains were found, as rodents enjoy living within the crevices in collapsed rubble (Chapman et al. 1982; Hoffmeister 1986). Bone tools, awls, whistles, jewelry, and other modified bone found at Goodman Point show specialization was common during the height of Pueblo III (McGregor 1941). Burned bones were more commonly found in middens and kivas associated with food use and hearths, and as expected as the degree of burning increased, the ability to identify specimens to finer taxonomic levels decreased (Johnson 1989; Knight 1985).

As expected via ethnographic accounts and other site reports from the surrounding area (e.g., Driver 2000, 2002a; Gnabasik 1981; Muir 1999, 2007; Muir and Driver 2003; White 1932, 1962) there are significant differences in the types of faunal abundances across spatial contexts at Goodman Point Pueblo. Middens had the highest abundances of turkey found within the site (approximately 20 percent) and slightly higher percentage of jackrabbits compared to structures (.8 percent of the site versus .16 percent and .11 percent within the masonry structures and kivas). Artiodactyls were more common within masonry structures (.75 percent) and kivas (.52
percent) than within middens (.41 percent). Cottontails were the most common taxon in masonry structures (9 percent) and kivas (11 percent), and were also well represented within the middens (15 percent). When all three structures are compared using NISP and NTAXA kivas as a whole possess fewer taxa than masonry structures and middens. This could either be due to the everyday activities that would occur in the masonry structures and middens, while kivas are reserved for ceremonial or special use areas or the abundance of fragmented calcined bones within kivas.

Also, the area around the great kiva (Block 1200), D-shaped bi-wall structure, and Kiva 107 represent unique structural units within Goodman Point Pueblo. The structure around the great kiva as well as the midden surrounding the D-shaped bi-wall structure housed more taxonomic diversity when compared to its sample size. This could be related to their use as a village level gathering places, and rooms surrounding ceremonial or special use areas within the village typically have storage space for items used during site-level gatherings (Lipe and Ortman 2000). Also, the surrounding midden, with less taxonomic diversity compared to its sample size could be due to more intensified use of animal carcasses within this area. Even though Kiva 107 is not considered a significant outlier when examining trends between NISP and NTAXA it contains the highest abundance of cottontail remains found anywhere within Goodman Point Pueblo. The diversity of species and NISP is similar to that of one of the largest midden areas excavated within the village. Also, a large proportion of small mammal remains, likely cottontail, were found within the kiva, leading to the notion that several almost complete skeletons of cottontails were present. Because of the remains’ depositional context and absence of burrows, cottontail remains were likely deposited culturally within the kiva. Also, with the abundance of animal remains it was perhaps one of the first structures to be abandoned at
Goodman Point. When structures are abandoned they can be used as areas for secondary refuse (e.g., Reid 1974). This area could have also been used as a storage area for whole carcasses, but typically other masonry structures are used for such purposes (Gnabasik 1981; Muir 1999; White 1932, 1962). Further research should investigate ceremonial or special uses of cottontails associated with kivas at other nearby villages to help explain this phenomenon.

Similar to Sand Canyon Pueblo and other nearby Pueblo III villages Goodman Point Pueblo shows the importance of turkey and cottontail overall during Pueblo III time period, and the decline in domesticated resources prior to the end of occupation within the village. Although there could be several causes for the appearance of particular indices used to measure changes in foraging efficiency it is likely human occupants played a considerable role in altering food resources over time and at Goodman Point (e.g., Badenhorst and Driver 2009; Driver 2002b; Driver and Woiderski 2008; Muir and Driver 2002). During Pueblo III populations reached their peak within the central Mesa Verde region (e.g., Duff and Wilshusen 2000; Kohler et al. 2009). Along with environmental issues, such as cold spells and drought, larger population densities likely lead to faster degradation of the surrounding environment (Benson and Berry 2009; Hamilton and Watt 1970; Petersen 1988). Also, inhabitants altered the surrounding landscapes with the formation of larger villages and agricultural practices, and therefore, likely pushed away deer and jackrabbit populations (e.g., Adams and Bowyer 2002; Chapman et al. 1982; Driver and Woiderski 2008; Hanley 1983; Kohler and Matthews 1988). When high-ranked prey become rare on the landscape, more low-ranked prey, such as cottontails, were incorporated into the inhabitants’ diet to make up for the loss of caloric value from higher-ranked resources and patch ranks were also altered as different patches became more efficient on the landscape, in this case turkey domestication within the villages (e.g., Badenhorst and Driver 2009; Charnov 1976;
Driver 2002b; Driver and Woiderski 2008; Kaplan and Hill 1992; MacArthur and Pianka 1966; Muir and Driver 2002). However, closer to the end of Pueblo III, prior to when the ancestral Puebloans permanently left southwestern Colorado, turkey use within the villages decrease along with little evidence of turkey domestication within the region (Clinton et al. 2011; Kuckelman 2010; Munro 1994, 2006). The only pathological damage on turkey remains at Goodman Point, for example, was on foot phalanges which can happen naturally in the wild (Robin Lyle pers. comm. 2010/11) along with some evidence of eggshell and gizzard stones. However, other signs of domestication, such as turkey pens, were not found at Goodman Point Pueblo. Further evidence of decreasing turkey domestication is the abundance of turkey bones in middens and few turkey bones in “abandonment” contexts at both Goodman Point and Sand Canyon Pueblo (Kuckelman 2010).

In conclusion, as population densities increased within the central Mesa Verde region during Pueblo III coupled with climatic changes and cultural landscape alterations populations increased over what the environment could support (e.g., Benson and Berry 2009; Duff and Wilshusen 2000; Kohler et al. 2009). Several other issues occurred typically seen with decreasing foraging efficiency, including violence, shifts in settlement patterns, migration and intensification of lower-ranked resources (e.g., Broughton et al. 2010; Duff and Wilshusen 2000; Kuckelman et al. 2002; Mahoney et al. 2000; Varien et al. 2000). Diminishing wild resources seen at Goodman Point Pueblo and in surrounding villages lead to dietary stress prior to the complete abandonment of the region. Also, trends in faunal resources seen within Goodman Point correlate with long term trends already seen throughout the central Mesa Verde region during the end of Pueblo III (e.g., Badenhorst and Driver 2009; Driver 2002b; Driver and Woiderski 2008; Muir and Driver 2002).
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