Heath Site (39LN15): Faunal and Floral Analysis of a Great Oasis Site

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ABSTRACT

As of yet, no final analysis of the Heath Site (39LN15), a Great Oasis site located in southeastern South Dakota, has been prepared. Two preliminary reports (Hannus, Winham and Lueck 1986) have been published concerning the 1974 and 1976 excavations. Even so, only the large mammal bones, ceramics and lithics have been analyzed. This research paper analyzes both the faunal and floral assemblages. The entire faunal assemblage was entered into an Access database and analyzed for NISP, MNI, meat weight calculations to determine the importance of specific resources, as well as aid in the environmental reconstruction of the region. Soil samples analyzed for floral remains were from a hearth feature excavated during the second round of excavations in 1974. Additional charcoal samples were also analyzed for non-wood floral remains. These remains assist in answering questions concerning the subsistence pattern and seasonality of the Great Oasis culture as well as provide environmental indicators of the region.

INTRODUCTION

The Heath Site (39LN15), located in northeastern Lincoln County, South Dakota, see Figure 1, has been identified as a terminal Late Woodland - Great Oasis site. The Great Oasis culture is a sedentary, agricultural Native American culture located throughout southwestern Minnesota, southeastern South Dakota, northeastern Nebraska and northwestern Iowa. Identification of a site as Great Oasis is based primarily on pottery. Great Oasis pottery lacks Middle Mississippian influenced pottery traits specifically handle types, shell tempering and other elements which are not present in Great Oasis sites but in the Initial Middle Missouri culture. The Great Oasis cultures had subterranean, rectangular houses, which contained internal storage pits and hearths and external storage pits. Settlements and houses are also smaller than of the later Middle Missouri culture. As of 2005, only six Great Oasis houses have been excavated, including the one from the Heath Site, of which only two have been thoroughly reported (Lensink and Tiffany 2005). The remains of either coyotes or medium-sized domesticated dogs have been found in Great Oasis sites indicated that these people harvested them on occasion (Morrow, Vanderford and Sisler 2005; Semken and Graham 1996; Bozell and Rogers 1989; Snyder 1991; Hannus 2004). The Great Oasis culture also typically grew domesticated maize and perhaps Goosefoot (*Chenopodium)*, as well as harvested local non-cultivated plants. Bison scapula hoes, used in agriculture, have been recovered from the Heath Site. Floral remain analysis would provide additional evidence for the cultivation of plants and agriculture.

However, much remains unknown about the Great Oasis culture. Only ten major Great Oasis culture sites have been excavated, including the Heath Site, and only three of them have fully published reports (Johnson 2007). Given the lack of published data, any generalizations about the Great Oasis culture are difficult to evaluate. There is also debate among archaeologists whether the Great Oasis culture precedes or is a part of the Initial Middle Missouri tradition. Initial Middle Missouri culture is dated approximately 1000-1250 A.D, while Lensink and Tiffany (2005) propose Great Oasis is dated approximately 950-1100 A.D. Ceramics and lithics have also been recovered, as well as faunal and floral remains including a bison scapula hoe, a nearly complete articulated bison vertebral column and charcoal. As of now, no formal evaluation of the Heath Site excavation or collection has been published. A preliminary statement (Hannus 1974) on the 1974 excavation was published and an evaluation of the archaeological collection is still in progress (Hannus, Winham and Lueck 1986). Even so, the three decades since excavation and various effects of curation complicate analysis.

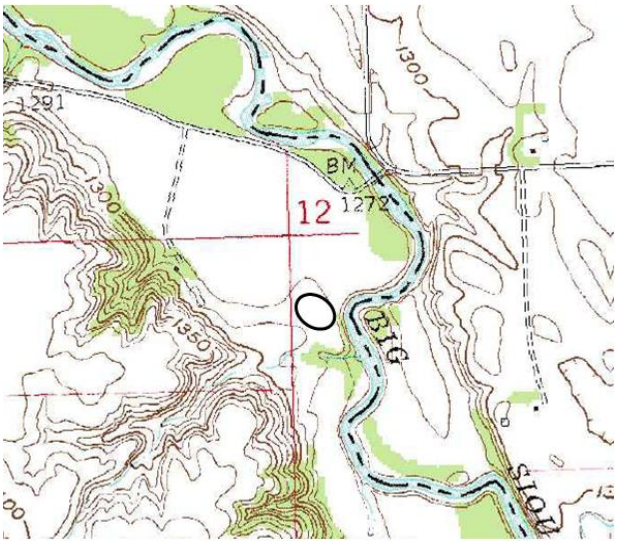

Figure 1. Heath Site (39LN15) location, denoted by the circle, along the Big Sioux River in Lincoln County, South Dakota. Site location based on Biggs 1975 report (Source USGS 1962)

RESEARCH OBJECTIVES

Analysis of faunal and floral remains and the application of environmental archaeology give us information on the subsistence pattern of the indigenous population and are environmental indicators of contemporary climate and environmental change. Microfauna are great indicators of environmental change, since their reproduction cycles are shorter, any kind of environmental stress is easily apparent by examining these populations. Additionally, some microfauna are part of the subsistence basis of the indigenous population while others can indicate if the population was using agriculture. Work done at the West Broken Kettle Great Oasis and Pammel Creek sites shows that faunal and floral remains can also yield seasonality information (Baerreis 1970; Theler 1989; Arzigian 1989a). Analysis of pit features and associated artifacts and remains has also been conducted to examine seasonality and site usage (Arzigian et al. 1989b). The season when certain species were harvested for subsistence in turn indicates the season that the site was inhabited. The relative proportion of exploited faunal remains indicates the population's dependence on these resources for food. It is also important to realize that certain faunal remains may have been traded for uses other than subsistence; shellfish and mussels can be used as food or their shells for temper in ceramics or shell hoe manufacture (Theler 1991).

This project analyzed the faunal access database and the floral assemblage currently housed at UW-L on loan from Augustana College. Additionally, two radiocarbon samples were submitted for dating to provide further evidence for the temporal distribution of the Great Oasis culture. The floral assemblage consisted of a hearth feature, which lacked any labeled provenience information, as well as several boxes of carbon/charcoal samples and one box of seeds recovered during excavation. Only one sample, which was stored with the faunal assemblage, consisted of a water-screened sample of a fire pit feature. This water screened sample contained identifiable and non-identifiable bone fragments, charcoal, and primarily corn fragments along with other seeds. This absence of flotation has several implications for analysis. First, smaller rodent bones were most likely present at the site, but due to the presumed ¼ inch screened excavation methods were not recovered. Second, micro-floral remains are limited at the site in lieu of more exotic artifacts like bison bones, lithics and ceramics. Both these implications are discussed more fully in the corresponding faunal and floral sections.

BACKGROUND

Heath Site Excavations

Excavations of the Heath Site were undertaken in 1974 and 1976. While first discovered in 1973 during a cultural resource survey for a prospective transmission line, excavations began in 1974 with a field school led by Dr. L. Adrien Hannus of Augustana College (Hannus, Winham and Lueck 1986). These excavations involved the second (middle) and third (upper) terraces. In June 1974, John Sigstad and student volunteers continued excavation left open by the previous field school in which a fire pit, basin shaped pits and a possible posthole suggesting a possible house, making the total of Great Oasis houses unearthed six (Biggs 1975; Lensink and Tiffany 2005). The

1976 joint field school continued excavation on the third terrace resulting in the unearthing of an earthlodge house and associated cache pits labeled (Hannus, Winham and Lueck 1986). Excavation methods are not well described. While the plowzone in several northern units was not screened due to lack of time near the end of the field season, screen sizes and methods are not published. Given the type of material recovered, excavations most likely used ¼ inch mesh screens. Grids are excavated in 10cm levels after removal of the Plowzone designated: Level I: Plowzone (0-20cm), Level II: 20-30cm, Level III: 30-40cm, Level IV: 40-50cm, Level V: 50-60cm below datum. If the plowzone extended further below the surface, then the next level was labeled the next designated level. Additionally, at least one soil sample was obtained from the field to be floated.

Soils Description

Soil identification of the site region was obtained from the USDA National Resources Conservation Service (National Cooperative Soil Survey 2010), see Figure 2. Additional soil descriptions were gathered from the USDA NRCS Official Soil Series Descriptions (Soil Survey Division 2010).

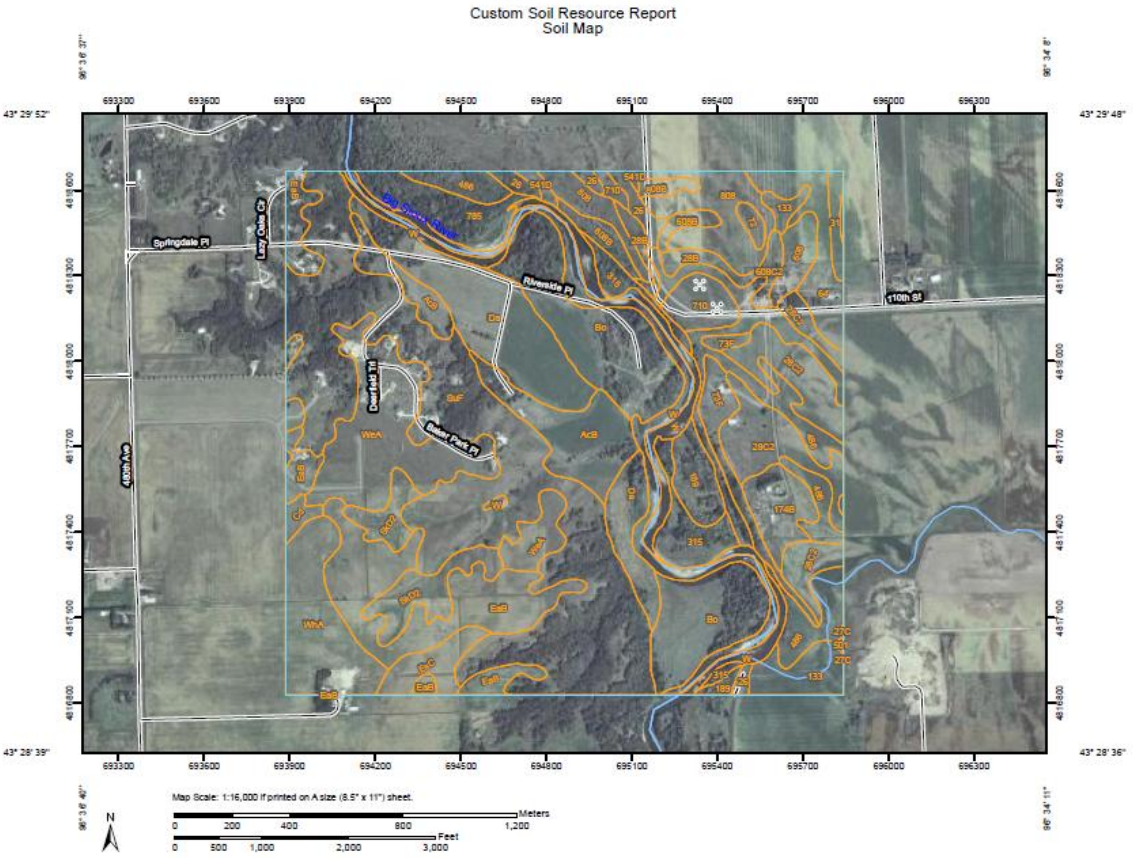

Figure 2. Soil map of the Heath Site location (Source: National Cooperative Soil Survey 2010)

While there are many soil types in the area, only four soil types were found in significant quantities and locations seen as influencing the site. The site itself is located entirely on Alcester silty clay loam (AcB) soil. AcB are found in 4% of the area, and signify 2-6 percent slopes. These soils are used to grow modern corn, oats, soybeans and alfalfa. Native grasses include big bluestem, little bluestem, green needlegrass, sideoats grama and needle and thread. Neighboring soils include Bon (Bo), Davis loam (Da), and Steinauer-Shindler clay loams (SuF) soils. In combination, they account for 38.6% of the soils in the Area of Interest (AOI). The largest concentration of soil is Steinauer-Shindler clay loams, located on 2-60 percent slopes. The SuF soil accounts for 19.6% of the AOI. Least sloping areas are used today for crops like corn, soybeans, grains and alfalfa. Steeply sloped areas grow native grasses such as big and little bluestem, Indian grass, and green needle grass. Trees are also commonly

supported in these soils including bur oak, elm, ash, basswood, ironwood and cottonwood. Bon soils (Bo) are the second most frequent soil in the area (8.4%) and are frequently flooded. These soils are used to grow corn, alfalfa, other small grains and feed crops. Native grasses include big bluestem, needle grass, switch grass, western wheatgrass and forbs. The soil also supports trees. Overall, the soils in the region are currently used for agriculture and easily could have been used for such a purpose in the prehistoric record. Agriculture of the three sisters (maize beans and squash) could easily have been cultivated by the Great Oasis culture.

Radiocarbon Dates

Two samples were submitted to The University of Georgia Center for Applied Isotope Studies on January 8th 2010. The results of the dating are shown in Table 1. Both samples were selected from charcoal size graded 5mm mesh or larger from within the 30-40 level of a hearth feature with unknown provenience. This hearth feature is presumed to have been excavated during the 1974 excavations; the discussion regarding the provenience information is discussed more fully in the floral analysis section. At the time of selection of material for dating, this hearth feature was the only charcoal present.

Table 1. Radiocarbon dates

UGAMS#	Sample ID	Radiocarbon ^{13}C Corrected	$\delta^{13}C$ (‰)
05912	39LN15 #1	1590±20	-24.5
05913	39LN15 #2	1580±25	-25.9

Before dating, the samples were treated to remove possible contamination of humic acids by treating the sample with a 5% HCl at 80^{o} C for 1 hour, washed with deionized water and rinsed with a diluted solution of NaOH. After that, the sample was treated with a diluted HCl solution, washed with deionized water and then dried at 60^{o}C. The sample was combusted using the Parr bomb, of which the recovered carbon dioxide was cryogenically purified, converted to benzene and the $^{13}C/^{12}C$ ratio was measured using a stable isotope ratio mass spectrometer. The sample's activity was recorded using the liquid scintillation analyzer Packard Tri-carb 1050 and reported as a radiocarbon age. Years before present (YBP) was calculated using the ^{14}C half-life of 5568 years (Cherkinsky 2010). The sample was corrected for isotope fractionation, but the date still needed calibration.

The amount of carbon varies year-by-year requiring calibration of radiocarbon dates for accurate dating. Calibration was done using the CALIB Radiocarbon Calibration (Stuiver, Reimer and Reimer 2010). Sample 39LN15 #1 was found to date between 422 and 536A.D. with a two sigma range, while sample 39LN15 #2 was calibrated to 422-541 AD with a two sigma range. Figure 3 graphs the date range of these dates. While the individual sigma ranges are different, on a whole the second sigma ranges of both samples cover essentially the same range.

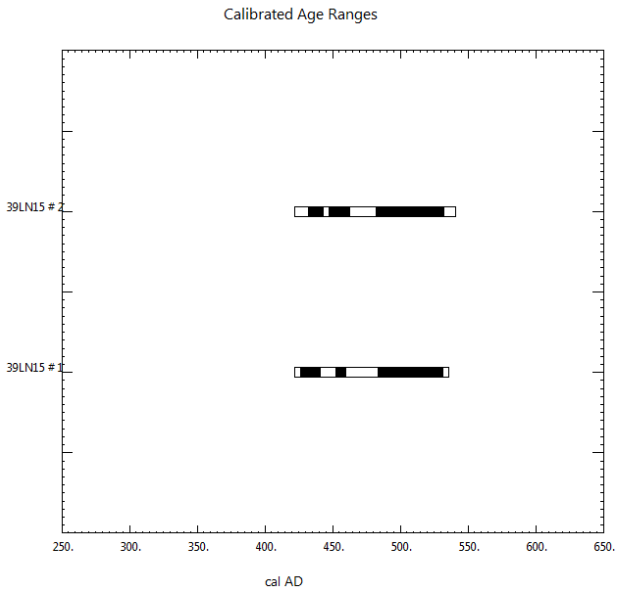

Figure 3. Calibrated radiocarbon dates distribution (Stuiver, Reimer and Reimer 2010)

While the dates show consistency and reliability, these dates do not fit with previously published dates of Great Oasis occupations near 950-1100 A.D. (Lensink and Tiffany 2005). Only one other date has been tested from this site. It dated to 940 +/-195 BP, or 815-1205, however this date is not very precise or reliable as the 1-sigma range is over 100 years (Johnson 2007). Instead, the new dates suggest an occupation closer to 422-541 AD, several hundred years earlier during the Middle to early Late Woodland period. Great Oasis is believed to have originated in the Late Woodland culture. Late Woodland has generally been believed to be non-agriculturalists due to the lack of cultivated crops like corn (Falk and Semken 1990). However, this is most likely due to the lack of or small flotation samples obtained from sites. The lack of flotation samples is also witnessed in the excavation methods of the Heath Site, as discussed later. Additionally, it is possible that the earlier date is caused by a contaminated sample. Samples were taken from charcoal samples stored in small plastic medical containers, stored in cardboard boxes most likely since their excavation. It is also possible that the samples were gathered from old wood used by Great Oasis peoples, or that there may have coincidentally been an earlier Late Woodland occupation in the same location.

FAUNAL METHODS AND DATA

The Microsoft Access faunal database was assembled previously by Dr. Hannus and contained catalogue, provenience information and element descriptions for all faunal remains recovered during excavations. The mollusk assemblage had not yet been identified. J. Theler analyzed and identified the mollusks in March 2009. This information was appended as a table, "Naiad Mollusks", to the faunal database, and the larger faunal assemblage table "LN15 Fauna." Queries were conducted to find the total sum of NISP per taxon. MNI calculations were done independently looking at the most commonly reported element and side. Several methods were used to analyze the faunal assemblage. NISP, MNI and meat weight contributions were used to determine the relative frequency of animals and the basis of the subsistence pattern. The site yielded an unusual distribution of gopher remains, which led to a discussion about the role of rodents found at the site and the possibility of garden hunting as a subsistence strategy. The habitats of animals recovered were also used to determine the local environment. The variety of qualitative approaches allowed analysis of many aspects of the faunal assemblage.

Faunal Assemblage

The Heath assemblage contained a total of 4,758 recovered bones and bone fragments, with 250 identifiable specimens (NISP) and a minimum number of individuals (MNI) of 73 at the genus and species level. Table 2 lists the animals identified from the Heath Site.

Table 2. List of archaeological recovered animals from across the Heath Site

	Scientific Name	Common Name	NISP	MNI
Amphibia	*Rana pipiens*	Northern Leopard Frog	1	1
Reptiles	*Emydoidea blandingii*	Blanding's turtle	1	1
Osteichthyes	*Catoslemidae*	Sucker	1	1
Aves	*Anas platyrhynchos*	Mallard duck	5	1
	Anas rubripes	American Black Duck	2	1
	Branta canadensis	Canada Goose	4	1
	Pelecanus erythrorhynchos	American White Pelican	1	1
Mamalia	*Antilocapra americana*	Pronghorn	1	1
	Bison bison	American Bison	67	1
	Canis sp.	Dog	7	1
	Castor canadensis	American Beaver	11	1
	Geomys bursarius	Plains Pocket Gopher	63	7
	Lutra canadensis	River Otter	2	1
	Mephitis mephitis	Striped Skunk	1	1
	Microtus ochrogaster	Prairie Vole	1	1
	Mustela vison	American Mink	2	1
	Odocoileus sp.	Deer	5	1
	spermophilus sp.	Ground Squirrels	6	2
	Vulpes vulpes	Red Fox	1	1
Naiads	Total Mollusks		69	48

Using NISP, mollusks, bison and plains pocket gophers dominate the assemblage, see Figure 4. MNI shows that while bison have the second most identified specimens, only one individual is represented. Yet, mollusks and plains pocket gophers have the largest minimum number of individuals, see Figure 5.

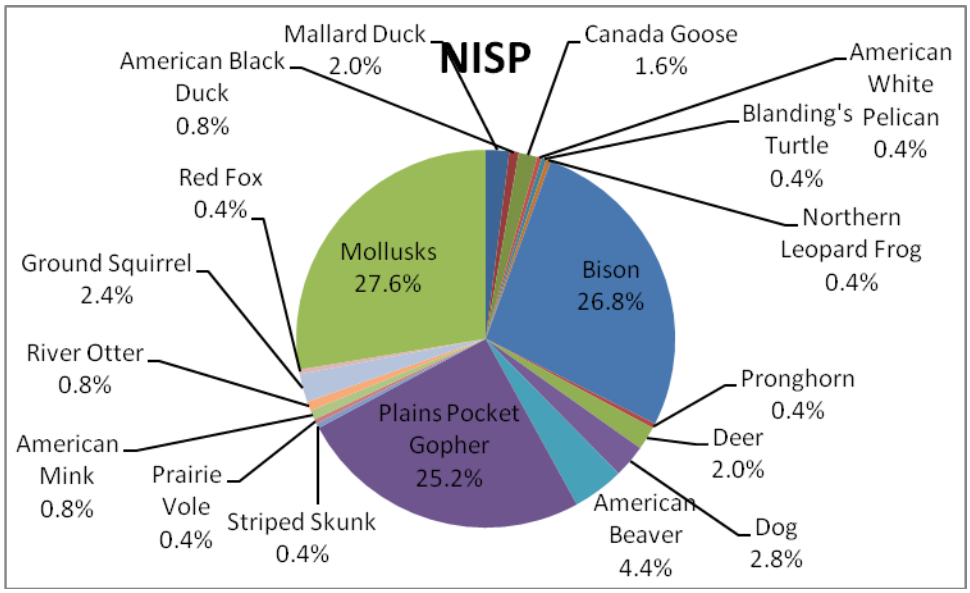

Figure 4. Heath Site faunal assemblage distribution using NISP (N=250)

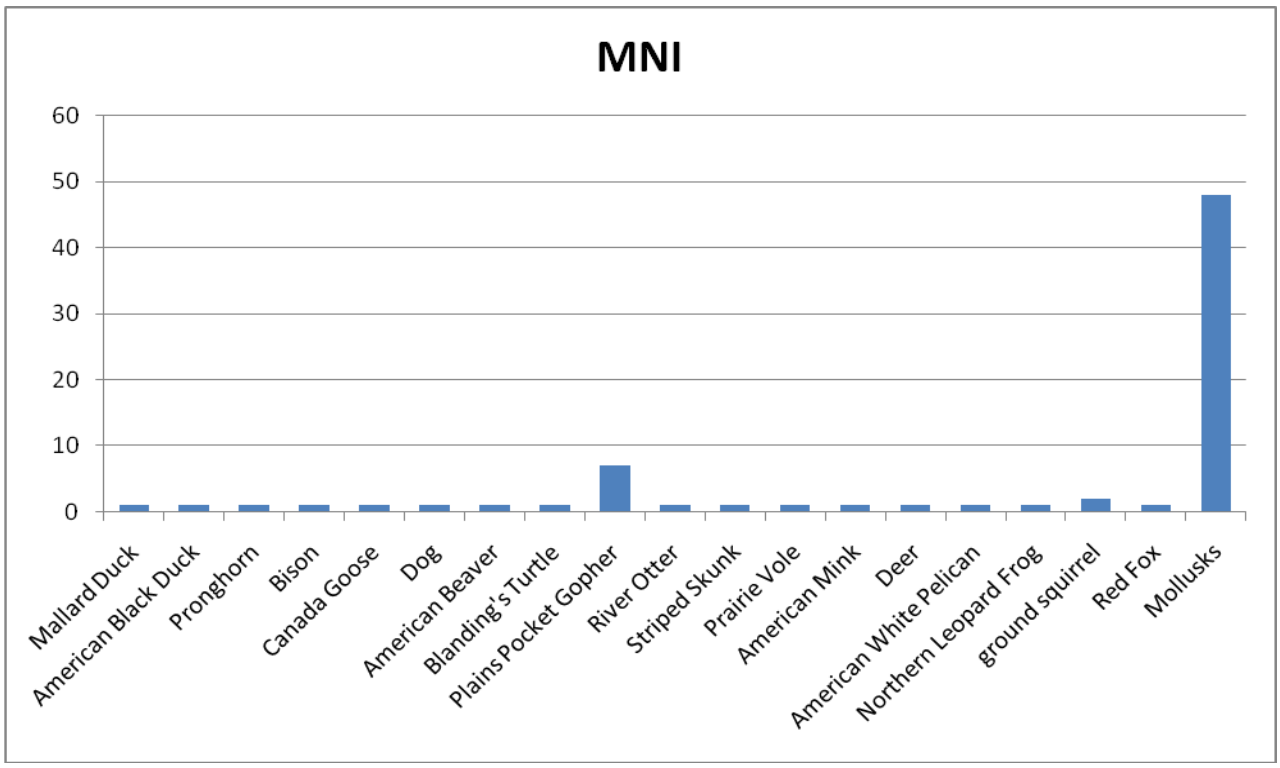

Figure 5. Heath Site faunal assemblage distribution using MNI (MNI=73)

While mollusks appear to dominate the faunal assemblage in both the MNI and NISP calculation, it should be noted that these remains are often more identifiable. With only two valves representing an individual, mollusks have fewer elements to consider when making a MNI calculation. Otherwise, the plains pocket gopher also appears to contribute a significant portion of the MNI population. Looking at NISP, an interesting trio emerges between mollusks, gophers and bison elements recovered. Both these patterns emerge even if you categorize the individual animals into categories (birds, small mammals, large mammals, mollusks, etc.). Without the mollusks in the MNI distribution, the plains pocket gopher, and the ground squirrel have the next largest percent of the population.

Mollusks

Of the mollusk assemblage, a total of 69 elements and nine different species were identified, see Table 3. In both, the NISP and MNI calculation, *Ligumia recta* and *Lampsilis cardium* dominate the mollusk assemblage although they provide a small percentage of the edible meat contribution, to be discussed later.

Table 3. Mollusks recovered by species, NISP and MNI

Subfamily	Taxon	Common Name	NISP	MNI
Anodontinae	*Alasmindonta marginata (Say)*	Elktoe	1	1
Anodontinae	*Lasmigona complanata (Barnes)*	White Heelsplitter	1	1
Ambleminae	*Quadrula pustulosa (Lea)*	Pimpleback	3	2
Ambleminae	*Fusconaia flava (Rafinesque)*	Wabash Pigtoe	8	5
Ambleminae	*Fusconaia flava (Rafinesque)*	small stream form	3	2
Lampsilinae	*Leptodea fragilis (Rafinesque)*	Fragile Papershell	6	3
Lampsilinae	*Potamilus alatus (Say)*	Pink Heelsplitter	2	2
Lampsilinae	*Ligumia recta (Lamarck)*	Black Sandshell	22	17
Lampsilinae	*Lampsilis siliquoidea (Barnes)*	Fatmucket	2	2
Lampsilinae	*Lampsilis cardium (Rafinesque)*	Plain pocketbook	21	13
	Totals		69	48

Large Mammals

While bison account for 27% of the NISP calculation, there is a MNI of one bison recovered from the site. The difference in these calculations does not diminish the importance of bison in the subsistence. Instead, it indicates that although there was a minimum of one bison recovered, there were many recovered elements, which can indicate good soil preservation. Likewise, there is a MNI of one individual for deer and pronghorn represented at this site. As we will see later, while large mammals have fewer individuals present at the site, these animals have a more significant meat weight contribution.

Small Mammals

The role of small mammals in the diets of prehistoric peoples is not clear; only a few plain sites indicate rodents were part of the subsistence. The Rainbow Site (Falk and Semken 1990) in Iowa unearthed a surprising 209 MNI of plains pocket gophers (*Geomys bursarius*), accounting for 82% of all recovered rodents indicating a cultural influence in the accumulation of rodents at the site. In Horizon C, a minimum number of 97 individuals (77%) of an MNI of 126 rodent remains recovered were identified as gophers, of which 79 individuals (81%) were recovered in association with structure 1 or associated outlying features. Additionally, there was a higher recovery rate of cranial elements as opposed to postcranial elements. Of the 97 individuals recovered in that Horizon, only 65 postcranial elements (accounting for a MNI of 5) were recovered indicating that there was a cultural selection for gopher heads. In the same horizon, cranial and post cranial elements of the more fragile tree squirrel skeleton were found in equal abundance further illustrating the cultural selection for gopher crania (Falk and Semken 1990). As the plains pocket gopher is a burrowing creature, the presence of its remains could indicate post-depositional intrusive burrows through the site. However, if burrowing creatures were included only through natural deposition, then we would expect to find equal percents of cranial and postcranial elements recovered.

The most common elements recovered were teeth, mandibles and crania, see Table 4. This may be due to the fact that rodent dentition is very distinctive. According to Shaffer's (1992a) study, if the complete skeleton was present, as predicted in the die-in-the-hole intrusive burrowing animal instance, we would expect additional elements to be present. His study attempted to replicate field recovery of a gopher if the complete skeleton was present. Using ¼ inch screens, he performed nine trials of shaking a disarticulated gopher skeleton in the screen for 30 seconds to see what elements would remain in the screen. Seventy percent of all trials yielded the following elements: femur, cranium, scapula, pelvis with fused sacrum, ramus, as well as additional elements from larger specimens including axis vertebra, lumbar vertebra, tibiofibula, and humerus, (Shaffer 1991; Shaffer 1992a). The idea is that these elements would be recovered if they were represented at the site.

Table 4. Elements of *Geomys bursarius* from the Heath Site

Element	Number of Elements	Percentage of Elements
Astragalus	1	2%
Femur	5	8%
Humerus	1	2%
Radius	2	3%
Scapula	1	2%
Skull*	10	16%
Teeth**	41	65%
Tibia	2	3%
Totals	63	100%

* maxilla/premaxillas included in calculation
** mandibles included in calculation

Several of these elements were recovered from the Heath Site as well as the additional smaller elements astragalus and radius bones. Recovery of smaller elements is likely due to the fact that matrix in the screen blocks the screen openings to a certain degree. The presence of these smaller elements may indicate the whole individual was present, and thus the product of intrusive post-depositional activity. However, even looking at the unidentified rodent elements, the most commonly associated elements in the same feature are mandibles and crania, together they account for 81% of the recovered gopher elements. The proportion of postcranial elements to cranial elements may indicate the selection for cranial and mandible elements like at the Rainbow Site, suggesting they were incorporated

into the sites through non-intrusive methods. Looking at recovered gopher remains by feature reveals that only three features have elements other than crania, mandibles or teeth, see Table 5. Feature 1 and Feature 6 both have one tibia, while Feature 5 has only one radius and no associated crania, mandibles or teeth.

Table 5. *Geomys bursarius* elements by feature location

Feature	NISP	Element	Portion
Pit 1	1	Tibia	tibia, distal end absent
Pit 2	1	Skull	anterior palatine foramen absent, vomer absent, only
Pit 5	1	Radius	complete radius
Pit 6	1	Teeth	mandible with complete dentition
Pit 6	1	Skull	maxilla and premaxilla with complete dentition
Pit 6	1	Tibia	distal tibia
Pit 6	1	Teeth	complete upper incisor
Pit 7	2	Teeth	complete upper incisors
Pit 7	1	Skull	maxilla and premaxilla fragments, L=upper P4, M1-3,
Pit 8	2	Teeth	upper incisors fragments
Pit 8	1	Skull	maxilla, only L upper P4, M1-3 present
Pit 10	1	Humerus	humerus, promixal end absent
Pit 10	1	Teeth	upper incisor
Pit 10	2	Teeth	2 mandibles: 1) coracoid process absent, only incisor
Fire Hearth	1	Teeth	lower M3
Fire Pit	1	Teeth	mandible, coracoid process absent, all dentition present
Fire Pit	2	Teeth	incisor

It is unlikely that the inclusion of these elements is explained by natural predation. Shaffer (1992b) shows that the presence of abnormally higher percentage of cranial and mandible elements is not explained through predation looking at owl, cat and snake scat. If these elements had been consumed, we would expect to find acid etching, or other indicators, none of which were identified on the recovered specimens. Only one element, a femur, had acid etching noted on the distal end. Otherwise, the gopher bones in the database were not otherwise modified, cut or ingested, thus it is unlikely that all individuals present were consumed.

Context and bone modification or burning could suggest the consumption of these critters as food. At the Cowan site in Iowa, of the 213 plains pocket gophers bones recovered, 16 were burnt (7.5%). While this could be due to natural conditions, the authors concluded that at least some plains pocket gophers were most likely consumed by humans (Morrow, Vanderford and Sisler 2005). Faunal identification of the Heath Site was performed by Robert Brand in 2007. Three elements, consisting of one incisor, squamosal, astragalus, in the Heath Site faunal database were identified as burnt, however, no provenience information was noted in the database. The lack of provenience information is consistent with the input of all the 1974 excavation data. Thus, we cannot be certain if the burnt bones were modern, and given the lack of concrete archaeological context, like a hearth, their presence does not indicate that these individuals were consumed. The percentage of the Heath assemblage that is burnt, 3 out of 63 identified specimens (4.8%), compares with the Cowan site's 7.5% of burnt gopher bones. The presence of burnt bones with the given lack of context does not provide a strong case for the consumption of these small mammals.

Garden Hunting

Several arguments have been made against viewing small mammals as utilized only for food in a starvation diet. As rodents are readily available and reproduce quickly despite environmental and predation pressures it is this author's opinion that they would not only be utilized in times of starvation. As agriculture changes the ecological habitat and attracts various types of small mammals, it is possible that the rodents were killed to protect the crops. In addition to protecting crops, rodents may have actually been hunted as a food source in what is called "garden hunting" (Linares 1976). This so-called "garden hunting" is a form of prehistoric multitasking to protect crops, a way for children to practice their hunting skills and provide food for the table.

Evidence for garden hunting in the archaeological record would be provided if there appeared to be a selection for animals that are likely to be found in gardens and fields. Neusius' (2008) study tested for a garden hunting subsistence pattern by using NISP to test the faunal remains from seven different habitation sites, in the Dolores, Colorado region of the Southwest. To account for small sample size; the study used NISP instead of MNI because

MNI is a calculation based on NISP. The study found that garden hunting fauna ranged from 41-87% of the fauna assemblage with the average at 73.9 percent. Based on this, Nesius (2008) concluded that subsistence in the Dolores region was significantly based on garden hunting, but could not distinguish the relative importance of this subsistence strategy among the sites.

This author attempted to investigate the abundance of plains pocket gopher using a garden hunting perspective. A total of 250 NISP and 73 MNI of all classes of animals were recovered from the site, of which 149 NISP and 16 MNI were categorized as garden animals to be used in this calculation. Categorization as garden animals was based on the habitat information for all genus and species recovered at the Heath Site; animals categorized as garden animals are presented in Table 6. Animals with a habitat preference identified as grassland, open areas, or edge habitats were considered garden animals. Using this classification scheme, animals like bison, pronghorn and deer were determined to be garden animals. As a result, garden animals include all grassland animals except large game like bison, pronghorn and deer. This distinction was drawn because of the cost benefit of hunting large game animals.

Table 6. Grassland and Garden Hunting Animals

Scientific Name	Common Name	NISP	MNI
*Antilocapra Americana**	Pronghorn	1	1
*Bison bison**	Bison	67	1
Branta canadensis	Canada Goose	4	1
Geomys bursarius	Plains Pocket Gopher	63	7
Mephitis mephitis	Striped Skunk	1	1
Microtus ochrogaster	Prairie Vole	1	1
Odocoileus sp.*	Deer	5	1
Spermophilus sp.	ground squirrel	6	2
Vulpes vulpes	Red Fox	1	1
	Garden Animal Totals	81	13
	Grassland Animal Totals	149	16

*Grassland only animals

Due to the small sample size of the Heath Site assemblage, this author decided to compare both NISP and MNI calculations to determine the significance of a garden hunting faunal assemblage. Using the animal categories discussed above, the portion of the garden animals to the entire faunal assemblage is calculated based on Table 6. The NISP total of 81 animals categorized as garden animals accounts for 32% of the entire faunal assemblage. Garden animal MNI accounts for 18% of the total faunal assemblage. Compared with Nesius's (2008) study where garden animals accounted for around half of the entire faunal assemblage, at the Heath Site garden animals only account for 18% of the total assemblage. While this indicates the main subsistence was on large mammals, this does not mean that small mammals were insignificant. Rather, the role of small mammals in the subsistence pattern is inconclusive.

Ethnographic Consideration of the Selection of Gophers

Ethnographic record documents the use of small mammals and rodents for consumption. Du Bois (1940) noted how the California Wintu people ate squirrels, gophers and small rodents including wood rats. In processing small game, first the paws and tails were cut off and the internal organs removed and then the animal was roasted on a bed of coals. Afterwards, the head was cut off and ribs and other large bones removed. The rest of the carcass, meat, bones and all were pounded until fine powder (Du Bois 1940). If the plains people used a similar method of processing, it could explain the presence of predominantly skull, mandible and teeth portions in features and the overall selection for these elements across the site.

The ethnographic record concerning the Blackfoot plains dwellers indicate that gophers were used for children's games and as starvation foods. Boys would practice their hunting skills in trapping gophers, and the skins were then used to create miniature clothing and tipi covers for a prehistoric version of house (Ewers 1958). An ethnographic account of the Blackfoot reservation in Canada recounts that in times of starvation and the lack of buffalo and deer, the people would eat skunks, badgers, gophers and other creatures (Hanks 1950). However, given the circumstances that the account is of a reservation, it begs the question if there is cultural continuity to draw a cultural analogy or if the circumstances of reservation life forced cultural change.

Meat Weight

Simply calculating the number of elements or minimum number of individuals does not clearly illustrate on what resources the inhabitants were relying to obtain their nutritional needs. These calculations do not reflect the drastic difference in meat contribution of animals, for example the difference in edible meat of one bison compared to seven plains pocket gophers. Exploring the relative contribution of different animals is another method to evaluate faunal assemblages and to explore subsistence patterns.

Based on contemporary meat packers, White (1953) used a calculation of 70% edible meat weight for longer legged animals such as bison, elk, deer, and antelopes, and a 50% meat weight for short legged animals like raccoons, badger, beavers, prairie dogs and others. Stewart and Stahl (1977) tested the accuracy of White's calculation and found that his numbers often overestimated the amount of actual meat weight. In accordance with Theler's (1987) paper on meat weight calculations and calorie counts, this study uses a 50% meat weight calculation for all mammals in an attempt to not overestimate the significant meat contributions of various animals.

Additionally, rodents were also considered for their contribution in meat weight. Stahl (1982) found that rodents have a relatively high edible meat to body weight ratio, generally between 67 and 76 percent. This author decided to use a conservative 50% calculation in determining meat weight and nutrient count of rodents. Not only is this a conservative measure, but rodent weight can fluctuate depending on the season of the year and hibernation patterns.

For these calculations, edible meat weight was multiplied by MNI for each species represented at the site. Where data was available from other publications, it was verified and used in this table, see Table 7. In other instances, data was obtained regarding the estimated live weight for the animal and then multiplied by 50% to calculate meat weight contribution.

Table 7. Edible Meat Contribution by MNI and species

Taxon	Common Name	Usable Meat	MNI	Meat
Anas platyrhynchos	Mallard Duck	0.8	1	0.8
Anas rubripes	American Black Duck		1	
Branta canadensis	Canada Goose	2.7	1	2.7
Pelecanus erythrorhynchos	American White Pelican		1	
Emydoidea blandingi	Blanding's Turtle		1	-
Rana pipiens	Northern Leopard Frog		1	-
Antilocapra americana	Pronghorn	26.75*	1	26.75
Bison bison	Bison	272.2	1	272.2
Canis sp.	Dog	4.5	1	4.5
Castor canadensis	American Beaver	11	1	11
Geomys bursarius	Plains Pocket Gopher	0.1	7	0.7
Homo sapiens sapiens			-	NA
Lutra canadensis	River Otter	4.5	1	4.5
Mephitis mephitis	Striped Skunk	1.6	1	1.6
Microtus ochrogaster	Prairie Vole	0.025	1	0.025
Mustela vison	American Mink	0.5	1	0.5
Odocoileus sp.	Deer	38.6	1	38.6
Spermophilus sp.	Squirrel	0.0625	2	0.125
Vulpes vulpes	Red Fox	2.5	1	2.5
Alasmindonta marginata (Say)	Elktoe	0.021	1	0.021
Lasmigona complanata (Barnes)	White Heelsplitter	0.099	1	0.099
Quadrula pustulosa (Lea)	Pimpleback	0.018	2	0.036
Fusconaia flava (Rafinesque)	Wabash Pigtoe	0.016	7	0.112
Leptodea fragilis (Rafinesque)	Fragile Papershell	0.044	3	0.132
Potamilus alatus (Say)	Pink Heelsplitter	0.056	2	0.112
Ligumia recta (Lamarck)	Black Sandshell	0.076	17	1.292
Lampsilis siliquoidea (Barnes)	Fatmucket	0.055	2	0.11
**Lampsilis cardium (Rafinesque)	Plain pocketbook	0.08	13	1.04

Mollusk data taken from Parmalee and Klippel (1974) Table 1 Mean Soft Part Weight
Faunal data taken from Theler (1989) "Pammel Creek Site Faunal Remains"
-Not a significant contribution to dietary subsistence *Calculated by the author

Meat weight quantifies the importance of varying animal resources. As seen above, bison contribute an averaged 272 kilograms of edible meat weight per individual, whereas all seven plains pocket gophers only contribute .7 kilograms of edible meant. Overall, bison account for 74% of the meat weight contribution. As a result of this large bias towards bison, Figure 6 shows the meat weight contribution for all resources other than bison. Even so, large game mammals, including pronghorn and deer, provide the largest portion of the subsistence represented by the faunal remains recovered.

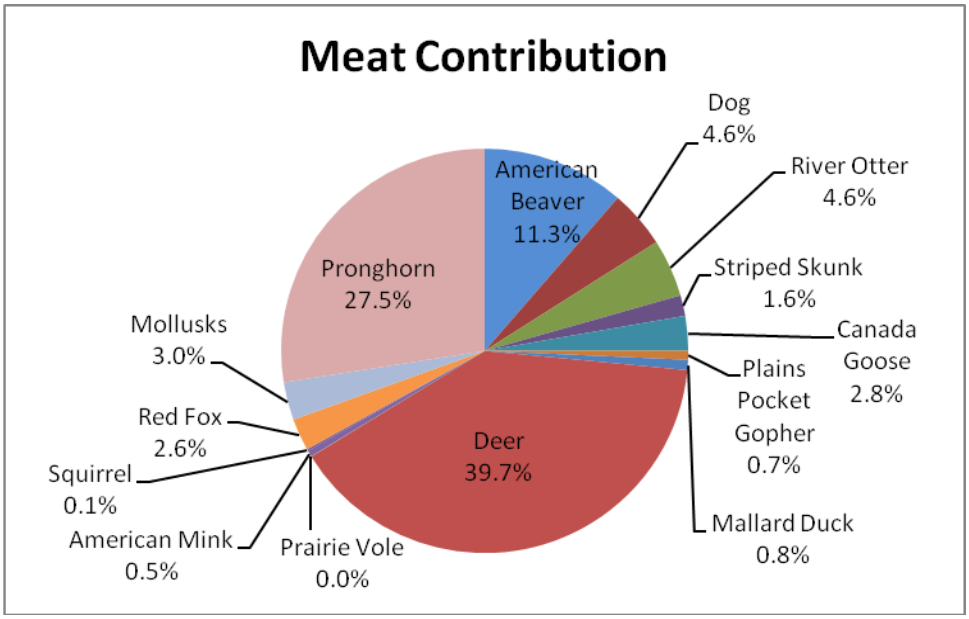

Figure 6. Edible meat contribution for animals excluding bison

Summary

Large mammals, consisting of bison, pronghorn and deer, provide the largest portion of the edible meat contribution at this site. Beaver provide the next largest percent (11.3%), however, since beaver are sought after for their teeth and pelts, this may not accurately reflect subsistence reliance. Lastly, while mollusks had the largest MNI, they only contributed 3% of the edible meat represented by the faunal assemblage.

Concerning the plains pocket gophers, the archaeological record at this site indicates a selection for mandibles, crania and teeth elements. While natural deposition is a probable cause for at least one individual, the proportion of postcranial and cranial elements is inconsistent with the expected recovered remains of die-in-the-hole intrusive post-deposition of burrowing creatures. However, the lack of post cranial elements could be due to the lack of flotation samples which would recover the elements more likely to pass through ¼ inch mesh screens. The postcranial elements that were recovered are consistent with Shaffer's (1992a) experiment of recovery rates of complete gopher skeletons.

Only three elements were identified as having been burnt, for a total of 4.5% of the elements. While so few of the recovered remains were identified as having been additionally modified or burned, this may be the result of an incomplete database rather than the lack of occurrence. Therefore, it is inconclusive whether rodents were used as a food source. There is evidence that people hunted and killed small mammals, but their purpose is unclear. The selection of head elements could reflect a conscious activity for the utilization of the incisors, or crop protection. Selection for heads could reflect a consumption or utilization pattern. Analyzing the gopher assemblage from a garden hunting perspective was equally inconclusive. While the MNI assemblage was dominated by gophers, the percentage of this assemblage to the total animal assemblage and their relative meat contribution is not strong enough to suggest a strong reliance of these animals in the daily subsistence.

FLORAL METHODS AND DATA

The floral assemblage, on loan to Dr. Tiffany and housed at the Mississippi Valley Archaeology Center, consists of a hearth feature, which lacked any labeled provenience information, several boxes of carbon/charcoal samples and one box of seeds recovered during excavation. The boxes of carbon/charcoal samples were very small, and likely only taken for the possibility of dating. These were used instead for floral analysis. Only one water-screened sample of a fire pit feature was found stored with the faunal assemblage. This water screened sample contained bone fragments, charcoal, and floral remains, primarily corn fragments along with other seeds. Like other studies of the region, uncharred seeds were considered modern (Lensink and Tiffany 2005). Uncharred seeds would most likely decay over hundreds of years.

Analysis of the hearth feature was complicated by lack of good labeling and provenience information. In total, the assemblage was contained in three boxes labeled Hearth 0-10cm, Hearth 20-30cm, and Hearth 30-40cm. The assemblage for the 10-20cm level was missing, if there was such an excavation level. Since the plowzone extended to 20cm below ground surface (and lower in certain areas), it is quite likely that the first level was mislabeled as excavated 0-10cm. This would be consistent with the designated excavation zones outlined in Hannus, Winham and Lueck (1986). While this is possible, it is unlikely because the hearth feature was most likely not visible until below the plowzone. This author believes this hearth feature was excavated in 1974 (see discussion below). Excavations continued in 1974 after the initial field school by the South Dakota Archaeological Center to continue unearthing a potential earth lodge structure and fire hearth. The Center assigned new feature numbers and used metric measurements since they lacked the excavation notes during the field school. The boxes could be the result of this discrepancy.

Additionally, there was a lack of information on how the hearth feature assemblage was treated, curated, or even if the soil was sorted. No information concerning the provenience of the hearth or even the year of excavation was recorded. The sample must have been floated, as the 20-30 level bag was labeled "Float Bag 2." The soil had been re-bagged in 1990, when it was presumably floated, and the original excavation information was not included on the bag labels. As the water screened sampled found among the faunal material was from a 1974 fire hearth, it is possible that the hearth feature lacking provenience and the water-screened sample may be from the same feature.

Hearth Feature

Since the original excavation information was nowhere with the collection, I was forced to make several assumptions. Comparing the excavation information between the 1974 and 1976 excavations (Biggs 1975, Hannus, Winham and Lueck 1076), this author determined the hearth feature was most likely excavated during the 1974 excavations. Both excavations only mention that one hearth feature was discovered, and both were excavated down to the save level, around 51-53cm below ground surface. The plowzone extends to 20 cm below the ground surface. Since the assemblage for the hearth is labeled from 0 to 40 cm, this most likely refers to the levels of the feature below the plow zone. Thus, this feature fits in the depth description for both years.

The 1974 excavations were carried out by two different groups. The field school opened the area, and then the South Dakota Archaeology Center came out in June to finish the excavation of a hearth, and post molds what was considered a potential house feature, see Figure 7. While there are several charred features, this is the only one that is associated with a structure and is therefore what was probably considered a "hearth" at the time of excavation. The hearth had been unearthed during the field school excavations and then covered with sheet plastic until the Center continued excavations. This is consistent with the feature. In the 0-10cm level, a fragment of plastic was found, which could have originated from the plastic sheeting over a period of time. Also, if an area was left open to the elements for a period of time, even covered by plastic sheeting, this would explain the uncharred modern and grassy seeds and modern mouse evidence recovered 20-30cm below datum.

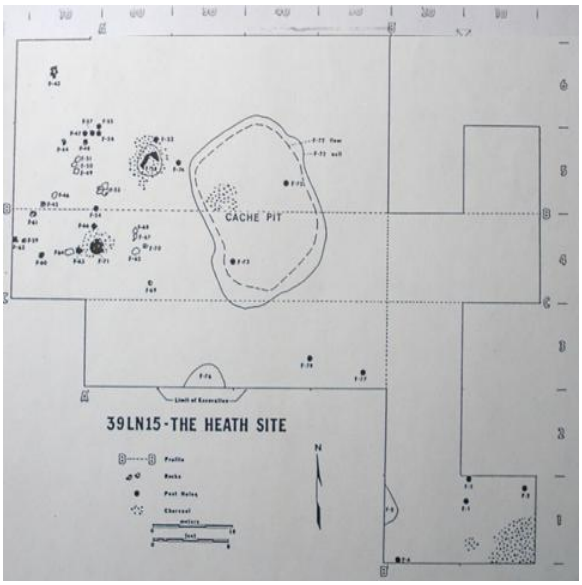

Figure 7. The house feature, 3rd (upper) terrace, 1974 excavations (Hannus, Winham and Lueck 1986)

In order to facilitate the identification of non-wood floral materials, the soil samples were sized graded by excavation level. Mesh size grades were categorized as: greater than 5mesh (4mm opening), 5-10 mesh (mm opening), 10-20 mesh (.85mm opening), 20-40 mesh (.425mm opening) and smaller than 40mm, see Table 8. Smaller size grades were further sub-sampled due to time constraints. Level 30-40cm, size graded 5-10mm was sub-sampled due to the large soil sample. It was assumed that corn and other domesticates, if present, would be more readily identifiable in the large size grades.

Table 8. Percentage of soil sample sorted

Feature Level (cm)	Size Grade	Soil Sampled (%)
0-10	>5	100%
	5-10	100%
	10-20	25%
	20-40	50%
	<40	25%
20-30	>5	100%
	5-10	100%
	10-20	12.5%
	20-40	12.5%
	<40	12.5%
30-40	>5	100%
	5-10	25%
	10-20	6.25%
	20-40	6.25%
	<40	6.25%

In total, only three identifiable seeds and numerous other plant materials were recovered; the results are summarized in Table 9. No corn or other domesticates were recovered from this sample. In fact, the lack of many floral materials and the lack of provenience information or any kind of identifying information led this author to the impression that the sample may have already been sorted. Additionally, identifiable seeds were recovered from the smaller size grades, suggesting if the sample was sorted, they may not have sorted the smaller size grades. Interestingly enough, floral material was only recovered in the smaller size grades of the 0-10cm level instead of the

lower 30-40cm level of the hearth. It is possible that the lower levels were sorted more thoroughly if that was where people expected floral materials to be recovered.

Table 9. Plant material recovered

Feature Level	Size Grade	Material Recovered
0-10	>5	2 fragments of starchy plant
	5-10	1 unknown seed
	10-20	7 charred grass seeds
	20-40	1 charred Chenopodium
	<40	12 seeds cf Cyperaceae
20-30	>5	None
	5-10	2 fragments spiky plant
	10-20	2 spiky plant
	20-40	1 gastropod
	<40	None
30-40	>5	4 fragments spiky plant
	5-10	1 seed cf viburnum
	10-20	None
	20-40	None
	<40	None

The only seed recovered from the 30-40 hearth level was identified as comparing favorably to *Viburnum* sp., a best fit with either *Viburnum acerifolium L*. or *Viburnum lentago L* based on seed structure and geographical distribution (Gill and Pogge 1974). In either case, viburnum is a wild grape, one that would not have been utilized as part of the subsistence. Also identified were several grass seeds of the Cyperaceae family; sedges indicate a wetland environment. The one identified *Chenopodium* sp. seed and two embryos were recovered from the same level. The embryos are most likely *Chenopodium* sp. as well, but identification to the species level was not possible.

The spiky plant material is so named due to the structure of the material. It looks like the exterior of some plant that has frequent spikes. Also, several pieces show that the host material is elongated and tubular like a straw and could represent the stem of a plant instead of a seedpod. Dr. Theler informally suggested identification as "prickly cucumber" (*Echinocystis lobata*). After looking at reference materials, this specimen does not compare favorably with the prickly cucumber; the spikes are too widely spaced and are thinner than the recovered material. It is truly a "prickly pickle," as this author has not yet been able to identify the material. It is more than likely just an exotic piece of tree bark.

Water-Screened Sample

There was one additional bag of water screened soil sample from a hearth feature excavated in 1974. No provenience location was noted on the sample bag, except the year of excavation and the catalogue number (B34-915,917,919). This sample included bone, flakes and plant materials including corn (*Zea mays*). As this sample was relatively small, it was sorted in its entirety, the results of the sorting is summarized in Table 10. Corn was sorted into kernels, cupules, embryos, and corn fragments. The majority of the fragments were probably kernels, but the lack of positive identification caused this researcher to be conservative. Improper identification as kernels instead of cupules would disrupt the relative frequency calculations.

Table 10. Floral materials recovered from the water-screened sample

	Corn kernel	Corn cupule	Corn embryo	cf Compositae	cf Leguminosae
Count	72	17	1	3	1
Weight (g)	0.320	0.051	0.002	0.001	0.013
Total corn weight (g)	0.373				
Total sample weight (g)	58.2				

Corn was the most commonly recovered floral material, with kernels the most common element. Other floral remains include one cf. Fabaceae (Leguminosae), three fragments of Compositae, and one c.f. Helianthus. Of these seeds, only Helianthus is a possible cultigen. As non-cultigens, the other seeds provide environmental indicators of the region. Both the Fabaceae and the Compositae elements indicate a grassland habitat.

Carbon/Charcoal Samples

Charcoal samples were taken from all pits and most major grid units. While these samples were very small (the average sample size was 2.6 grams), sorting and analysis of these samples allowed for the calculation of the ubiquity of corn across the site. The predominantly recovered floral material was corn, both kernels and cupules. A summary of the total count and weight of the corn recovered from each unit is presented in Table 11. As before, corn was sorted into kernels, cupules, embryos and corn fragments in an effort to represent the accurate relative frequencies, as accurate as the small soil sample size will allow.

Table 11. Corn counts and weights

	Pit 1	**Pit 2**	**Pit 4**	**Pit 5**	**Pit 6**	**Pit 8**	**Pit 9**	**Pit 9**	**Pit 10**	**Pit 12**
soil sample size (g)	0.034	0.404	0.012	0.593	7.138	8.891	0.561	3.216	1.708	0.795
Corn (Count)										
kernels	1	3	1	2	98	252	110	57	22	27
cupules		5			43	25	80	6	10	1
total corn (g)	0.034	0.028	0.012	0.062	0.681	1.769	0.567	0.666	0.182	0.139

In total, over 746 pieces of corn (573 kernels, 165 cupules, 8 embryos, and over 250 corn fragments) were identified from nine features, but from a total of ten different proveniences (Pit 9 extended into two excavation units and so was given two catalogue numbers). The corn fragments were often too fragmented to make a proper identification, but most are probably kernels. Of the identified corn, the majority were kernels (76.8%), 22.1 % were cupules, and the last 1.1% consisted of corn embryos. In several instances, the embryo was still connected to the kernel, or the kernel was still connected to the cupule.

Corn was ubiquitous throughout the site, having been recovered from all features that had carbon samples. Soil from Pit 4 contained a single kernel of corn, indicating that during excavation it was recognized and carefully extracted. Pit 9 had the largest percentage of corn recovered in the sample weight, 19% of the total sample (as several soil samples were obtained from this feature, the total seed assemblage was added together divided by the total soil sample weight for both catalog numbers). As the sample sizes were quite small, it is not possible to extrapolate what the original feature percentages were.

One non-feature related charcoal sample was also analyzed for floral remains. One seed c.f Amaranth (*Amaranthus* sp.) was recovered from Grid 20,12 from Level 4. This seed was charred, so it is considered archaeological.

Analysis of Pit Features

A total of 14 pits were excavated during the 1976 excavation season. Through ethnographical and archaeological evidence, pit shape can indicate its original purpose; pit shapes are seen in Figure 8. Table 12 details feature dimensions and associated remains recovered during the excavation of these pit features.

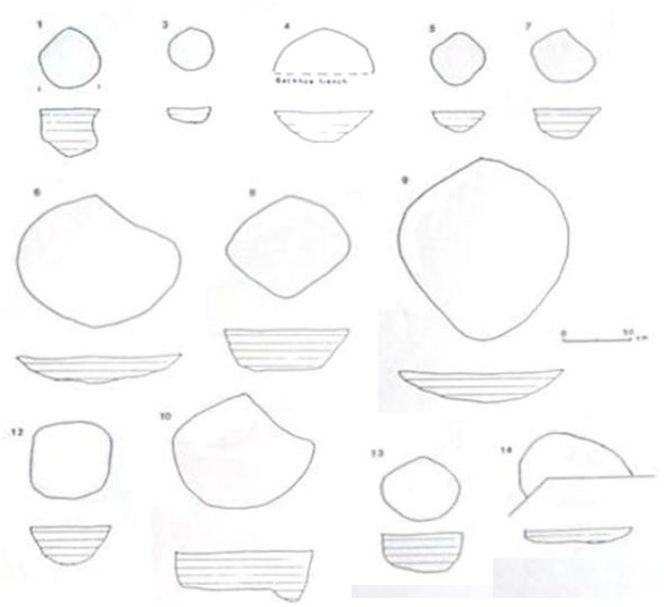

Figure 8. Profile and shape description of pit features (adapted from Hannus, Winham and Lueck 1986)

Table 12. Feature Descriptions

Pit 1	Located in Grids 20-11 and 19-11. Dimensions 44cm N-S by 49cm E-W and 35cm deep. It contained charcoal, bone, shell, and one corn kernel. The pit bells out at the bottom.
Pit 3	Located in Grid 20-10. Dimensions 30cm N-S by 33cm E-W and 21cm deep. It contained a few ceramic fragments, bone, charcoal flecks and corn.
Pit 4	Located in Grid 20-12, it was cut into by a test backhoe trench. It is 62cm E-W; the N-S dimension is unknown (over 22cm). It has a depth of 23cm. The pit contained a considerable quantity of shell and charcoal, some burnt ceramic garments, a bone spatula, a stone adze, and one corn kernel.
Pit 5	Located in Grid 19-10. Dimensions 39cm N-S by 41cm E-W and a depth of 8cm. It contained very little cultural material, both corn kernels and cupules were recovered
Pit 6	Located in Grids 19-10 and 18-10. Dimensions 98cm N-S by 122cm E-W and 28cm deep. This pit contained ceramic material, bone, shell and several medium-sized (ca. 20x12cm) rocks. A small knife fragment came from this pit and a large charcoal sample was collected. About 10% of the charcoal sample was corn (kernels and cupules).
Pit 7	Located in Grids 21-10 and 20-10. Dimensions 42cm N-S by 53cm E-W and 31cm deep. This pit contained fish bones and scale, shell, a few flakes, ceramics and pecked stone and two complete rodent skeletons. No charcoal sample was collected so the type and extent of floral remains are unknown.
Pit 8	Located in Grids 18-10 and 18-11. Dimensions 79cm N-S by 90cm E-W, and 47cm deep. The pit contained considerable bone material from small animals, fish and fowl. Much ceramic material, but only a little charcoal, shell and no lithic debitage. A worked bone awl came from this pit.
Pit 9	Located in Grids 22-8, 21-8, 22-7, and 22-8. Dimensions 137cm N-S by 120cm E-W, and 37cm deep. This pit contained a considerable quantity of ceramic material, bone, shell, charcoal and some flake debris. This feature was the most productive in terms of corn yield, including corn kernels, cupules, and embryos.
Pit 10	Located in Grids 21-9 and 22-9. Dimensions 105cm E-W by 88cm N-S, and was 43cm deep in the east and 53cm deep in the west section. The top of this pit contained a complete bison vertebral alignment. Below this some shell, a portion of a knife blade and some ceramics were recovered and charcoal flecking was noted. This feature also contained kernels, cupules and corn embryos.
Pit 12	Located in Grid 21-13. Dimensions 58cm N-S by 61cm E-W with a depth of 29cm. This pit contained the frontal section of a bison crania badly shattered at the orbital area, other bone, a large number of small chert flakes, some shell, burnt fish scales, ceramic fragments and charcoal. Corn kernels were found in greater abundance than cupules.
Pit 13	Located in Grids 22-12 and 22-13. Dimensions 50cm N-S by 60cm E-W with a depth of 30cm. This pit was rich in cultural material with much charcoal and many large ceramic fragments and burnt bone. Soil samples were not taken from this feature.
Pit 14	Located in Grids 15-13, 16-12, 15-12 and 16-13. Not completely excavated. The E-W dimension is ca. 83cm and the depth is 8cm. This pit contained a few ceramic fragments, some charcoal flecking, very little bone and no lithic or shell material. Soil samples were not taken from this sample.

Table adapted from Hannus, Winham and Lueck (1986)

Of these shapes, Pit 1 appears to be a bell-shaped pit, which often indicates the storage of domesticates, primarily corn (Wilson 1987). Unfortunately, there was not a large charcoal sample taken from this pit. A single kernel of corn was recovered, indicating that kernels were witnessed during excavation, and this one was carefully extracted during the process. No charcoal samples were otherwise taken from this feature.

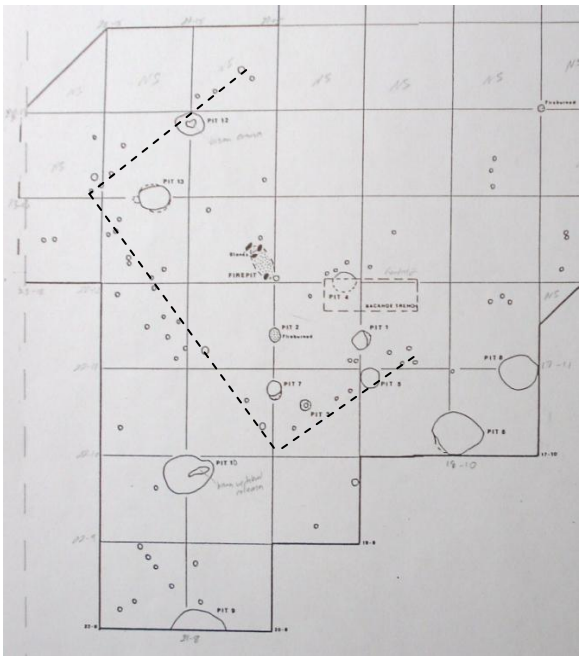

Figure 9. Close-up of the 1976 excavations on the 3rd (upper) terrace, dashed line added by the author (Hannus, Winham and Lueck 1986)

There appears to be a rectangular structure in Figure 9, highlighted by the dashed line. Associated features include Pits 1 through 5, 7, 12, 13, a fire pit. Features 6 8 and 10 could also be nearby outlying pits. All features that had soil samples taken showed they had corn. As seen in Figure 9, many of these features appear associated with a house structure. It is likely, that in keeping the house clean, fire pit charcoal and ashes would have been swept up and thrown away in the nearby garbage pit. Pit 10 contained an articulated bison vertebral column, while the bison crania is located in pit 12, which appears to be centered on the northern wall within the rectangular structure. As there is a MNI of one bison, the crania and vertebral column are most likely from the same animal.

The unusual use of the bison crania inside the house feature, and the distribution of the one individual bison shows that the bison remains were split up, which may indicate food sharing. Bison remains were fairly concentrated in three areas. Elements recovered from Pit 6 include: one astragalus, two calcanei, one metacarpal, one metapodial, two naviculo-cuboid, one premaxilla, two ribs, tarsals, and one tooth. The presence of these elements may indicate the remains expected with the Schlepping effect where the feet elements and crania are attached to the hide to carry the meat. Pit 10 contained a completely articulated vertebral column. Given the proximity of these two pits, and the fact that they contain the elements that the other lacks would indicate it is not the schlepping, but food sharing instead, or different methods of processing the meat.

Seasonality and Environmental Indicators

Great Oasis sites are often semi-nomadic sites and have been identified as having seasonal occupations. Sites like West Broken Kettle have been identified as winter occupation sites, while the Cowan Site appears to be a summer occupation (Alex 2000). The Heath Site appears to also have been a summer occupation site. In total, two buds were recovered from the site, one from the fire hearth charcoal samples and the other from the water screened fire hearth sample. Budding plants would indicate a spring season occupation.

Faunal remains provide evidence to seasonality as certain animals can only be obtained at certain times of the year. The large assemblage of mollusks indicates a spring, summer, and fall occupation as marine resources cannot be accessed during the winter months. Canadian geese are also a seasonal indicator, as they are hunted during their

seasonal migration, indicating either a spring or fall occupation. Large game like bison, if properly smoked and stored, could be used to provide enough food for the winter months. Deer are the most likely animals to be hunted during the winter months in time of need.

Corn was clearly provided a part of the subsistence, indicating this site was occupied during the growing season. While corn is harvested sometime in late September, it is often stored for later use. Pit 1 is a bell-shaped pit, which has been shown ethnographically to be associated with corn storage (Wilson 1987). One corn kernel was recovered from this pit, providing further evidence that corn was stored at this site for future use. It is possible that the presence of storage pits could indicate a winter occupation as well, yet it is indeterminate if the people of the Heath Site wintered in this location, or if they returned in the spring to plant crops for the next year.

Overall, the Heath Site provides strong evidence for a spring, summer and fall occupation. A winter occupation is indeterminate with the given information.

Summary

The only identified domesticate or cultigen recovered was corn. The presence of both kernels and cupules in the assemblage can indicate processing method. Kernels represent the edible portion of the corncob, while cupules (the part where the kernel is connected to the cob) is seen as a waste by product, a necessary part of removing the desired kernels (Arzigian 1989). As waste products, cupules may have been burnt to create the corn seasoning, to remove waste, or for smoking meat and hides (Binford 1967). The proportion of kernels to cupules would indicate if the feature was used for waste removal or to smoke items, or for food related activities. Overall, the corn assemblage at this site is primarily composed of kernels, which would indicate accidental food loss instead of food processing. However, as these samples were originally collected just to document the charcoal present, it is quite likely that the percentages recovered do not fully resemble the original assemblage.

Pit shape would also indicate the purpose behind how corn fragments entered the archaeological record. Ethnographically, we know that bell-shaped pits were used to store corn for the winter (Wilson 1987). Both shape and the presence of corn indicate that Pit 1 was used for this purpose. The same ethnographic work with Buffalo Bird Woman, a member of the Hidatsa people, revealed that after processing, corncobs were burnt as waste and the ash molded into balls to be used for corn seasoning (Wilson 1987). Binford (1967) describes pits that were filled with charred wood and corncobs in what may appear to be "corn cob caches" (1967:3) that were used for smoking. Smoking pits would have relatively straight sides, a flat bottom, of which several pits excavated may fit this pattern.

Other possible cultigens recovered were representative of the Chenopodiaceae and Helianthus families. In total, one charred Chenopodium seed, another charred seed of Chenopodiaceae family identified as c.f *Amaranthus* sp., and two embryos were identified to this family as well. As these seeds are very small, processing for a food source would be more time intensive than the food benefit. Unlike chenopodium, amaranth is generally not considered a plant that was harvested for subsistence.

CONCLUSIONS

Great Oasis culture is generally considered semi-sedentary agriculturalists that, at least seasonally, hunted bison. Often this culture utilized two seasonal occupation sites. This study reaffirmed this basis. Present at this site was a minimum of one bison with elements spread throughout the site, which may indicate food sharing. The presence of the entire bison indicates that bison was killed nearby and then distributed. The schlepping effect, with the cost benefit of transporting certain bones, means the archaeological record for bison remains killed far from the base camp would lack rib bones or upper leg bones, with the feet and skull left intact (presumably as handles to carry the meat). As these elements are represented in the Heath Site faunal assemblage, the bison was killed on or near location. Sufficient corn was recovered from charcoal samples to indicate a reliance on agriculture for subsistence. Seasonal occupation is supported for the spring, summer and fall months, but is inconclusive concerning a winter occupation.

Overall, the Heath Site contributes to our understanding of the region by providing a snapshot of the cultural practices and environmental habitat of the time. Additionally, more work needs to be conducted to fully understand the regional chronology of Great Oasis culture sites.

ACKNOWLEDGEMENTS

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