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Subsistence Practices at Nancy Patterson Village

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A thesis submitted to the faculty
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Master of Arts

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ABSTRACT

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The purpose of this thesis was to gain an insight into the macrobotanical subsistence practices of Nancy Patterson Village and see how those practices fit in with the practices of the general Mesa Verde region by analyzing the burnt macrobotanical remains found in processed flotation samples. Previous work done at Nancy Patterson Village showed a shift in the faunal subsistence practices to a greater reliance on domesticated turkey during the Pueblo III period. However, the macro botanical analysis showed a higher richness of wild plant taxa in the Pueblo III period when compared to Pueblo II. The change to a higher richness of plant taxa in the later period is attributed to the changes in social and environmental climates causing difficulties in sustaining the population. These difficulties pushed the inhabitants to expand their selection of plant types used for food. Despite the higher richness of plant taxa in Pueblo III, other sites from the Central Mesa Verde region had higher richness. However, Nancy Patterson Village used the smaller number of wild plants types more intensely than the other sites from the region. No explanation was found to explain this difference.

Keywords: Archaeology, macrobotanical, Nancy Patterson Village, Monezuma Canyon

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1 Introduction

The Central Mesa Verde region has a diverse environment with large changes in elevations from the series of canyons and mesas in the area. The population in the region expanded and reduced many times through the centuries, by the end of the 13^{th} century, the land was depopulated. From past research, we have learned there was a shift in the faunal subsistence practices over time, especially towards the end of the occupation of the area. However, little has been done to understand the changes in plant based subsistence practices during the same time. Growing food in the region is a balancing act between having enough precipitation, which is easier to find in the higher elevations, and having the weather be warm enough, easier to find in the lower elevations. With the constant changing climate, both social and environmental, the subsistence practices changed to adapt. The work done in this thesis explores the plant based subsistence practices and changes that occurred through the analysis of the macrobotanical remains from Nancy Patterson Village.

In this paper I give an overview of Nancy Patterson Village and the past work and research done there. I will then discuss my hypothesis, the methods I used and my findings. Finally, I will discuss how this fits in with what was previously known about the site and the overall region.

Overview of Nancy Patterson Village

Nancy Patterson Village is located in the Central Mesa Verde region approximately twenty miles southeast of Blanding, Utah, on the east side of Montezuma Creek, less than a mile above the confluence of Montezuma Creek with Cross Canyon Wash (Janetski and Hurst 1984; Figure1). Montezuma Canyon funnels into the San Juan River from the Abajo mountains along with other tributaries. Other tributaries of the San Juan River include Butler Wash, Cottonwood Wash, Recapture Creek, and McElmo Creek (Janetski and Hurst 1984). The site is situated on top of and next to a mesita in the middle of an alluvial floodplain (Figure 1) (Janetski and Hurst 1984). Montezuma Canyon is connected with a series of smaller canyons and drainages (Janetski and Hurst 1984). The environment is a semi-arid desert shrub land in the Upper Sonoran Life zone (Hurst and Janetski 1985). Due to the diversity of the environment around Nancy Patterson Village, the inhabitants had access to a broad range of plants.

The mesita on which Nancy Patterson Village is located is at an elevation of 1,463 meters above sea level and the surrounding canyon walls have an average elevation of 1,585 meters above sea level. In the higher elevations, there is juniper (*Juniperus communis*) pinyon pine (*Pinus edulis*), big sage brush (*Artemisia tridentata*), gambel oak (*Quercus gambelii*), squawbush (*Rhus trilobata*), mountain mahogany (*Cercocarpus ledifolius*), and ponderosa pine (*Pinus ponderosa*) among other plants. The lower elevation has plants such as, four-wing Saltbush (*Atriplex canescens*), blackbrush (*Colegyne ramosissima*), yucca (*Yucca (sp*.), shadescale (*Atriplex confertifolia*), and greasewood (*Sarcobatus vermiculatus*). Along stream banks and lower terraces there were more riverine plants like cottonwood (*Populus sp*.), and willow (*Salix sp*.) (Janetski and Hurst 1984).

Vegetation on and near the site is dominated by greasewood and saltbush, but inhabitants of Nancy Patterson Village had access to the plants at higher elevations from the surrounding mesas, the top of the canyon, and from the riparian zone along the wash to the west of the site.

Nancy Patterson Village is a multi-component site and consists of an upper ruin on top of the mesita and a lower ruin at the base of the mesita on the southern end (Figures 1 and 2) (Janetski and Hurst 1984). Although this site was occupied during the historic times, the focus of this research is on the prehistoric time, as I am looking at the change that occurred with plant use between the Pueblo II and Pueblo III periods.

Figure 1. Overview of Nancy Patterson Village (Nancy Patterson Village Archaeological project files, photo number 84-NP-4-12.).

Figure 2. Overview of lower ruin (Nancy Patterson Village Archaeological project files, photo number 85-NP-4-11).

Nancy Patterson Village appears to have been occupied from around AD 800 to 1250 with two main periods of occupation (Janetski and Hurst 1984; Allison and Thompson 2016; Thompson 2019). This date range is based on the architectural styles and the ceramics found at the site.

Thompson (1990) analyzed the faunal bones from Nancy Patterson Village, comparing the earlier occupation to the later. Thompson divided the occupation into two peak periods. Period 1 covers AD 900– 1000, or through the Pueblo II occupation. While the upper ruin was also inhabited during Pueblo I and Pueblo III periods, most of the architecture located on the mesita top dates to the early Pueblo II period. Period 2 is AD 1150 – 1250, the Pueblo III occupation. Since I focus on the same site, and the focus is very similar to the work Thompson did, I have decided to use her division and classification of time periods.

Past Work at Nancy Patterson Village

The lower portion of Nancy Patterson Village was first discovered in 1964 and recorded as 42SA960 (Janetski and Hurst 1984). The portion of the site on top of the mesita was not recorded until 1969 and was given the number 42SA2110, which eventually became the number for the entire site, both the upper and lower sections. The property on which Nancy Patterson Village is located was purchased by Mark Evans in 1978 (Janetski and Hurst 1984). After initial explorations with a bulldozer, Evans decided the site should be excavated by professionals and contacted Brigham Young University (BYU) to start the process. Test excavations began in 1983.

The site was excavated/documented over a four-year period using a combination of strategies including survey, test trenches, test pits, full excavation of areas, aerial photogrammetry and 16mm film documentation. Below is a table of features excavated between 1983 and1986 (Table 1).

Table 1: Excavated features.

Feature Type	Time Period	Number Excavated	Feature Numbers
Burial	Period 1	1	In 470
Circular plaza	Period 1	1	340
Midden	Period 1	2	365, 470
Storage	Period 1	1	539
Habitation	Period 1	2	540, 658
Turkey Pen	Period 2	1	44
Habitation	Period 2	2	84, 224
Midden	Period 2	1	106
Kiva	Period 2	3	114, 362, 395
Storage	Period 2	4	222, 242, 315, 864
Activity Area	Period 2	1	236
Mealing room	Period 2	2	249, 638
Burial	Period 2	2	25, 181

Some features had interesting specifics that should be mentioned. Features 249 and 638 were determined to be mealing rooms, from the mealing bins in each room. There were three bins located in F249 and five located in F638. The bins in F638 had metates plastered into place with a catch stone at the base of each one, each one the length of its respective metate.

Three 2X2 meter test pits, plus a 1 meter wide trench were excavated in F340, the circular plaza. There was no evidence of a roof, hearth or specialized features. The only evidence for floor preparation was compaction.

Feature 44 may have been used as a turkey pen (Hurst and Janetski 1985). However, there is no firm evidence. While artifacts were sparse, eggshells, presumably turkey, were abundant.

In the eastern half of Feature 864 was a storage bin. There were squash seeds both in the bin and on the floor (Thompson et al. 1987). Below are maps of excavated areas (Figures 3 and 4).

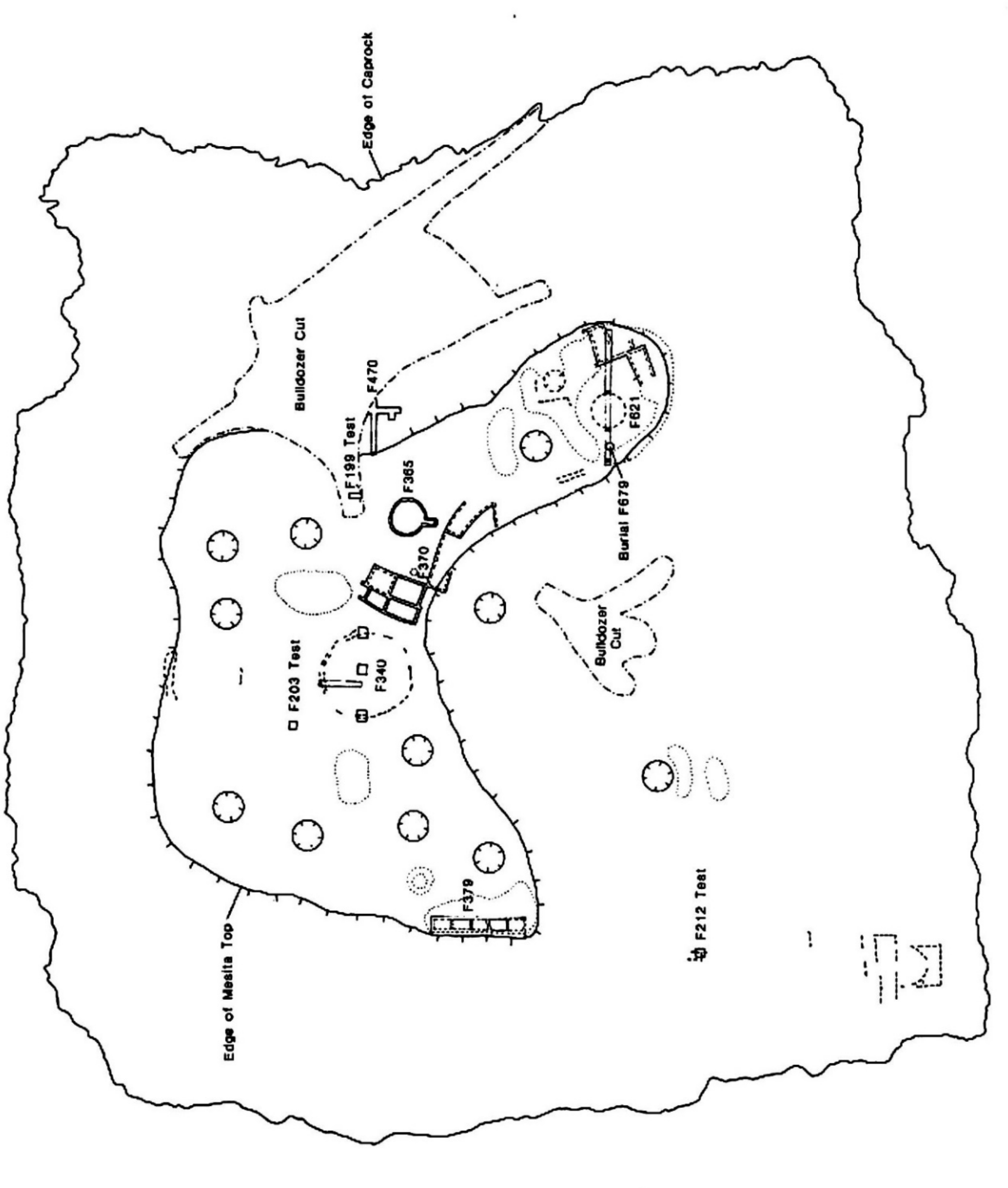

Figure 3. Plan map of upper ruin at Nancy Patterson Village (Thompson et al. 1987).

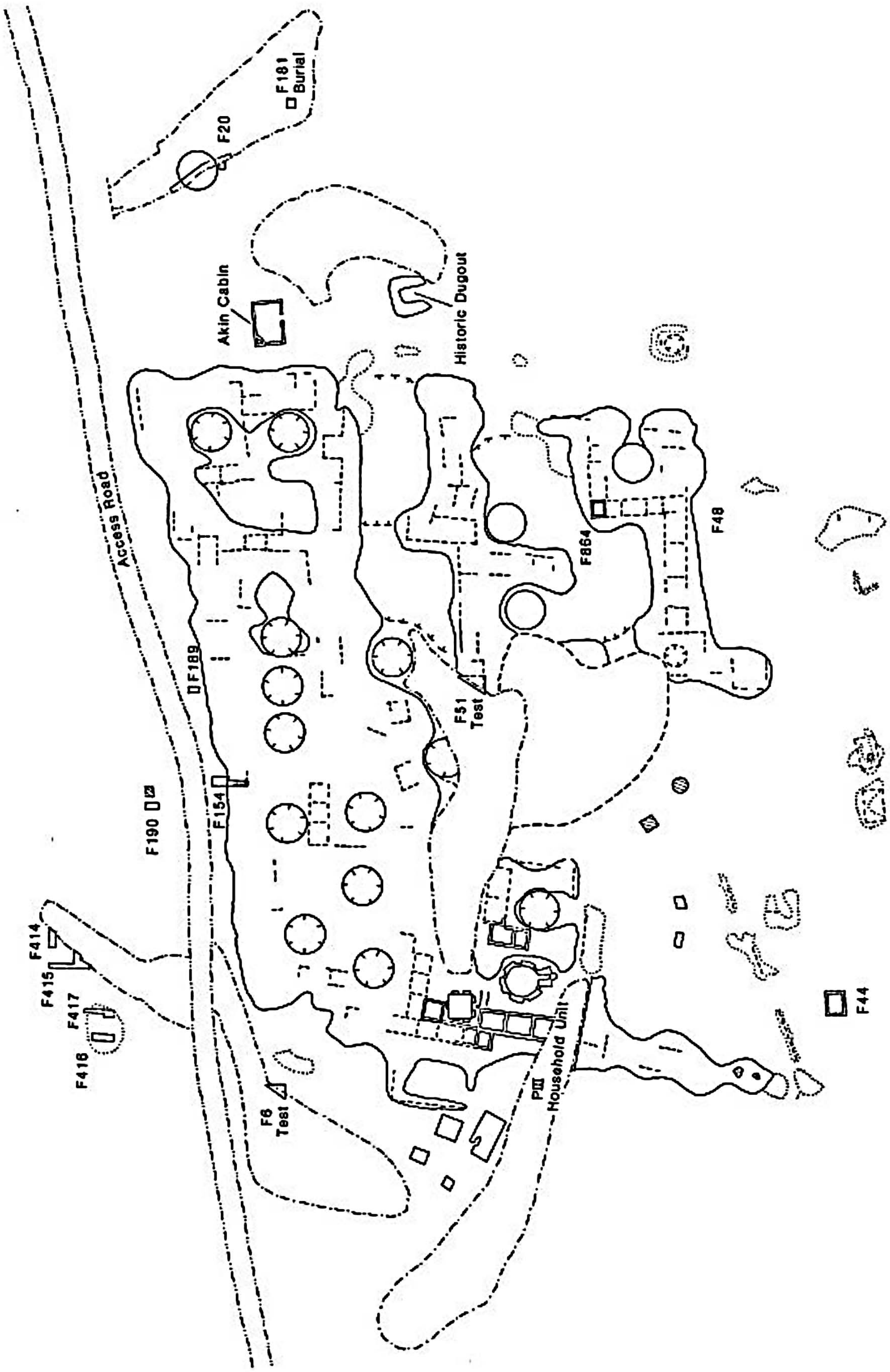

Figure 4. Plan map of lower ruin at Nancy Patterson Village (Thompson et al. 1987).

Food practices

Research by Charmaine Thompson at Nancy Patterson Village provides an interesting insight into some aspects of the subsistence practices of the past inhabitants. Turkeys were kept at Nancy Patterson Village, as early as Pueblo I. However, the turkeys do not appear to have been used as a main source of food until later times. (Thompson 1990). Material remains indicate that in the early times of Nancy Patterson Village turkeys were kept, but they seemed to be used more for ceremonial purposes rather than food. Other animals were used as sources of meat, including cottontail rabbit and mule deer (Table 2). It should be noted that the faunal bone used for Thompson's (1990) thesis came from the trash deposit, whereas the seeds used in this thesis came from many locations, not just the trash deposit.

Table 2: NISP from Nancy Patterson Village Period 1and 2 (Thompson 1990).

Species	Common Name	NISP
Period 1		
Sylvilagus spp.	Cottontail rabbit	90
Lepus californicus	Jackrabbit	37
Odocoileus hemionus	Mule deer	59
Artiodactlya		109
Meleagris gallopavo	Turkey	1
Spermophilus variegatus	Rock squirrel	2
Cynomys gunnisoni	Prairie dog	1
Neotoma spp.	Pack rat	5
Canidae		12
Period 2		
Meleagris gallopavo	Turkey	306
Sylvilagus spp.	Cottontail rabbit	42
Cynomys gunnisoni	Prairie dog	28
Lepus californicus	Jackrabbit	9
Spermophilus variegatus	Rock squirrel	4
Thomomys sp.	Pocket gopher	1
Peromyscus sp.	Deer mouse	1
Neotoma spp.	Pack rat	4
Canis familiaris	Dog	1

Mule deer would have had the highest energy return of the animals hunted but were only in abundance around the site seasonally. Rabbits would have been more available throughout the year (Thompson 1990).

There were over 50 large bird bones found in the early period and most were probably turkey. Of those, 18% were burned (Thompson 1990). Senior and Pierce (1989) suggest criteria to consider fauna used as food, including the bones are found with other food refuse, there is evidence of burning, and they are disarticulated (Thompson 1990; Senior and Pierce 1989). Again, finding only 18% of these bones burned and not finding them among other fauna bones used for food indicates that turkeys, while possibly used for food during Period 1, were not a large source of food. The faunal record indicates there was a shift in faunal based subsistence practices from Period 1 to Period 2 (Table 2).

These numbers indicate that turkey was by far the most important source of meat in Period 2. Despite the large numbers, cottontail and prairie dog would not have been a significant source of meat due to their small size (Thompson 1990).

Thompson attributes this shift in faunal subsistence practices to efforts being put towards using local resources. There would not have been many mule deer in the lower Montezuma Canyon area (Thompson 1990). When deer were hunted, it was most likely by solitary individuals or small groups that set out to higher elevations, purposefully looking for the mule deer. (Thompson 1990). Cottontails, preferring cleared areas like fields, could be found close to the site, as could the turkeys that had been domesticated. Prairie dogs could also be found locally.

The effort to stay near to the village for subsistence may be since the areas available to village inhabitants became more constricted with time, causing the more distant food resources to be not as available, thus we see the change (Thompson 1990). We know that by Period 2 in the San Juan region, there were more people living in highly aggregated settlements. There was also a large amount of violence (Kohler 2000; Kuckelman 2010; Mahoney et al. 2000). These factors may have made it unsafe for the Nancy Patterson Village inhabitants to go on long distance hunting trips. Thus, they put a greater emphasis on local resources for meat. This idea is supported by the higher use of turkeys during Period 2 in other areas of the San Juan region including Three Kiva Pueblo, Recapture Wash, and all over the southwest of Colorado (Driver 2002; Munro 1994; Thompson 1990).

Summary

Based on ceramics found at the site, the peak of Period 1 occupation was in the mid-late AD 900s. The Period 2 component dates from AD 1150 – 1275. During this time, the total rooms in the settlement is believed to be 260-325, including 21-29 pit structures, and with a much higher population than in Period 1. While Period 1 inhabitants had a broad range of interaction and trade, Period 2 inhabitants seemed to have turned inward and did not have the same amount of interaction with outsiders.

Big game seems to have been more important in Period 1 than Period 2 due to the greater number of formal stone tools found from that time. Turkeys and small mammals were of greater importance to the inhabitants of Nancy Patterson Village in Period 2. This could be due to large game being less abundant in Period 2 time or to a restriction of access to resources.

Hypothesis

The purpose of this thesis was to gain an insight to the botanical subsistence practices at Nancy Patterson and possibly in the Central Mesa Verde region, in general, by analyzing the macrobotanical remains from the site and comparing them to those of other sites in the area. Two main questions that follow from this broad topic are (1) what were the standard plant based subsistence practices in the area (though, these plants were likely used for other purposes as well), and (2) were there changes from the earlier period to the later one in these practices?

With evidence of Period 2 Nancy Patterson Village inhabitants relying on domesticated turkey for most of their meat subsistence and the restriction of travelling far from home, I hypothesized I would find a similar pattern for plant subsistence. I expected to find a shift from the use of a wide variety of wild plants in Period 1 to a greater dependence on a small number of domesticated items in Period 2 times. Thompson (1990) found a shift to a greater dependence on domesticated turkey in Period 2 and I expected the plant subsistence practices to follow the same pattern Thompson's thesis also focused on size of area which resources were being pulled from. While I had hoped to also look into this for plant subsistence, there was little evidence to analyze to determine how far the inhabitants were going for used for subsistence. All of the plants identified for this thesis can be found in and around the site and are adapted to drier conditions (except for the one seed from the rush family dating to Period 2).

2 Methods

Flotation Samples

For my research, I processed 94 flotation samples taken from the 1983 – 1986 Nancy Patterson Village excavations. The samples came from 17 features (Table 3). For each sample, I picked out all the seeds and maize fragments I found in the light fraction, keeping the burnt seeds separated from the unburnt ones. I identified only the burnt seeds for my thesis. The following discusses how I chose which samples to analyze and the methods I used.

Table 3: Features with associated structure type and time period.

Structure Type	Period 1	Period 2
Living area	658	84, 224,
Kiva	None	114, 361, 395
Storage	539	222, 242, 864
Exterior use area	340	236
Mealing room	None	638, 249
Midden	365, 470	106
Turkey Pen	None	44

There are a greater number of excavated areas from Period 2 and in consequence, a greater number of samples taken from a wider variety of places for Period 2 (Table 4). Because my research focused on a comparison between the two periods, I wanted to have similar sample sizes from the same type of structures from both periods. In order to meet my requirements for samples, I chose to do judgmental sampling. However, the number of samples taken in the field for the separate periods limited the number of samples I could use for each structure type.

Table 4: Number of samples available for structure type and time period.

Structure Type	Period 1	Period 2
Living area	19	31
Kiva	0	14
Storage	13	17
Exterior use area	0	17
Mealing room	0	4
Midden	28	14
Total	60	97

In order to have a balanced sample from both time periods, I reviewed the list of flotation samples and selected samples based on where they were taken from in a feature and how many samples were available for similar features. I tried to take samples from as many available features as possible. I also tried to take a similar number of samples from the same type of features from both periods (Table 5). For example, in Period 1, I processed more samples from middens than I did for storage. To keep things similar, I made sure to process more midden samples from Period 2 than Period 2 storage samples. I focused on samples that came from the floor or from inside features like hearths or intact jars. I also chose two samples that came from post occupational fill to process as control samples. These were to see what would show up in places that less likely to be the result of cultural practices. One sample came from a habitation feature in Period 2 and the other came from a work area also from Period 2. From those two samples, I pulled out *Amaranthus*, *Chenopodium*, Juncaceae, and *Zea mays*.

Table 5: Number of samples selected for both Periods.

Structure Type	Period 1	Period 2
Living area	15	10
Kiva	0	15
Storage	9	6
Exterior use area	0	8
Mealing room	0	8
Midden	13	10
Total	37	57

By sampling in this manner, I have similar sample sizes from both periods. For the structure types that have more than one sample area in the same period, I sampled evenly from each feature in order to gain a clearer idea about what was occurring site wide.

Macrobotanical Remains Not in Flotation Samples

I did not find any squash seeds from the flotation samples that I processed, which presented an uncomplete picture since squash seeds had been found on site. Having seeds pulled out during excavation, but finding none while processing flotation samples demonstrated my work was lacking important information. Therefore, I went to the Edge of the Cedars museum and analyzed the macrobotanical remains found and bagged during excavation. These were included in the overall count, analysis, and discussion.

Processing Samples

I used a machine called Flote Tech, model A1, produced by RJ Dausman Technical Services Inc to process the flotation samples. The machine is designed to separate and keep both light and heavy fractions.

The machine takes nearly half an hour to fill each time. After use, and once the machine is empty, it takes another half hour to thoroughly clean the machine so future samples are not contaminated. Due to the time costs in filling the machine, I processed up to 3 samples using the same water. I only did this for samples that came from the same feature. When using the same water for samples from the same feature, I was careful to make sure the section of the machine where the sample is poured in did not overflow to contaminate the rest of the water, and I thoroughly wiped down the sides to make sure the macrobotanical remains went to the collection section of the flotation machine. In order to prevent cross contamination between features, I only processed the samples from the same feature in the same water. When I started processing a different feature number, I would change the water, even if I had only processed one sample. In between processing a feature and starting a new one, I would do a thorough cleaning of the machine. If I had already processed three samples and had more samples from the same feature to process, I would still change the water.

Sorting the Light Fraction

Sorting seeds was done by hand using a microscope and a fine bristle paintbrush. I poured the sample of light fraction remains into a Petri dish and under a microscope would brush through the remains until I found a seed or piece of corn. I would then remove this item with either the paintbrush or if necessary, an extremely flexible pair of tweezers in order to avoid crushing delicate items removed from the sample. I focused on removing seeds, burnt seeds and corn parts. If the sample had a large amount of remains, I would only search through only a small portion of the sample at a time in order to avoid overcrowding the Petri dish, which would have made it hard to sort through and identify individual items. In an effort to make it easier to identify seeds, I would presort the samples by size so I was not dealing with larger items blocking the view of smaller items. The samples were sorted into anything bigger than 4 mm, material between 2 – 4 mm, and anything smaller than 2 mm.

Identifying seeds

Before identification, the seeds were pre-sorted into vials with seeds of similar shape and size from the same sample. This was done under the assumption that the seeds would either be the same seed type or close to the same types, making the identification process go quicker. Seeds of the same type but from different samples were kept in separate vials.

I performed an initial identification using the plant type collection located at the Museum of Peoples and Cultures, BYU, and books about the flora of Utah. I would then bring my results to Lisbeth Louderback from the University of Utah. She would either confirm my identification or help me figure out what the seed type actually was.

While both burnt and unburnt seeds were found in the samples, only the burnt seeds found in the flotation samples were identified. This is due to the fact that unburnt seeds from 800-1000 years ago are unlikely to be preserved and show up in archaeological samples.

Quantitative Methods

I used a variety of statistical methods to help understand the information gathered from analyzing the seeds found from the processed flotation samples. The methods used include absolute count, ubiquity, correspondence analysis, and Shannon-Weaver index.

Absolute count

Absolute count is the simplest form of descriptive measures (Marston 2014). I decided to use absolute count to describe exactly what I found. This way, will allow continued research on the topic without reliance on my interpretations. Another reason I used absolute counts is I am looking at the degree of reliance on certain types of plants, I needed to know the abundance of the various macrobotanical remains. I recognized that an absolute count would not provide a fully accurate account of the degree to which the plants were used in the past and would be influenced by the degree of preservation, as would any measurement used. There was no evidence that there were different preservation impacts between Period 1 and Period 2.

Ubiquity

Ubiquity is the presence or absence of an item, in this case, seeds or pieces of corn. The value of using ubiquity is the ability to see at a glance whether the same plants were present between the two main occupational time periods and features and see how widely the seeds were distributed among the samples. Because there is not as much information included in a ubiquity graph, it is easier to see the desired information quickly. The following equation was used to calculate ubiquity:

$$U = \frac{Q_P}{Q_S}$$

Shannon-Weaver index

In order to determine if there was a significant shift among plants used for dietary purposes between different sites, I used the Shannon-Weaver index which examines the total number of taxa and the evenness of frequency for each taxon (Popper 1988). The first step in using the Shannon-Weaver index is calculating the actual richness by using the following equation (Beals and Harrell 2000):

$$H = -\sum_{i=1}^{k} p_i \, ln(p_i)$$

Once the richness index is calculated, the evenness can be calculated (Beals and Harrell 2000). The evenness shows how similar of amounts from each species was present. The equation to calculate evenness is (Popper 1988):

$$J = \frac{H}{H_{max}}$$

The ratio gives a value that represents the spread of numbers. H expresses the richness of the population using logarithmic functions. The H_{max} expresses maximum richness possible in logarithmic functions (Beals and Harrell 2000). Dividing H by H_{max} will give a number between 1 and 0. The closer the number is to 1, the more evenly distributed the population (Beals and Harrell 2000).

The Shannon-Weaver index is useful because it shows whether the diet was general or specialized (Popper 1988). This means the index can help show the degree on which people focused on the various plants and whether a few plants were used to a greater degree rather than others.

When comparing different sites to Nancy Patterson Village, differences were found between the counts and types of plants found at each site. However, it is difficult to discern whether there is any importance in those differences by looking at the total counts. Using the Shannon-Weaver index to distill all of the numbers down to two indices for each site was extremely helpful to determine if the differences were meaningful or not.

Correspondence analysis

I also used Correspondence Analysis (CA) with my findings. CA can manipulate large quantities of data and on a large variety of species to put the numbers into a graph, making it easier to find patterns, which is why it is included in this thesis. The ability to handle, organize, and interpret large amounts of data is a valuable feature while working with plant remains as there is often a large amount to interpret and understand.

Unintentional and Intentional Deposition

For this thesis, unintentionally deposited seeds means the plants and in extension their seeds that ended up at the site without being intentionally being brought for a specific purpose. Unintentionally deposited plants would include seeds blowing in to the site, plant remains being caught on the clothing of the inhabitants, or plants being accidentally gathered up during the intentional gathering other plants. Intentional causes for deposition would include bringing plants in to specifically use them for food, fuel, building material, or other purposes. While there is strong evidence that the plants species identified for this thesis were used for subsistence, there is a possibly that they were used for other purposes as well.

3 Results

This chapter discusses the results of the analysis from both periods. To give greater understanding how the seeds were identified and their potential uses, included is a section giving a description of each seed type found and how those plants have been used ethnographically by Native Americans.

Seed Characteristics and Past Uses

Please note that all of the tribes listed in the following tables are still actively using wild plants for all of the purposes listed here. While the data came from past studies, and the practices are referred to as past practices, I do recognize and appreciate that these practices are still presently in use.

We cannot know for sure how these foods were being processed and eaten prehistorically. Just because these plants were used a specific way ethnographically, does not mean that is how they were being used prehistorically. However, this information can be used to help how to think about these plants and their potential uses. Because there is a wide range of uses by so many groups of Native Americans, I have included the top five most common uses for each plant. Further information can be found in the database "Plant Use by Native Peoples of the American Southwest" by Katharine D. Rainey and Karen R. Adams (2004) on crowcanyon.org.

Amaranthaceae Amaranthus (Amaranth)

Amaranthus seeds are dark reddish brown to black, sometimes making it difficult to determine if they are burnt or not. The seeds can be either be shiny or dull, but always with a smooth surface (Heil et al. 2013). The shape is either subglubose or lenticular (Heil et al. 2013).

Amaranthus and *Chenopodium* seeds are often difficult to distinguish from one another because they are similar in size and shape. Two distinguishing characteristics were used identify the two seed types. The first is *Amaranthus* tends to be flatter than *Chenopodium*. The second characteristic is *Amaranthus* has a small ridge around the edge of the seed, whereas *Chenopodium* typically does not, though some species do, which is why knowing *Amaranthus* tends to be flatter is so important.

The most common past use of *Amaranthus* by various Native American cultures in the Southwest was to eat the leaves as raw greens (Table 6) (Castetter 1935; Castetter and Bell 1951; Castetter and Opler 1936; Colton 1974; Lange 1968; Rainey and Adams 2004; Whiting 1985). The next most common use was grinding the seeds up to use for meal to be used in various ways (Bye 1972; Castetter 1935; Castetter and Bell 1951; Castetter and Opler 1936; Colton 1974; Curtin 1984; Elmore 1944; Gallagher 1977; Gifford 1936; Jones 1931; Lange 1968; Norris 1980; Rainey and Adams 2004; Robbins et al. 1916; Stevenson 1915; Swank 1932; Vestal 1940; White 1945).

Table 6: Past uses of Amaranthus.

Eaten: Boiled	Eaten: Bread	Eaten: Greens	Eaten: Ground	Eaten: With Meat
Acoma	Chiricahua Apache	Acoma	Cocopa	Hopi
Chiricahua Apache	Mescalero Apache	Cochiti	Hopi	Mescalero Apache
Cocopa	Navajo	Hopi	Maricopa	Papago
Havasupai	Papago	Isleta	Mojave	
Picuris	Pima	Jemez	Navajo	
Pima		Keres	Papago	
		Laguna	Western Apache	
		Mescalero	Zuni	
		Mojave		
		Navajo		
		Northeastern Yavapai		
		Papago		
		Southern Paiute		
		Pima		
		Tewa		
		Yuma		
		Zia		

Amaranthaceae Chenopodium (Pigweed)

Common names for *Chenopodium* are Pigweed and Goosefoot (Heil et al. 2013). This plant can grow in a variety of environments including either dry or moist areas, sandy, clay, saline, or gravely soils, along river banks, in marshes, or in open, disturbed soils such as plowed fields (Heil et al. 2013). Like *Amaranthus*, *Chenopodium* is lenticular to spherical in shape and reddish brown to black in color. Seeds range from .5 mm to 2 mm in size (Heil et al. 2013).

Chenopodium was used in similar ways as *Amaranthus*. The most frequent uses were eating the leaves as greens, boiling the plant, or grinding the seeds up for various uses (Table 7) (Buskirk 1986; Bye 1972; Castetter and Bell 1951; Castetter and Opler 1936; Curtin 1984; Elmore 1944; Jones 1931; Lange 1968; Rea 1997; Rainey and Adams 2004; Russell 1908; Vestal 1940; White 1945; Whiting 1966; Wyman and Harris 1951).

Table 7: Past Uses of Chenopodium.

Eaten: Boiled	Eaten: Fresh	Eaten: Greens	Eaten: Ground	Medicine
Chircahua Apache	Chircahua Apache	Chiricahua Apache	Havasupai	Kayenta Navajo
Cocopa	Mescalero Apache	Cochiti	Hopi	Navajo
Gila River Pima	Navajo	Cocopa	Navajo	Picuris
Hopi	Papago	Hopi	Pima	Ramah Navajo
Mecalero Apache	Pima	Isleta	Rama Navajo	Zuni
Mojave	Western Apache	Kayenta Navajo	Southern Paiute	
Pima		Keres	Western Apache	
Wetern Apache		Mescalero Apache	White Mountain Apache	
White Mountain Apache		Mojave	Zuni	
		Navajo		
		Northeastern Yavapai		
		Papago		
		Picuris		
		Pima		
		Yaqui		
		Zia		
		Zuni		

Asteraceae Helianthus (Sunflower)

Helianthus, also known as sunflower, grows along roadsides, streambanks or disturbed soils, and in sandy or saline soils (Heil et al. 2013). The pericarp of the *Helianthus* seeds found in the flotation samples were burnt, but striping was visible running from the base to the top.

As can be seen in Table 9, unlike *Chenopodium* and *Amaranthus*, the most common use of sunflower was to make cakes out of the ground seeds (Basehart 1974; Buskirk 1986; Bye 1972; Castetter 1935; Elmore 1944; Lange 1968; Rainey and Adams 2004; Vestal 1952; Whiting 1985) (Table 8). Another difference from *Amaranthus* and *Chenopodium* is the common use of *Helianthus* for medicinal purposes (Camazine and Bye 1980; Colton 1974; Cook 1930; Hocking

1956; Lange 1968; Rainey and Adams 2004; Reagan 1929; Swank 1932; Wyman and Harris 1951).

Table 8: Past uses of Helianthus.

Bread	Cakes	Ceremonial	Medicinal Juice	Snack Food
Chiricahua Apache	Apache	Hopi	Acoma	Gila River Pima
Mescalero Apache	Cochiti	Isleta	Cochiti	Hopi
Navajo	Havasupai	Jemez	Hopi	Western Apache
	Mescalero Apache	Navajo	Jemez	
	Navajo	Picuris	Kayenta Navajo	
	Ramah Navajo	Zuni	White Mountain Apache	
	Southern Paiute		Navajo	
	Western Paiute		Zuni	
	Western Apache			

Brassicaceae c.f. Brassica (Mustard)

Brassica seeds are typically spherical in shape and dark brown with skin that has an almost netlike texture (Heil et al. 2013). The texture on the seed found in the flotation samples had raised bumps instead of dimpling or a netlike pattern, making it difficult to decide if the seed was really *Brassica.* However, *Brassica* was the closest match and had enough similarities to make it the final identification.

No historical uses are recorded for *Brassica.* However, another wild mustard genus (*Descuraninia*) in the Southwest region was recorded being used historically by Native Americans. The most common method of preparing the plant was grinding the seeds as done by the Cocopa, Gila River Pima, Havasupai, Navajo, Papago, Ramah Navajo, and Southern Paiute (Bailey 1940; Bye 1972; Castetter and Bell 1951; Rainey and Adams 2004; Rea 1997; Vestal 1952; Whiting 1985). Some used the ground seeds for making cakes as the Ramah Navajo did or to be mixed with water to make a drink as done by the Gila River Pima (Rainey and Adams 2004; Rea 1997; Vestal 1952). The other method most common of preparing the plant to eat was by boiling it as done by the Hopi, Havasupai, Mohave, Pima, Southern Paiute, and Yuma. This genus is not the one that was found in Nancy Patterson Village samples, but these records give us an idea of how plants from this family were used.

Brassicaceae Lepidium (Peppergrass)

Lepidium grows in desert environments including pinyon-juniper and sagebrush environments (Heil et al. 2013). *Lepidium* seeds are oblong or obovate in shape and measure about 1.3mm to 2.3mm in length (Heil et al. 2013). *Lepidium* is a grassy type plant that you can pluck the small fruit off and eat. While there are species of *Lepidium* that are native to Utah, no records of historical use in the Southwest were found. It is from the same family as *Brassica* and what is written for the *Brassica* past use section applies here as well.

Cactaceae Opuntia (Pricklypear Cactus)

Opuntia seeds are sub circular in shape with a protruding girdle (Heil et al. 2013). These plants can be found in sandy to rocky soils in sagebrush and pinion/juniper environments (Heil et al. 2013).

The most common use of the prickly pear cactus was eating the fruit fresh, though some effort was naturally put into removing the spines including rolling the fruit on the ground (Bailey 1940; Castetter 1935; Castetter and Bell 1951; Castetter and Opler 1936; Cook 1930; Crosswhite 1981; Gifford 1936; Jones 1931; Rainey and Adams 2004) (Table 9).

Table 9: Past uses of Opuntia.

Beverage	Boiled	Dried (For winter Use)	Fresh	Medicinal
Chiricahua Apache	Gila River Pima	Acoma	Acoma	Cochiti
Gila River Pima	Hano	Laguna	Isleta	Hopi
Havasupai	Hopi	Mescalero Apache	Jemez	Hualapai
Hualapai	Isleta	Northeastern Yavapai	Maricopa	Jemez
Mescalero Apache	Navajo	Papago	Mescalero Apache	Mescalero Apache
Northeastern Yavapai	Papago		Mojave	Navajo
			Navajo	
			Northeastern Yavapai	
			Papago	

A number of tribes dried *Opuntia* out specifically for food storage for winter (Castetter 1935; Castetter and Opler 1936; Gifford 1936; Norris 1980; Rainey and Adams 2004; Swank 1932). *Opuntia* was not the only plant, as will be shown later, that was prepared in a specific manner for either winter use or times of food shortage. *Opuntia* was also used as a medicine for a wide variety of cures (Lange 1968; Rainey and Adams 2004; Swank 1932; Whiting 1966). *Opuntia* was considered a famine food by the Acoma, Hopi, Gila River Pima, Laguna, and Papago (Rainey and Adams 2004; Rea 1997; Swank 1932; Whiting 1966).

Capparaceae Cleome (Beeplant)

Cleome seeds are very similarly shaped to *Chenopodium* seeds as they are round and slightly pointed toward the end. However, the *Cleome* seeds are more spherical than flat and, in the case of the seeds found at Nancy Patterson Village, have more texture on the skin than *Chenopodium.* The *Cleome* plant grows in a wide variety of environments including desert scrub, pinion-juniper, and ponderosa pine communities.

Cleome had very similar uses as *Amaranthus*. The above ground plant was boiled and eaten as greens (Table 10) (Bartlett 1943; Elmore 1944; Gallagher 1977; Jones 1931; Rainey and Adams 2004; Swank 1932; Wyman and Harris 1951). The next most common way to preparing *Cleome* as food was to boil it (Castetter 1935; Franciscan Fathers 1929; Krenetsky 1964; Rainey and Adams 2004; Swank 1932; Vestal 1952).

Table 10: Past uses of Cleome.

Boiled	**Ceremonial**	**Dried (For Winter Use)**	**Greens**	**Medicinal**
Acoma	Cochiti	Hopi	Acoma	Gosiute
Navajo	Hopi	Navajo	Hopi	Kayenta Navajo
New Mexico Pueblo Groups	Kayenta Navajo	Western Apache	Isleta	
Picuris			Kayenta Navajo	
Ramah Navajo			Laguna	
			Navajo	
			Western Apache	

Fabaceae Type (Legume Family)

Fabaceae seeds are oblong with the tip of the radicle coming off on one side. The Fabaceae seeds found in the flotation samples could potentially match with several different genera from the Fabaceae family. Due to the lack of ability to make a more specific identification, the seeds were only given a family level identification.

Because no specific genus was determined, a genus known to have been used historically in the Southwest was used to examine the historical uses by Native Americans, specifically *Phaseolus*. The most common ways to use the beans for eating was either boiling them or parching them (Table 11) (Buskirk 1986; Gifford 1965; Rainey and Adams 2004; Rea 1997; Stevenson 1915; Whiting 1966).

Table 11: Past use of Phaseolus.

Boiled	Ceremony	Parched
Cocopa	Hopi	Cocopa
Gila River Pima	Keres	Gila River Pima
Western Apache	Navajo	
Zuni	Zuni	

Juncaceae Type (Rush Family)

The one Juncaceae seed found in the flotation samples was oblong, round and sat vertically in the bractlet based on the shape of the base. The top is slightly pointed and the skin has a striped texture. Because the seed could fit into multiple genera of the Junaceae family, this seed was only identified to the family level.

Because no specific genus was determined, a genus known to have been used historically in the Southwest was used to examine the historical uses by Native Americans, specifically *Juncus*. Few historical uses were listed for *Juncus*, the most common use recorded was making baskets from the plant stalks (Table 12) (Castetter and Bell 1951; Rainey and Adams 2004). The uses recorded here are for one specific genus, but knowing how this genus was used gives an understanding how other plants in the Juncaceae family could be used.

Table 12: Past uses of Juncus.

Ceremony	Basket	Medicine	Thatching	Sandpaper
Hopi	Cocopa	Navajo	Isleta	Navajo
	Mohave			
	Yuma			

Malvaceae Sphaeralcea (Globe Mallow)

Sphaerlacea seeds are kidney shaped and instead of the walls of the seeds curving out, they curve in towards the center of the seed, creating two ridge lines along the back of the seed. This plant grows in sagebrush, pinion-juniper, and ponderosa pine type environments (Heil et al. 2013).

Unlike all of the other plants and their recorded uses, the main use of globe mallow was not for consumption as food but medicinal purposes (Table 13) (Franciscan Fathers 1929; Gallagher 1977; Krenetsky 1964; Lange 1968; Rea 1997; Rainey and Adams 2004; Robbins et al. 1916; Russell 1908; Swank 1932; Vestal 1952; Whiting 1966; Wyman and Harris 1951).

Table 13: Past uses of Sphaeralceae.

Ceremonial	**Glue**	**Medicinal**	**Under Baking Yucca**
Acoma	Acoma	Acoma	Acoma
Laguna	Laguna	Laguna	Laguna
Kayenta Navajo		Cochiti	
Navajo		Gila River Pima	
Ramah Navajo		Hopi	
Tewa		Kayenta	
Zuni		Navajo	
		Picuris	
		Pima	
		Ramah Navajo	
		Tewa	
		Western Apache	

Poaceae Stipa (Needlegrass)

The one *Stipa* seed found is long and round, pointed at both ends with a smooth skin. This plant grows in desert scrub and pinion-juniper communities (Heil et al. 2013).

Very few historical uses were recorded for *Stipa*. The Hopi would use part of the plant to make ceremonial necklaces and the Ramah Navajo would use the stalks to make play arrows (Colton 1974; Rainey and Adams 2004; Vestal 1952). The Crow Canyon database listed both the Hopi and Goshute as using *Stipa*, but the specific uses were unknown (Chamberlin 1974; Rainey and Adams 2004).

Portulacaceae Portulaca (Purslane)

Portulaca seeds are very similar to *Chenopodium* in size and shape. The distinguishing feature for *Portulaca* seeds are rows of bumps following the shape of the seed. This genus can be found in a wide variety of environments (Heil et al. 2013). *Portulaca* tends to grow in disturbed soils (Heil et al. 2013).

Similar to *Amaranthus* and *Chenopodium*, the most common use of Purslane was to eat the leaves as greens, or eating the plant fresh (Table 14) (Bye 1972; Castetter 1935; Castetter and Opler 1936; Crosswhite 1981; Lange 1968; Meals for Millions 1980; Rainey and Adams 2004; Vestal 1952). While both the Isleta and Picuris dried purslane, only the entry for the Picuris specified that drying it was for winter use (Jones 1931; Krenetsky 1964; Rainey and Adams 2004).

Table 14: Past uses of Portulaca.

Boiled	Cooked with Meat	Dried	Fresh	Greens
New Mexico Pueblo Groups	Acoma	Isleta	Chiricahua Apache	Chiricahua Apache
Picuris	Chiricahua Apache	Picuris (For Winter)	Mescalero Apache	Cochiti
Pima	Hopi		Papago	Laguna
San Felipe	Mescalero Apache		Pima	Mescalero Apache
			San Felipe	Papago
				Pima
				Ramah Navajo
				Southern Paiute

Seed discussion

As can be seen from the discussion above, the plants represented by the seeds I found were used, and in many cases still used, for a broad range of purposes in the lives of Native Americans. As mentioned earlier, just because these plants were used in certain ways ethnographically, does not mean that was how they were being used prehistorically. The importance of looking at these uses is to help broaden the perspective of how plants could have been used.

The full results of the analyses will be covered in the following section. For now, it should be noted that a greater variety of wild plants was found from the Period 2 samples. Initially, the results seemed to indicate that there a broader range of plants were used during Period 2. However, many of the plants found at Nancy Patterson Village could have been eaten raw or the seeds ground up. Such methods would not leave behind seeds to be discovered in the archaeological record centuries later. Other methods such as boiling and drying the plants have a higher potential for seeds to be preserved. Instead of a broader range of plants being used, another possibility is the plants were being prepared in different ways in the later period, allowing the seeds to be better preserved. There is no evidence that this was the case, but it something to think about. Either way, there does seem to have been a change in subsistence practices over time at Nancy Patterson Village. It is important to note that all of the plants types found in the flotation samples from Nancy Patterson Village could be found within a short distance of the site.

Analysis

Of the 94 flotation samples processed, 54 samples had burnt seeds or pieces of corn in them. Other macrobotanicals included charcoal, and uncharred plant remains. This thesis is about the subsistence patterns at Nancy Patterson Village, so the focus was on identifying burnt seeds and domesticate plant parts. Other macrobotanical remains were not analyzed. A total of 794 seeds and plant remains from the flotation samples was analyzed (Table 15).

Table 15: Total macrobotanical count from flotation samples.

Plant Taxon	Period 1	Period 2	Total
Amaranthaceae *Amaranthus*	56	154	210
Amaranthaceae *Chenopodium*	15	59	74
Asteraceae *Helianthus*	-	2	2
Brassicaceae *Brassica?*	1	-	1
Brassicaceae *Lepidium*	1	1	2
Cactaceae *Opuntia*	-	10	10
Capparaceae *Cleome*	-	10	10
Fabaceae Type	-	9	9
Juncaceae Type	-	1	1
Malvaceae *Sphaeralcea*	-	2	2
Poaceae *Zea mays*	235	165	400
Poaceae *Stipa*	1	-	1
*Portulaca*ceae *Portulaca*	48	7	55
Unidentified	5	12	17
Total	362	432	794

Included in the interpretation with the seeds and corn found in the flotation samples are the macrobotanical remains picked out of the screen during excavation (Table 16).

Table 16: Total macrobotanical remain count pulled during excavation.

Plant Taxon	Period 1	Period 2	Total
Cucurbitaceae Cucurbita	-	73	73
Poaceae *Zea mays*	60	125	185
Total	60	198	258

A total of 1,052 burnt seeds and corn fragments was found and analyzed, 422 from Period 1 and 630 from Period 2 (Table 17). The following discussion identifies which burned seeds were determined to be from cultural use rather than from natural deposition. Knowing which plant taxa are present from cultural use is important. If some seeds were present due to natural causes rather than cultural ones, interpretation of subsistence practices at Nancy Patterson Village would shift.

Table 17: Total number of seeds and corn pieces found.

Plant Taxon	Period 1	Period 2	Total
Amaranthaceae *Amaranthus*	56	154	210
Amaranthaceae *Chenopodium*	15	59	74
Asteraceae *Helianthus*	-	2	2
Brassicaceae Brassica?	1	-	1
Brassicaceae *Lepidium*	1	-	1
Cactaceae *Opuntia*	-	10	10
Capparaceae *Cleome*	-	10	10
Fabaceae Type	-	10	10
Juncaceae Type	-	1	1
Malvaceae Sphaeralcea	-	2	2
Poaceae *Zea mays*	295	290	583
Poaceae Stipa	1	-	1
Portulacaceae Portulaca	48	7	55
Unidentified	5	12	17
Cucurbitaceae Cucurbita	-	73	73
Total	422	630	1052

Period 1

Most of the macrobotanical remains from Period 1 are from four main plant taxa, *Amaranthus* (pigweed)*, Chenopodium* (goosefoot)*, Portulaca* (purslane) and *Zea mays* (corn) (Table 18). Three other plant taxa were found from Period 1, *Brassica* (mustard)*, Lepidium* (peppergrass), and *Stipa* (needle grass) (Table 18). Only one seed from each of the three was found. All the plant taxa found besides corn are weedy type plants that tend to grow in disturbed areas such as fields for crops (Heil et al. 2013). In addition, all of the plant types found from Period 1 except for *Brassica* grow naturally in the alkaline soil that is found at Nancy Patterson Village (Heil et al. 2013). *Brassica* has been reported to grow in the San Juan region (Heil et al. 2013).

Table 18: Seed count from Period 1.

Plant Taxon	Seed Count
Amaranthaceae *Amaranthus*	56
Amaranthaceae *Chenopodium*	15
Brassicaceae *Brassica?*	1
Brassicaceae *Lepidium*	1
Poaceae *Zea mays*	295
Poaceae *Stipa*	1
*Portulaca*ceae *Portulaca*	48
Unidentified	5
Total	422

Absolute count

Looking at the counts, it may seem *Zea mays* was used to a greater degree because the count is so high (Table 19). However, looking at absolute count does not give an entirely accurate picture of the past because many of the fragments found could come from the same cob. Also, many of the other plants, including *Amaranthus*, *Chenopodium*, and *Portulaca* have very small, plentiful seeds. There may be many of the seeds around, but that does not necessarily indicate the plant was relied on heavily, since the seeds from one plant spread everywhere. Absolute count is not a sufficient gauge on its own in indicating how much Nancy Patterson Village inhabitants were relying on certain plants, though it does help.

Table 19: Period 1 seed count by feature type (see Appendix B for feature numbers).

Plant Taxon	Habitation	Midden	Plaza	Storage	Total
Amaranthaceae *Amaranthus*	-	51	4	1	56
Amaranthaceae *Chenopodium*	-	15	-	-	15
*Brassica*ceae *Brassica?*	-	-	-	1	1
*Brassica*ceae *Lepidium*	-	-	-	1	1
Poaceae *Zea mays*	7	272	4	12	295
Poaceae *Stipa*	-	-	-	1	1
*Portulaca*ceae *Portulaca*	13	35	-	-	48
Unidentified	-	5	-	-	5
Total	20	318	8	16	422

The fact that there is one seed of *Lepidium, Brassica,* and *Stipa* each, but no more is interesting. Evidence suggests (see following section) that the inhabitants were using these plants culturally. However, there was only one seed of each plant found. Does that mean the Nancy Patterson Village inhabitants were not using these plants that much? Without further research, it may not be possible to know.

Ubiquity

Because I was more interested in what could be seen from each feature rather than each sample, the ubiquity was found by determining how many features from each period was each seed type in. For example, I looked at flotation samples coming from four features in Period 1 so the equation used to find ubiquity for each seed type in Period 1 was:

$$U = \frac{Q_S}{Q_4}$$

Chenopodium was surprisingly uncommon in Period 1 (Table 20). Only 15 *Chenopodium* seeds were pulled from Period 1 samples, and all of those came from the midden. Forty-eight *Portulaca* seeds were found in Period 1 samples, thirteen of those came from the habitation features, and thirty-five came from midden features. Even where *Chenopodium* was present, there was more *Portulaca* than *Chenopodium*.

Table 20: Plant taxa ubiquity from Period 1.

Plant Taxon	Ubiquity, % of Presence
Amaranthaceae *Amaranthus*	75.00%
Amaranthaceae *Chenopodium*	25.00%
Brassicaceae *Brassica?*	25.00%
Poaceae *Zea mays*	100.00%
Poaceae *Stipa*	25.00%
Portulacaceae Portulaca	50.00%
Unidentified	25.00%

Amaranthus, found in the midden, plaza, and storage features, was more ubiquitous than either *Portulaca* or *Chenopodium*. This is interesting, since it was not in the habitation feature either. Only amaranth and corn were found in the plaza, a large stone-lined circle of compacted earth that had no covering. Because of the structural features of the plaza, it was curious that only *Amaranthus* and *Zea mays* were there. Also of interest, the habitation rooms had only *Porutlaca* and *Zea mays* in them.

Correspondence analysis

Correspondence analysis plots show correlations by analyzing vast amounts of data and then plotting items that correspond close together. In this case, when taxa types are plotted close together, they had connections with the same features. If features were plotted together, they had connections with the same taxa. This provides a method to simplify and view connections that are more difficult to find by just looking at numbers.

Beyond the strong correlation between the three plant taxa found in the gray ware pot in Period 1, there were no other strong correspondences found from a correspondence analysis between seed type and Secondary Feature Period 1 This analyses was based on count rather than ubiquity. The amount of *Zea mays*, *Amaranthus*, and *Chenopodium* found in comparison to the other plant taxa was so great that they hid any underlying patterns that might exist. By running the correspondence analysis on ubiquity, those three plant taxa were still part of the analysis, but did not skew the result.

As can be seen by looking at the graph (Figure 5), all of the seeds (besides the three found in the gray ware pot) and features are grouped together, indicating that everything is connected. This continued lack of pattern is because there were only a small number of plant taxa found, not allowing for much pattern. The small number of excavated areas to samples from exacerbates this tendency; there is not really much opportunity for patterns to arise.

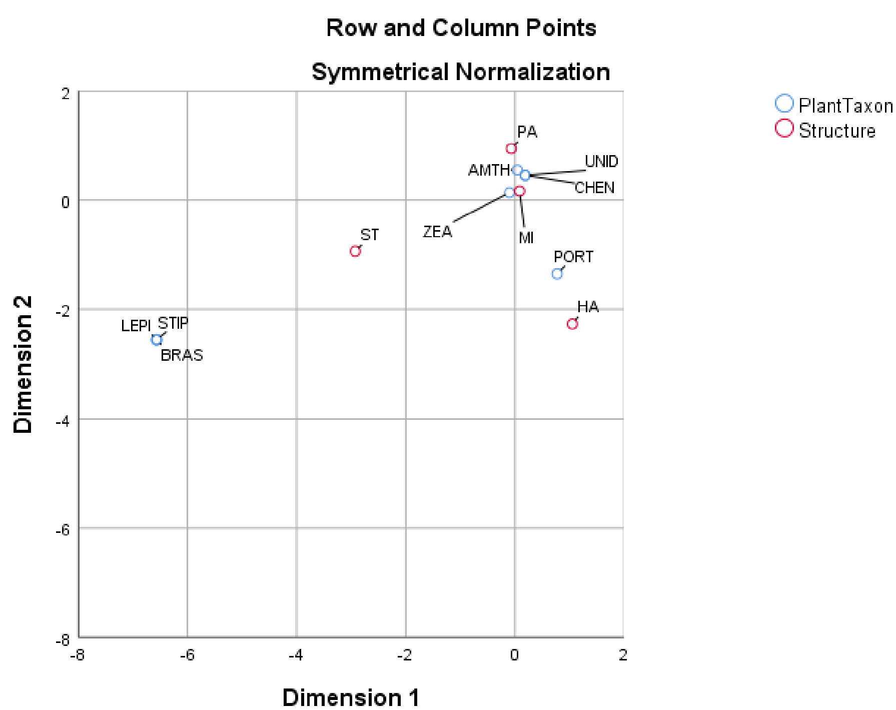

Figure 5: Period 1 structure/plant taxa CA. Abbreviations: Amaranthus (AMTH), Chenopodium (CHEN), Brassica (BRAS), Lepidium (LEPI), Zea (ZEA), Stipa (STIP), Portulaca (PORT), Habitation (HA), Midden (MI), Plaza (PA), and Storage (ST).

Period 2

Absolute count

Period 2 had high a richness (number of plant taxa) found, with the greatest richness in the midden (Table 21). This is unsurprising, as the highest number of Period 2 flotation samples processed came from the midden. The other features with the greatest richness of plant remains found were the kiva, storage, and mealing bins. The habitation features only had seeds from *Amaranthus, Chenopodium, Zea mays,* and *Portulaca* (Table 21).

Table 21: Period 2 structure seed count (See Appendix C for feature numbers).

Plant Taxon	Courtyard	EU work	Habitation	Kiva	Mealing bin	Midden	Possible turkey pen	Use Surface	Rock alignment	Storage	Total
Amaranthaceae *Amaranthus*	-	1	8	2	4	126	-	-	-	13	154
Amaranthaceae *Chenopodium*	-	1	4	3	8	39	-	-	-	4	59
Asteraceae *Helianthus*	-	-	-	-	1	-	-	-	-	1	2
Cactaceae *Opuntia*	-	-	-	-	-	10	-	-	-	-	10
Capparaceae *Cleome*	-	-	-	1	-	9	-	-	-	-	10
*Cucurbit*aceae *Cucurbita*	1	-	-	-	-	-	-	-	-	72	73
Fabaceae *Type*	-	-	-	1	-	8	-	-	-	-	9
Juncaceae *Type*	-	1	-	-	-	-	-	-	-	-	1
Malvaceae *Sphaeralcea*	-	-	-	-	-	2	-	-	-	-	2
Poaceae *Zea mays*	28	-	5	76	-	146	1	2	16	16	290
*Portulaca*ceae *Portulaca*	-	-	1	-	2	4	-	-	-	-	7
Unidentified	-	-	-	1	-	10	-	-	-	1	12
Total	29	3	18	84	15	355	1	2	16	107	630

The four plant types with the highest count in Period 2 are *Amaranthus, Chenopodium, Cucurbita,* and *Zea mays.* Three of those plant types were among the four found in the habitation structure.

Ubiquity

Same as Period 1, I focused on the ubiquity of seeds within features for Period 2. While there is greater richness in Period 2, few of the counts for the wild seeds reach over 10. What that means is difficult to determine. It may mean these plants were not used intensely so there were not that many seeds around, or it may mean that they were eaten in such a way that seeds were not preserved as often as corn or squash. The ubiquity of the seeds supports the theory that a number of the wild plants were not relied upon intensely for subsistence (Table 22).

Table 22: Plant taxa ubiquity in Period 2.

Plant Taxon	Percent Present
Amaranthaceae *Amaranthus*	76.9
Amaranthaceae *Chenopodium*	76.9
Asteraceae *Helianthus*	15.3
*Brassica*ceae *Lepidium*	7.6
Cactaceae *Opuntia*	15.3
Capparaceae *Cleome*	15.3
Fabaceae Type	15.3
Juncaceae Type	7.6
Malvaceae *Sphaeralcea*	7.6
Poaceae *Zea mays*	61.5
*Portulaca*ceae *Portulaca*	23.0
Unidentified	23.0

Note: Cucurbita and the corn pulled out during excavation is not included with in the ubiquity table since it did not come from the flotation samples and would show an inaccurate representation of ubiquity.

There are far fewer squash seeds found in comparison to corn pieces from Period 2. That could mean a greater reliance on corn than squash, but not necessarily. The squash seeds found were unburnt and squash seeds are naturally much more delicate than corn. The lower number of seeds may just mean not as many squash seeds survived the years.

Correspondence analysis

A correspondence analysis focused on the ubiquity of plant taxa in Period 2 structures types showed a loose grouping of structure types and plant names on the graph with a few outliers, indicating that nothing is really correlated. This was from the high ubiquity of *Zea mays*, *Amaranthus*, and *Chenopodium*. Because these three plant taxa are so ubiquitous, they have connections with all of the other taxa and features, pulling the plotted points closer to their own points. However, since none of the other plants had the same connections, the points were pushed farther apart. The strong pull from three plant types, and the lack of connection among the others, creates a one loose grouping instead of the distinct groups that would indicate what is correlated. With the data for those three plants removed, the graph was not as grouped, but still did not show any clear patterns (Figure 6).

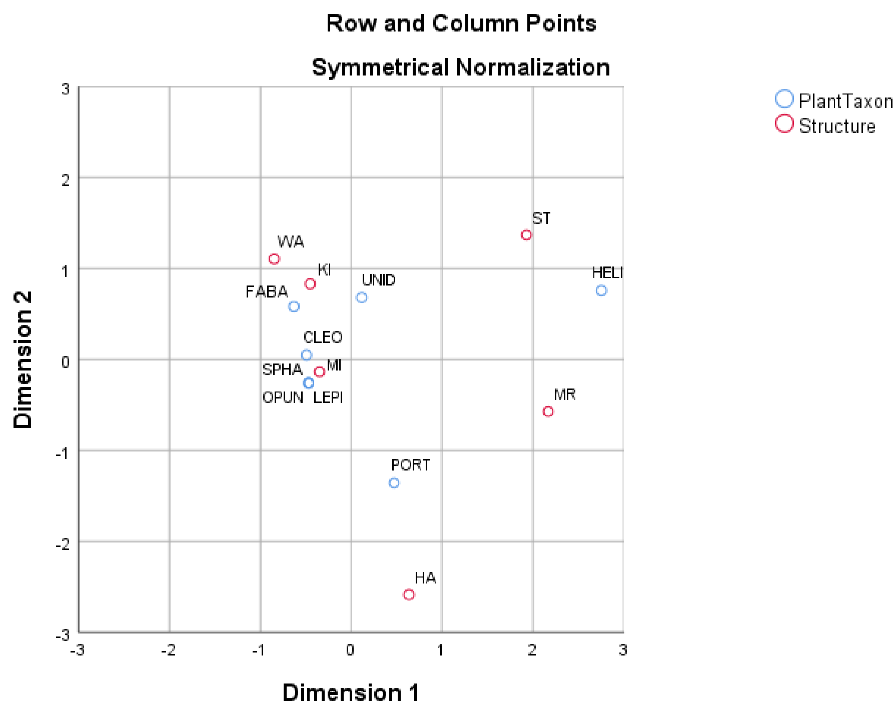

Figure 6: Period 2 secondary feature/plant taxa CA without Zea, Amaranthus, Chenopodium. Abbreviations: Cleome (CLEO), Fabaceae (FABA), Helianthus (HELIA), Lepidium (LEPI), Opuntia (OPUN), Portulaca (PORT), Sphaeralcea (SPHA), Habitation (HA), Kiva (KI), Midden (MI).

Because the larger number of seed types found within the midden hid other patterns of less significance (causing the same problem that *Zea mays*, *Amaranthus*, and *Chenopodiud had)*, the midden samples were taken out of the analysis as well. The resulting graph had three, correlated groups (Figure 7). These three groupings indicate which plants and features are more closely correlated with each other.

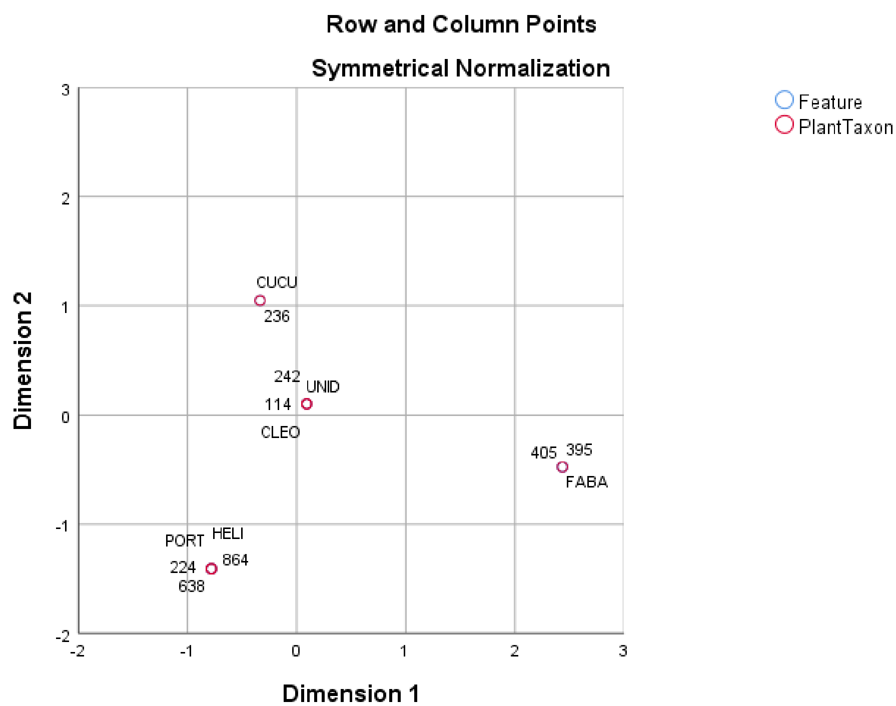

Figure 7: Period feature ubiquity without Zea mays, Amaranthus, Chenopodium, and midden. Abbreviations: Cucurbita (CUCU), Cleome (CLEO), Fabaceae (FABA), Helianthus (HELI), Portulaca (PORT), and Unidentified (UNID).

One group consisted of Fabaceae with Features 395 (a kiva) and 405 (a work area). The work area and kiva are adjacent to each other in the construction, close to *Cucurbita* and feature 236 (Figure 8). The storage room, feature 242, and kiva, feature 114, were grouped with *Cleome* and features 638 (mealing bin), 864 (storage), and 224 (habitation) were all grouped with *Portulaca* and *Helianthus*.

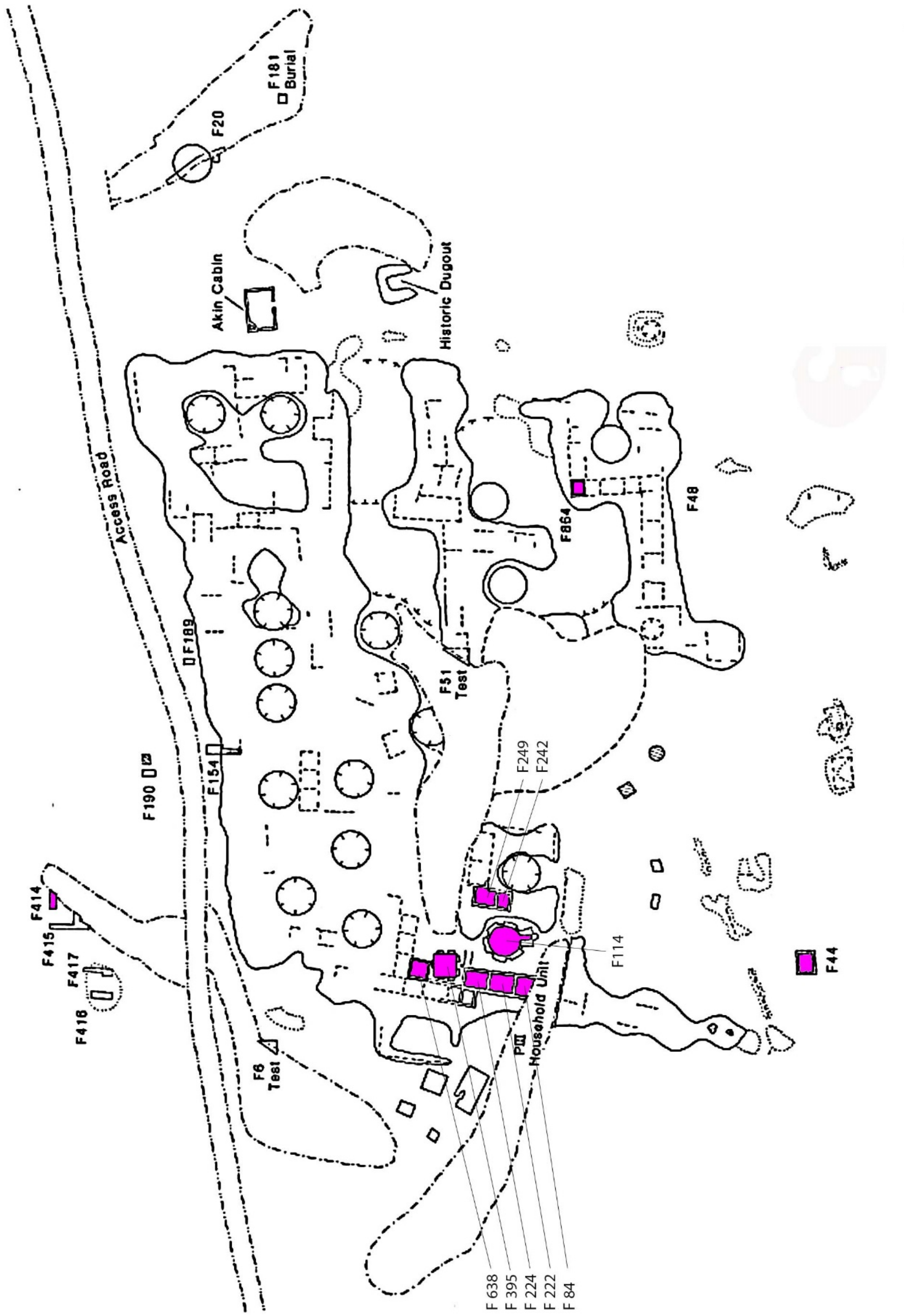

Figure 8: Labelled map of lower ruin.

The only two features that had *Portulaca* were feature 224, a habitation, and feature 638, a mealing room. Feature 395 (with no *Portulaca*) is in between those two rooms.

Helianthus and feature 864, a storage room, are also associated in the grouping with *Portulaca*. *Helianthus* was only found in feature 864 and feature 638 (storage), which explains why both features are in this grouping.

As stated above, these groupings indicate that in some way, the plants and features found in each grouping were more correlated with each other than the plants and features from the other groups. A possible explanation of the patterns here is that they reflect the cultural use of specific foods for specific situations, e.g., one type of food with common day meals, and another type food with more ceremonial or public meals. Another potential explanation is these rooms were part of different households.

While these patterns are extremely interesting to note, they are not based on a large enough sample. These patterns are discussed here because it would be of much worth to research these potential patterns by gathering more data and excavating more sites in a manner that could further investigate this possibility.

Discussion

Plant richness in Period 1 and Period 2

Period 2 had greater richness than Period 1 and most of that richness shows up in the midden. Only two of the plant taxa seeds found in Period 2, *Helianthus* and Junaceae, did not occur in the midden. One of the wild plant taxa, *Opuntia*, only found in Period 2 samples and not

Period 1, had a count in the double digits. The greater richness is likely from plants being used for subsistence rather than unintentional causes. This argument is based on the number of plant taxa found only in Period 2. Sixteen samples were processed from Period 1 middens and eleven from the Period 2 midden. There was more of an opportunity for greater richness from earlier middens than the later one, and yet it was not there.

One of the new plant taxa found in Period 2 was squash. All of the squash seeds found were recovered during excavation found deeply buried in Feature 864 room with unusually good preservation. No squash seeds were found from processing flotation samples. The lack of squash seeds found in Period 1 does not necessarily mean they were not using squash as food during Period 1. Squash seeds are fragile and decompose much more quickly than burnt corn. It is extremely likely that squash was used during Period 1 and the seeds simply did not survive the test of time.

Seeds in the gray ware jar

The *Lepidium, Brassica,* and *Stipa* seeds were found in the same gray ware jar in a storage room, Feature 539. There were also burnt corn fragments found in the jar (Table 9). Finding these three plant taxa inside a jar is interesting, since only three processed samples came from inside the grayware pots found in the storage room, while there were thirteen processed samples from Period 1 middens. Because of the greater number of samples processed, and the richer material typically found in middens, it is more likely to find the greatest richness of plant taxa from the midden samples. Middens on average have a greater number of seeds per sample than any other sampled area, increasing the likelihood of greater richness. Initially it seemed the seeds were most likely cultural if they were in the storage room, where it would be less likely for seeds to be naturally deposited and not in the midden, out in the open air.

However, the middens are created by dumping trash coming from other parts of the site, including cleaning out hearths or habitations areas, making the midden an aggregated sample of what was going on in the rest of the site. If plants were being used culturally in other parts of the site, remains of the plants are likely to end up in the midden. Yet there was no evidence of these three plants in the midden.

There are ways for the seeds to end up in those jars besides intentional causes. For example, all three of these plant types grow naturally in the type of environment found at or near Nancy Patterson Village and are weedy type plants that grow easily in disturbed soils and the seeds spread easily. While the corn was being processed and stored, seeds from the nearby plants could blow into the mix and be stored with the corn. However, due to the lack of presence of these plant types in other areas of the site, there is no evidence these seeds were deposited in the jar unintentionally, so they are most likely present from intentional causes.

Though these three seeds only account for only 0.3% of identified material from Nancy Patterson Village, it was important to determine whether the three seed types found in gray ware jars were from intentional use or unintentional causes before discussing Period 1. If these seeds were there due to subsistence practices, they nearly double the number of plant taxa used for subsistence during that time period. Without those three plant taxa, the plant taxa used for food found from Period 1 would be reduced to four types. None of these three plant taxa were found in Period 2 samples.

Period 2 habitation structures

Interestingly, the only plant taxa found in the habitation structure in Period 2 were the ones that were most common from Period 1, *Zea mays*, *Amaranthus*, *Chenopodium*, and *Portulaca*. While there were a number of new plant taxa found in Period 2, none of them were found in the habitation. They were in the mealing bins, midden, rock alignment (test excavations showed this was two rooms with cultural fill and ash in the soil), kiva, and storage contexts. This may indicate a specialization in how foods were processed and used.

Chenopodium and Portulaca

Another change from Period 1 is the ubiquity and amount of *Chenopodium* and *Portulaca* found in relation to each other. In Period 2, *Chenopodium* is found in most of the features and in greater quantities than found in Period 1. There was a smaller quantity of *Portulaca* found in Period 2 than in Period 1. If these seeds were at the site due to cultural practices, the change in ubiquity and count may reflect changes in subsistence practices at the site.

Working with the belief that both *Portulaca* and *Chenopodium* are present at the site due to intentional causes makes comparing Period 1 to Period 2 rather interesting. As mentioned earlier, the count and ubiquity of *Portulaca* is lower in Period 2 than the count and ubiquity of *Portulaca* in Period 1. In Period 2, *Chenopodium* has a higher count and ubiquity than in Period 1.

The count of *Portulaca* seeds in Period 2 goes down to seven seeds and they are mostly found in habitation and storage structures. Only two *Portulaca* seeds were found in the mealing bin. While the seeds were found in more locations in Period 2, samples were available from a wider range of locations from that time and therefore *Portulaca* is less ubiquitous in Period 2.

The count for *Chenopodium* in Period 2 was the fourth highest behind *Zea mays,* squash, and *Amaranthus* with a total count of 59 seeds found. *Chenopodium* was also found in over half of the features sampled, including structure types that did not have any *Chenopodium* in Period 1. In conclusion, there was a shift in Period 2 to using *Chenopodium* to a greater degree than *Portulaca*.

4 Discussion

In order to help understand the analysis results from Nancy Patterson Village, the findings from other sites in the Mesa Verde Region that date to the same time were examined. Nancy Patterson Village was one site in a greater culture area. There have been many sites excavated in the Mesa Verde Region. From these excavations, flotation samples were taken and analyzed. The following section covers environmental and social climate of the region and the archaeobotanical results from four sites that were excavated. These sites were chosen because they were all occupied around the same time that Nancy Patterson Village was occupied, have similar environmental settings, and are located in the same region (Central Mesa Verde).

Climate

Climate in the American Southwest is variable and dependent upon two types of climate systems: bimodal and unimodal (Cordell et al. 2007). Nancy Patterson Village is located in the western portion of the Mesa Verde Region which has a bimodal climate system. This means there are two peak seasons for precipitation (Cordell et al. 2007). The first peak is from July to August with the moisture coming up from the Gulf of California (Cordell et al. 2007). The second season is from December to March, with the moisture coming in mostly from the Pacific Ocean (Cordell et al. 2007). Van West and Dean (2000) found the average precipitation over a

400-year period, from AD 901-1300, was 457±109mm (18.0±4.3 inches) in the Mesa Verde Region.

Temperature and precipitation in the year impact whether the season will be good or bad agriculturally. The temperatures need to be warm enough to prevent the crops from freezing and there has to be enough precipitation for the crops to grow (Cordell et al. 2007). The higher elevations get more moisture, but also cooler temperatures (Cordell et al. 2007) The lower elevations have cooler temperatures, but less moisture (Cordell et al. 2007). These are the climatic conditions that people would have been dealing with and reacting to while living in the region. The migrations that occurred within the region and to other areas have frequently been associated with the climatic fluctuations that occurred (Kohler 2000; Cordell et al. 2007; Schwindt et al. 2016). Two associated theories are discussed in the following section.

Changing climates

There are multiple theories as to the effect the climate had on the inhabitants of the Mesa Verde region. Kohler (2000) focuses on the potential hindrances caused by the cooler temperatures. Schwindt et al. (2016) focuses on the precipitation and the effects caused by the abundance or lack of water. While the foci for the two theories is different, they are not opposing since both the temperature and precipitation affect the farming potential. While one will not necessarily change because the other does, both will impact the growing season. Because both temperature and precipitation had an impact on the inhabitants of the area, I cover both starting with Kohler.

Over the centuries, the Mesa Verde region in which Nancy Patterson Village is located saw warm and cold years. The late 800s to the early 900s were cold, based on tree ring records from Almagre Mountain and San Francisco peaks. Kohler (2000) found that the cold would shorten the growing season for crops for the higher elevations.

The A.D. 900s and 1000s had warmer weather, as well as an increased population density (Kohler 2000). The late A.D. 1000s and early 1100s were cold (Kohler 2000). Approximately from AD 1180 – 1210, the weather was warmer and thus good agriculturally followed by a decade of extremely low agriculture potential due to colder weather (Kohler 2000). The first 60 years of the 1200s were cold, which eventually contributed to the depopulation of the region (Kohler 2000).

Schwindt et al. (2016) instead focused instead on the soil moisture, which shows the other side of Kohler's (2000) precipitation/temperature balance than what. Farming in the lower elevations was easier in 800s and early 900s, worse in later 900s and early 1000s and then better again in late 1000s (Schwindt et al. 2016). Schwindt et al. believed that the increase and decrease in population size had a positive correlation with the farming potential, based on soil moisture. Soil moisture was low in the 13th century, based on tree rings and, following the previous years with low moisture, the inhabitants of Mesa Verde could not support the larger population and left the area (Schwindt et al. 2016).

Either way, farming potential in higher and lower elevations was low in the 13th century for the Central Mesa Verde region due to both cold temperatures and little precipitation. While the climate had not been constantly poor, the effects of the hard years between the good years compounded. When there was another climatic downturn in the 13th century, the land had already been depleted from the previous hard years and did not have the ability to support the inhabitants of the area if they continued to use the same subsistence practices that were in use during that time.

Subsistence strategies

Several studies show that in the Pueblo II times, the main source of meat came from mule deer and other artiodactyl fauna (Senior and Pierce 1984; Thompson 1990; Munro 1994). Archaeologists have found turkey remains from Pueblo II times, though evidence shows that turkey only made on average 12% of the economic species remains per site based on samples taken in the Mesa Verde Region (Munro 1994). In Pueblo III times, the dependence on turkey as an economic species increased to 49% (Munro 1994). This shift to a greater dependence on domesticated turkey occurred around the same time as increased aggregation in later periods (Cordell et al. 2007; Driver 2002).

In the general Mesa Verde area, during Pueblo II times, there was an abundance of farming and a reliance on *Zea mays* for calories. For most Ancestral Puebloans, *Zea mays* was the most important resource for calories, providing up to 70 – 80% of the calorie intake, supplemented with calories from other domesticated plants such as beans and squash (Adams and Bowyers 2002).

The dependence on *Zea mays* and turkey created an interesting situation for Pueblo III Mesa Verde inhabitants. Isotopic analysis of turkey bones from Pueblo III indicated diets of plants high in C4, i.e. *Zea mays*. Domesticated turkeys were fed *Zea mays* (Munro 1994). In years when there were sufficient crops, this subsistence strategy was viable. When there were poor agricultural years, keeping one diet staple (turkeys) alive was dependent on giving them the other main limited diet staple (maize). Being in competition for food with their own food source may have exacerbated the scarcity of food in bad years.

Social Climate

Though the Ancestral Puebloans were sedentary farmers, there was still frequent immigration and emigrations from AD 900-1300, which influenced the demographic makeup of the area (Mahoney et al. 2000; Schwindt et al. 2016).

Aggregation begins in the 8^{th} century in the Mesa Verde region, and then declined in the end of the 8^{th} century and beginning of the 9^{th} century. The population increased again to a greater degree around AD 1100 (Varien et al. 1996; Cordell et al. 2007). During this period of increased aggregation, there was an intensification in the agricultural effort, as evidenced by the increase of contour terraces and check dams in the Mesa Verde Region (Adams and Bowyer 2002 and Cordell et al. 2007). With the intensification of agriculture, there was reduced residential mobility as people were more tied to the land they were putting effort into manipulating (Cordell et al. 2007).

One reason for the population movement was climate fluctuation. As shown by the differing theories from Kohler (2000) and Schwindt (2016), the amount of precipitation was not the only consideration in determining whether the climate was good. While drought did have an impact on the potential success for subsistence, there were other factors that need to be considered to fully understand the situation the inhabitants of the San Juan region faced. What has been called the Great drought was between AD 1276 and 1299 (Varien et al. 2000). Depopulation of the region had already started in AD 1225. Though there were pressures encouraging inhabitants of the area to leave before the drought occurred, the drought was an added motivation to leave the area.

Other climatic factors to consider are the cool seasons that made farming difficult, as there was a shortened growing season as well as the spatial incoherence in the precipitation pattern (Varien et al. 2000). As mentioned previously, the Northern San Juan region had a bimodal precipitation system that seems to have become unreliable between AD 1239 and 1248. Having unpredictable rainy seasons would have a large impact on the success of their crops.

When the climate was favorable the populations would then increase, not only in the central areas, but in the peripheral ones as well (Schwindt 2016). The peripheral areas may still have been inferior to the central area for farming, but during the agriculturally favorable years, the peripheral regions were able to provide enough food for the population in those areas. More available land seems to have been a draw, even if it was not as agriculturally productive as the central areas. When times were good, population rose in the more peripheral regions as people moved into these areas and established their homes, brought in by the draw of available land. As families became established and new generations came, the numbers continued to increase.

When the climate worsened, the population that had increased during the favorable seasons was no longer supportable. While this occurrence was more manageable in Pueblo II times due to the greater ability to move and ability to rely on neighboring villages (Cordell et al. 2007), in Pueblo III he situation was more complicated. One of the differences between Pueblo II and Pueblo III is how flexible their subsistence patterns were. In the Pueblo II times when there was a change in the environment, a drought, or any event that would impact the agricultural productivity for the worse, the inhabitants were able to adapt to the situation by moving to a different area (Schwindt et al. 2016; Waters 2006). Schwindt et al. (2016) found evidence of population decrease in the peripheral regions during climatic downturns, from the population moving back to more agriculturally productive areas that could support a higher population.

While this practice was viable during Pueblo II times, and still occurred during Pueblo III times, the result in Pueblo III times was harmful (Varien et al. 2000). The peak population during the Pueblo II times never reached the same level as the population during the Pueblo III times. There was more flexibility for population increase in an area as the resources were not as strained. Those on the periphery were able to move to the central region in Pueblo II times and there were enough resources in the central region to support them as the number already living in the area was not enough to put a strain on the resources (Schwindt et al. 2016).

During Pueblo III times, there were multiple agriculturally unfavorable years in a row that depleted the resources. Depleted resources combined with higher populations made it harder to sustain the population (Dean and Van West 2002; Duff et al. 2010; Kuckleman 2010; Schwindt et al. 2016). That is, there were fewer resources supporting more people. The number coming in from the periphery was higher than it had been in the past as well. A population at its peak, having a greater number of people than ever before coming all at once in to an area where resources had been depleted, set the board for collapse.

Another option available to those living in Pueblo II times was to use more wild resources (Waters 2006). From evidence provided by the faunal bone, people in Pueblo III times relied on domesticated forms of meat to a greater degree than Pueblo II people did (Munro 1994; Thompson 1990). This may have been due to the lack of available wild resources nearby or the danger of going far to hunt. Pueblo III times saw a heightened amount of violence, and many authors speculate this is a potential cause for aggregation and the decreased dependence on wild game. Either way, using the once available wild resources no longer seemed to have been as much of an option.

The final option that Pueblo II inhabitants had available (Waters 2006) is the option to work with people in other areas who had a surplus (Cordell et al. 2007). As there were two types of climatic systems so close, the chances were high that someone within trading distance had fared better than those facing poor climatic conditions. However, the same problem existed with this option that existed with the first option discussed. The population was higher across the entire region, and there were not enough resources to go around.

When there were climatic downturns in Pueblo III times, the same flexibility was not available as during Pueblo II. Useable land was claimed, the wild resources were either used up, or it was unsafe to travel far enough to gather them, social tensions had increased, and it was not safe to work with others, or past trading partners had insufficient supplies for all those in need. The other options for subsistence were no longer available (Waters 2006).

On top of the shortage of resources, the social-political makeup of the land had changed by Pueblo III times. With higher populations, and greater aggregation, the social setting became more structural and hierarchal. Some believe this was to help deal with the tension of so many people living close together (Arakawa 2012).

Another change is the land ownership became more formal (Arakawa 2012; Varien et al. 2000). Land was no longer available for use by incoming populations, since there were residents that had already laid claim to the land. It was also harder to take land that was claimed when it belonged to a large group of people rather than a single family as was the case in earlier times. Leaving the area was less likely for individuals as well, as they became more tied to the land with the intensification of agriculture (Adams and Bowyer 2002; Cordell et al. 2007).

Finding other available land was an unlikely option. People put time and effort into protecting the land and making it able to support higher population by putting in terraces, check dams, and guard stations (Varien et al. 2000; Adams and Bowyer 2002; Cordell et al. 2007). They had made a commitment to using the land they were on. Leaving was not an easy option to accept. Also, as the social situation became increasingly violent in the Pueblo III times. Staying part of the system provided greater protection than a family would have on its own. Leaving was unsafe.

With the increasing population size, which continued to the 13^{th} century, and the heavy reliance on *Zea mays* and turkey for food, the situation was very unstable (Schwindt et al. 2016). This is the climatic and social dynamic that the inhabitants of Nancy Patterson Village experienced.

Comparison to Nearby Sites

Yellow Jacket Pueblo

Yellow Jacket Pueblo is located in the Central Mesa Verde Region and was inhabited from the mid A.D. 1000s to the late 1200s and is the largest site in the Mesa Verde region (Kuckelman 2003). Like the others, this site was chosen because it is located in the same region as Nancy Patterson Village and was occupied around the same time as the later Nancy Patterson Village occupation and had a similar environmental setting.

Murray and Jackman-Craig (2003) analyzed 47 flotation samples and 444 macrofossils found in excavation. Their findings were very similar to other sites in the area. The inhabitants of Yellow Jacket Pueblo were eating the domesticated plants *Zea mays,* beans (*Phaseolus vulgaris*), and squash (*Cucurbita*). Also similar to other sites, they found *Chenopodium*, *Amaranthus*, groundcherry (*Physalis*), yucca (*Yucca baccata*), purslane (*Portulaca*), bulrush (Scirpus), ricegrass (Stipa hymenoides), and big Sagebrush (Artemisia tridentata) (Murray and Jackman-Craig 2003) (Table 23).

Table 23: Comparison of Yellow Jacket Pueblo and Nancy Patterson Village subsistence macrobotanical remains (Table compiled from data found in Murray and Jackman-Craig 2003 and my own analyses).

Taxon	# from Yellow Jacket Pueblo	# from Nancy Patterson Village
Domesticated Plants		
Zea mays	16	583
Phaseolus vulgaris–type	7	0
Cucurbita-type	2	73
Wild Plants		
Chenopodium/*Amaranthus*-type	27	284
Physalis-type	7	0
Yucca baccata–type	7	0
Portulaca–type	6	55
Scirpus-type	5	0
Artemisia tridentata–type	4	0
Stipa–type	4	1
Echinocereus fendleri–type	2	0
Helianthus/*H. annuus*–type	2	2
Quercus-type	2	0
Corispermum-type	1	0
Gramineae-type	1	0
Juncaceae	1	1
Malvaceae-type	3	2
Rhus aromatica	1	0
Stipa	1	1
Brassica- type	0	1
Lepidium- type	0	1
Opuntia- type	0	10
Cleome- type	0	10
Fabeaceae- type	0	1

As can be seen in the table above, a greater variety of macrobotanical remains associated with subsistence was found at Yellow Jacket Pueblo in comparison to Nancy Patterson Village. This greater variety comes from a smaller number of flotation samples, only 47 soil samples processed instead of the 94 samples processed from Nancy Patterson Village, though both macrobotanical counts include items that were picked out during excavation and screening processes. For both sites, a standard of 1-liter soil samples were processed (Murray and Jackman-Craig 2003). In the cases where the samples were smaller than a liter, the entire sample was processed (Murray and Jackman-Craig 2003). In addition, the greater variety cannot be attributed to a greater number of macrobotanicals found since the total count for Nancy Patterson Village is higher than that of Yellow Jacket Pueblo.

Yet the numbers are still disproportionate. There were hundreds more pieces of corn and cheno-ams found at Nancy Patterson Village than Yellow Jacket. Yellow Jacket, on the other hand, had a greater variety of plant taxa found. Most of the wild plant taxa had a higher count at Yellow Jacket compared to Nancy Patterson. So, there was a somewhat smaller presence of some wild seeds and a much higher presence of corn, cheno-ams, squash, and purslane at Nancy Patterson Village in comparison to Yellow Jacket.

These numbers would seem to indicate a greater reliance on four main plant types in Nancy Patterson Village. This is difficult to tell from absolute count since seeds and corn pieces do not give an accurate representation of the amount of plants actually being eaten. However, this conclusion is made by looking at the proportion of these four plant taxa compared to other plants from each site.

The number of macrobotanical remains from Yellow Jacket Pueblo is more rich and evenly spread across species than Nancy Patterson Village, as can be seen by the results of using the Shannon-Weaver index for both sites. The richness index of Yellow Jacket was 2.33 with an evenness of .82. The index for Nancy Patterson Village was .92 with an evenness of .37. This means Yellow Jacket Pueblo had a richer subsistence base with the taxa used more evenly distributed than Nancy Patterson Village. The greater variety and disproportionate difference between seed count indicates a greater reliance on four types at Nancy Patterson. This pattern can be found when comparing Nancy Patterson Village to other sites as well.

Woods Canyon Pueblo

Woods Canyon is also a large site (though not as nearly as large as Yellow Jacket Pueblo) with around 50 kivas, 16 towers and between 120 to 220 surface rooms (Churchill 2002). The occupation dates for Woods Canyon start later than Nancy Patterson at A.D. 1140, and it was occupied through the 1200s (Churchill 2002).

Fifty-eight flotation samples were processed and 73 macrofossil samples were identified from Woods Canyon (Rainey and Jezik 2002). While *Zea mays* was found, no squash or beans were found (Rainey and Jezik 2002). The researchers accounted for this by the fragility of squash and bean seeds in comparison to *Zea mays*. The wild food found include *Chenopodium*, *Amaranthus, Portulaca, and Physalis* (Table 24) (Rainey and Jezik 2002).

Table 24: Comparison of Woods Canyon Pueblo and Nancy Patterson Village subsistence macrobotanical remains (Table compiled from data found in Rainey and Jezik 2002 and my own analyses).

Taxon[a]	# Woods Canyon Pueblo	# from Nancy Patterson Village
Domesticated Plants		
Zea mays	36	538
Cucurbita- type	0	73
Wild Plants		
Cheno-am	20	284
Physalis-type	12	0
Pinus-type	4	0
Portulaca-type	4	55
Echinocereus-type	3	0
Juniperus-type	2	0
Stipa–type	2	1
Amelanchier-type	1	0
Artemisia-type	1	0
Gramineae-type	1	0
Juniperus-type	1	0
Polygonum-type	1	0
Prunus/Rosa-type	1	0
Solanaceae-type	1	0
Helianthus	0	1
Brassica	0	1
Lepidium	0	1
Opuntia	0	10
Cleome	0	10
Fabaceae- type	0	10
Juncaceae- type	0	1
Sphaeralcea	0	2

Not as many flotation samples were processed from Woods Canyon as Nancy Patterson Village, which might affect numbers, but as seen in the case Yellow Jacket, a variety of plants found from Woods Canyon Pueblo is not found at Nancy Patterson Village (Table 26). Also like Yellow Jacket Pueblo, there was a more even reliance on a variety of plants at Woods Canyon Pueblo instead of a focused use of a few plants like Nancy Patterson Village.

Shields Pueblo

Shields Pueblo was occupied during the 700's and then abandoned for the next two centuries and then occupation resumed, with the most intensive occupation between A.D. 1050 and A.D. 1260 (Duff 2015). Shields Pueblo was completely abandoned around A.D. 1260. Of the 495 flotation samples taken during excavation, 165 samples were processed and analyzed along with 930 macrofossils samples that were analyzed for the final report (Adams 2015).

The domesticated plants most commonly used were corn, squash, and beans (Adams 2015)(Table 27). These were present at least by Pueblo II period. The researchers believe that these domesticates were there earlier but do not show up in the archaeological record due to small sample sizes and poor preservation (Adams 2015). Another reason squash and beans are unlikely to show up in the archaeological records is that rather than being parched, these seeds are frequently boiled (Adams 2015). Parching helps stabilize the seed structure, prolonging preservation. Boiling breaks down the seed structure, increasing the rate of decay (Rainey and Jesik 2002). Boiled seeds are much less likely to preserve long enough to be found in the archaeological record.

Something interesting to note at Shield's Pueblo is that *Zea mays* is less ubiquitous in the later years compared to earlier ones, and there is a greater use of wild plants. The ubiquity of corn goes down to 42.5% of samples in Late Pueblo III compared to at least 89 percent from flotation samples that came from Late Pueblo II (Adams 2015).

The most common wild plants found were cheno-ams followed by *Opuntia*. Researchers counted 18 other types, all with relatively low numbers. These include *Descurainia, Rhus aromatica, Stipa hymenoides, Cleome, Helianthus, Portulaca, Amelanchier, Echinocereus, Pinus, Prunus virginiana, Scirpus, Sphaeralcea,* and *Yucca baccata* (Table 25) (Adams 2015).

Table 25: Comparison of Shields Pueblo and Nancy Patterson Village subsistence macrobotanical remains (Table compiled from data found in Adams 2015 and my own analyses).

Taxon	# from Shields Pueblo	# from Nancy Patterson Village
	Domesticated Plants	
Cucurbitaceae- type	35	73
Phaseolus vulgaris- type	11	0
Zea mays	10,529	583
	Wild Plants	
Amelanchier utahensis-type	1	0
Cheno-am	709	284
Cleome-type	11	10
Descurainia- type	10	0
Echinocereus- type	1	0
Gramineae- type	46	0
Helianthus- type	3	1
Juniperus- type	1	0
Leguminosae- type	1	0
Malvacceae- type	12	2
Opuntia- type	39	10
Physalis- type	181	0
Pinus- type	6	0
Portulaca- type	52	55
Prusnus virginiana- type	3	0
Rhus aromatica	3	0
Scirpus- type	20	0
Solanaceae- type	9	0
Stipa - type	83	1
Yucca baccata- type	19	0
Brassica	0	1
Lepidium	0	1
Fabaceae	0	10
Juncaceae	0	1

Due to the greater quantity of both flotation and macrofossil samples analyzed for Shields Pueblo, there was a much higher count of plant remains associated with subsistence found in comparison to Nancy Patterson Village. There was a greater quantity of corn found at Sheilds Pueblo and beans were actually found there, while they were not found at Nancy Patterson Village. There was a greater quantity of squash seeds found at Nancy Patterson Village. However, these came from a specific area that had excellent preservation. Similar to Nancy Patterson Village, inhabitants at Shields Pueblo seemed focused on intensively using a few plant taxa.

Sand Canyon Pueblo

Sand Canyon Pueblo, also located it the Central Mesa Verde Region was a large site with over 420 rooms and 90 kivas (Kuckelman 2007). Occupation began around A.D. 1240 and ended around the same time as the Mesa Verde region was depopulated, in the late 1200s (Kuckelman 2007).

There were 80 flotation samples processed from Sand Canyon Pueblo, 25 of which were fully analyzed, and the rest were subsampled (Adams et al. 2007). *Zea mays* was the most ubiquitous domesticated plant followed by squash and beans. From coprolite testing in the Mesa Verde region, Adams et al. (2007) found that squash and beans were more heavily used than what is evidenced by material found in excavation and flotation samples (Adams et al. 2007). The most ubiquitous non-domesticated plants found at Sand Canyon were Cheno-ams, ground cherry (*Physalis*), and purslane (*Portulaca*).

The following table is looking at ubiquity instead of absolute count, as opposed to the tables from the other site comparisons. This is because only a ubiquity chart was provided (Table

26) (Adams et al. 2007). (Please note that N is the number of samples in which specimens occur. This was the only format was provided in the report, so the format is repeated here. The other reports had different formats which was used accordingly in this thesis.)

Table 26: Comparison of Sand Canyon Pueblo and Nancy Patterson Village subsistence macrobotanical remains (Table compiled from data found in Adams et al. 2007 and my own analyses).

Taxon[a]	Sand Canyon Pueblo		Nancy Patterson Village	
	N	%	N	%
Cheno-am	35	44	40	74
Physalis-type	30	38	0	0
Zea mays	16	20	37	68
Opuntia (prickly pear)-type	13	16	3	6
Portulaca retusa–type	11	14	19	35
Scirpus-type	5	6	0	0
Cucurbita-type	4	5	0	0
Helianthus type	4	5	2	4
Stipa hymenoides–type	4	5	1	2
Gramineae-type	4	5	0	0
Cucurbita moschata–type	3	4	0	0
Compositae-type	2	3	0	0
Phaseolus vulgaris–type	2	3	0	0
Rhus aromatica var. *trilobata*–type	2	3	0	0
Amelanchier/Peraphyllum-type	1	1	0	0
Cruciferae-type	1	1	0	0
Cycloloma atriplicifolium–type	1	1	0	0
Juniperus-type	1	1	0	0
Leguminosae-type	1	1	0	0
Malvaceae-type	1	1	1	2
Plantago-type	1	1	0	0
Polygonum-type	1	1	0	0
Yucca baccata–type	1	1	0	0
Brassica	0	0	1	2
Lepidium	0	0	1	2
Cleome	0	0	6	11
Fabaceae	0	0	4	7
Juncaceae	0	0	1	2

Sand Canyon Pueblo relied on a wider range of wild plants than Nancy Patterson or Shields Pueblo. Some plants were relied on to a greater degree, but overall the distribution seemed even. It is interesting to note for Sand Canyon Pueblo that corn was not as ubiquitous as cheno-ams or goundcherries.

Discussion

While there were some common plant taxa found among the four sites, each site had plant taxa found there that was not found at any of the other sites. Nancy Patterson stood out from the other sites how focused they were in the use of a small number of wild plants. This finding is quantified through the use of the Shannon-Weaver index.

Shannon-Weaver index

The Shannon-Weaver index was used to calculate the evenness of plant use for Nancy Patterson Village and three sites used for comparison. The fourth site, Sand Canyon Pueblo, could not be used in this comparison since only the ubiquity was reported instead of the absolute counts.

In Shannon-Weaver index, the closer the resulting number is to one, the more even the index, number closer to 0 indicates greater unevenness. Nancy Patterson Village shows a greater reliance on a specific foods than either Yellow Jacket Pueblo or Woods Canyon Pueblo (Table 27). Shields Pueblo on the other hand shows a very intense use of specific foods with an index at .17.

Table 27: Evenness including corn and squash counts.

Site	Evenness
Nancy Patterson Village	.46
Yellow Jacket Pueblo	.83
Woods Canyon Pueblo	.69
Shields Pueblo	.17

However, this first set of indices found is an incomplete picture. The extreme difference were in part due to the high number of corn pieces found. The first set of indices shows the extent to which the site relied on maize and supplemented with other plants. Maize and squash are easy to pick out of screens and during excavations. This skews the sampling, as corn and squash pieces were pulled out of screens and excavation areas that were not searched for other seeds, even though there is a high possibility other seeds were there. For future research, not combining the seeds and corn found from flotation sample counts and macrofossils found from the screen counts is recommended to avoid biases.

In order to better understand the full story, the Shannon-Weaver index was calculated for all four sites without including corn and squash numbers. While Shields Pueblo was most reliant on corn and had the lowest index in the first set, Nancy Patterson was the most specialized in the type of wild plant species used as can be seen by the second set (Table 28).

Table 28: Shannon-Weaver index without corn and squash counts.

Site	Evenness
Nancy Patterson Village	.37
Yellow Jacket Pueblo	.82
Woods Canyon Pueblo	.76
Shields Pueblo	.52

As can be seen, once the corn and squash have been removed from the equation, Nancy Patterson's evenness index is lower, while Woods Canyon and Shields Pueblo are higher, and Yellow Jacket only went down by .01. According to these results, Nancy Patterson Village used a few plants (*Amaranthus, Chenopodium, and Portulaca*) more intensively than others to a greater degree than the other sites.

Plant richness

While Nancy Patterson Village had a number of the same plants as the other sites discussed here, there were a number of plants found at the other sites that were not found at Nancy Patterson Village, including beans. This is could be due to poor preservation despite there being more squash found at Nancy Patterson Village than Shields Pueblo.

As for the wild plants used at other sites, there were differences between all the sites discussed here. There may be some commonalities, like ground cherry and yucca, but there are differences between each one. Nancy Patterson Village has a number of the same plants found at the others and some plant types that were not found at the others used. While the four sites are at a higher elevation than Nancy Patterson Village, the environments of all same sites are similar enough that elevation change does not explain the differences in plant types found. Currently, more research would need to be done in order to find a reason to account for these differences.

Summary

The overall subsistence practice found at Nancy Patterson Village was opposite from what was expected.. There was a change that occurred between Period 1 and Period 2, just not the one hypothesized. Instead of a shift to using fewer wild plants, the shift was to a greater use of wild plants. This conclusion is supported by the decreased ubiquity of corn, the increased ubiquity of wild plants, and the greater variety of wild plants found. As mentioned above, nine new plant types were found in the Period 2 flotation samples. These results indicate the change to using wild plants occurred before the shift to wild faunal during the Period 2 period. Evidence for new plant types being used for subsistence occurs in an earlier context than evidence for new faunal types being used for subsistence. This trend of using more wild foods and a decreased corn dependence is supported by the analyses from Shields Pueblo, the one site that had information provided divided by period. This finding was supported by the data analyzed from four sites found in the same region.

All of the sites analyzed showed an overall focus on a few number of domestic and wild food types supplemented with other wild plant varieties, though Nancy Patterson Village and Shields Pueblo did so to a greater degree than the other sites used for comparison. This pattern for all of the sites is based on the data from earlier and later periods combined. Not all of the sites provided the counts of plant remains divided up by Pueblo I, II, and III. However, Shields Pueblo, the one site report that did provide the numbers divided up into the different time periods, showed a greater degree of focus on a few plants, with supplementation with other plant types for subsistence in all periods (Adams 2015). The same was found at Nancy Patterson. Period 1 at Nancy Patterson had four main plants types used for subsistence by three others.

Even in Period 2, when there was greater richness of plants, there were four main plants used for subsistence and the nine others were supplemental.

The next question to answer is why this shift occurs. Those studying Shields Pueblo hypothesized the move towards using a higher amount of wild foods was at the end of Pueblo II and occurred due to drought in the mid-1100s (Adams 2015). Kohler (2000) agrees that the switch to wild foods was due to the drought, and it became more difficult to grow a sufficient amount of *Zea mays.* As a result, corn was supplemented with wild foods.

The difficulty of growing enough corn for the pueblo would be amplified by the need to also provide for their main faunal food source, the turkeys (Kohler 2000). While there is no firm proof that the inhabitants were feeding corn to the turkeys at Nancy Patterson Village, corn was found in what the excavators thought was a turkey pen. Growing enough corn for daily needs, for storage that is constantly being depleted due to droughts, and also for the turkeys would be a lot to do. Supplementing corn with wild foods would be a useful strategy.

Future Research

There are some points of potential research that should be acknowledged. The first is expanding the understanding on how plants were used. Finding three seeds, each from a different plant type, in a gray war jar with corn is what initiated this line of questioning. Why were the seeds in the jar with corn? Why do no more seeds from those plants show up elsewhere? One suggested explanation is that they were parched and ground to help store and give flavor to the corn. Another explanation is this was a jar and its contents were for ceremonial use. While the items were all edible, they may not necessarily have been for subsistence.

The other interesting point for potential research is the specialization of food use. From the limited samples found at Nancy Patterson Village, a pattern arose of only certain foods found in certain places that could be correlated with certain households. Focused excavation and sampling would need to occur to test whether or not this is an actual pattern or a random occurrence. Such research could provide insight into the social structure and functional organization of households of the Ancestral Puebloans.

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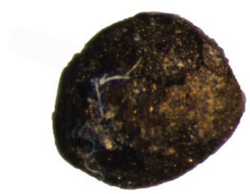
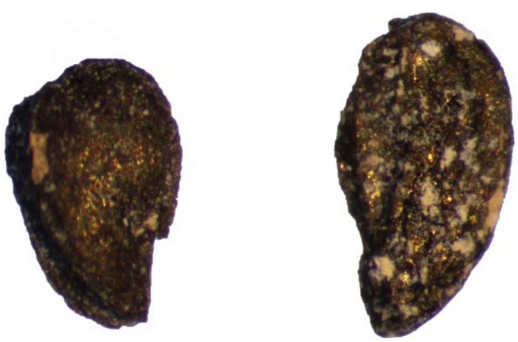
Appendix A: Photos of seed types found at Nancy Patterson Village.

 0.5mm Amaranthaceae *Amaranthus* (Amaranth)	 0.5 mm 0.5 mm Amaranthaceae *Chenopodium* (Pigweed)
 2 mm Asteraceae *Helianthus* (Sunflower)	 1mm Brassicaceae c.f. *Brassica* (Mustard)
 2 mm Brassicaceae *Lepidium* (Peppergrass)	 1 mm Cactaceae *Opuntia* (Pricklypear Cactus)

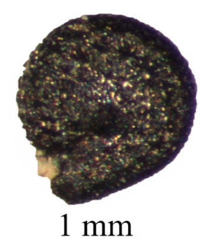
Capparaceae *Cleome* (Beeplant)

Fabaceae Type (Legume Family)

Junaceae Type (Rush Family)

Malvaceae *Spaeralcea* (Globe Mallow)

Poaceae *Stipa* (Needlegrass)



*Portulaca*ceae *Portulaca* (Purslane)

Appendix B: Total seed count from Period 1.

Feature	From FS#	*Plant Taxon*	Seed Total
340	4063	*Amaranthaceae Amaranthus*	4
340	4063	Poaceae *Maize*	4
365	5518	*Amaranthaceae Amaranthus*	1
365	5538	*Amaranthaceae Amaranthus*	4
365	5538	Amaranthaceae *Chenopodium*	1
365	5538	Poaceae *Maize*	3
365	5538	*Portulacaceae Portulaca*	1
365	5543	*Amaranthaceae Amaranthus*	3
365	5543	Poaceae *Maize*	1
365	5543	*Portulacaceae Portulaca*	10
365	5548	*Amaranthaceae Amaranthus*	4
365	5548	Amaranthaceae *Chenopodium*	2
365	5548	*Portulacaceae Portulaca*	4
365	5625	Poaceae *Maize*	6
365	5631	*Amaranthaceae Amaranthus*	9
365	5631	*Portulacaceae Portulaca*	5
365	5636	Amaranthaceae *Chenopodium*	2
365	5636	Poaceae *Maize*	15
365	5636	Portulacaceae *Portulaca*	1
365	5641	*Amaranthaceae Amaranthus*	2
365	5641	Poaceae *Maize*	19
365	6052	Poaceae *Maize*	5
365	6054	*Amaranthaceae Amaranthus*	5
365	6054	*Portulacaceae Portulaca*	8
365	6093	*Amaranthaceae Amaranthus*	4
365	6093	Amaranthaceae *Chenopodium*	1
365	6093	Poaceae *Maize*	20
365	6093	*Portulacaceae Portulaca*	2
365	6097	Poaceae *Maize*	25
365	6228	*Amaranthaceae Amaranthus*	3
365	6228	Poaceae *Maize*	8
365	6228	*Portulacaceae Portulaca*	1
365	6241	*Amaranthaceae Amaranthus*	1
365	6241	Amaranthaceae *Chenopodium*	8
365	6241	Poaceae *Maize*	2
365	6241	*Portulacaceae Portulaca*	2
365	6380	*Amaranthaceae Amaranthus*	10

365	6380	Poaceae *Maize*	8
365	6380	*Unidentified*	5
470	4623	Poaceae *Maize*	89
470	4626	*Amaranthaceae Amaranthus*	5
470	4626	Amaranthaceae *Chenopodium*	1
470	4626	Poaceae *Maize*	11
470	4626	Portulacaceae *Portulaca*	1
539	6886	*Amaranthaceae Amaranthus*	1
539	6886	*Brassicaceae Brassica?*	1
539	6886	Brassicaceae *Lepidium*	1
539	6886	Poaceae *Maize*	10
539	6886	Poaceae *Maize*	2
539	6886	*Poaceae Stipa hymnoides*	1
658	5993	Poaceae *Maize*	2
658	6159	Poaceae *Maize*	1
658	6159	*Portulacaceae Portulaca*	9
658	6564	Poaceae *Maize*	2
658	6564	Portulacaceae *Portulaca*	2
658	6568	Poaceae *Maize*	1
658	6568	Portulacaceae *Portulaca*	1
658	6740	Poaceae *Maize*	1
658	6740	Portulacaceae *Portulaca*	1

Appendix C: Total seed count from Period 2.

Feature	From FS#	*Plant Taxon*	Seed Total
84	736	*Amaranthaceae Amaranthus*	1
106	2845	*Amaranthaceae Amaranthus*	21
106	2845	Amaranthaceae *Chenopodium*	11
106	2845	Capparaceae *Cleome*	1
106	2845	Fabaceae *Type*	2
106	2845	Malvaceae *Sphaeralcea*	2
106	2845	Poaceae *Maize*	53
106	2933	*Amaranthaceae Amaranthus*	3
106	2933	Amaranthaceae *Chenopodium*	2
106	2933	Cactaceae *Opuntia*	3
106	2933	Capparaceae *Cleome*	1
106	2933	Capparaceae *Cleome*	1
106	2933	Capparaceae *Cleome*	5
106	2933	Poaceae *Maize*	3
106	2933	*Unidentified*	8
106	2933	Unidentified	1
106	2959	*Amaranthaceae Amaranthus*	5
106	2959	Amaranthaceae *Chenopodium*	4
106	2959	Brassicaceae *Lepidium*	1
106	2959	Fabaceae *Type*	3
106	2977	Amaranthaceae *Chenopodium*	2
106	2978	*Amaranthaceae Amaranthus*	16
106	2978	Amaranthaceae *Chenopodium*	2
106	2978	Portulacaceae *Portulaca*	1
106	2986	*Amaranthaceae Amaranthus*	18
106	2986	Amaranthaceae *Chenopodium*	10
106	2986	Fabaceae *Type*	3
106	3026	*Amaranthaceae Amaranthus*	21
106	3026	Amaranthaceae *Chenopodium*	1
106	3026	Capparaceae *Cleome*	1
106	3026	Poaceae *Maize*	14
106	3026	Portulacaceae *Portulaca*	1
106	3026	Unidentified	1
106	3096	*Amaranthaceae Amaranthus*	6
106	3096	Amaranthaceae *Chenopodium*	6
106	3096	Poaceae *Maize*	10

106	3096	Portulacaceae *Portulaca*	2
106	3097	Cactaceae *Opuntia*	1
106	3097	Poaceae *Maize*	5
106	3099	*Amaranthaceae Amaranthus*	36
106	3099	Amaranthaceae *Chenopodium*	1
106	3099	Poaceae *Maize*	1
114	4411	Poaceae *Maize*	5
114	4677	*Amaranthaceae Amaranthus*	2
114	4677	Capparaceae *Cleome*	1
114	4677	Poaceae *Maize*	21
114	4677	*Unidentified*	1
114	5332	Amaranthaceae *Chenopodium*	1
212	875	Poaceae *Maize*	16
222	1033	*Amaranthaceae Amaranthus*	1
222	1033	Amaranthaceae *Chenopodium*	1
222	1033	Poaceae *Maize*	1
222	1147	Poaceae *Maize*	1
222	1666	*Amaranthaceae Amaranthus*	1
224	1510	Amaranthaceae *Chenopodium*	1
224	1510	Portulacaceae *Portulaca*	1
224	2424	*Amaranthaceae Amaranthus*	3
224	2424	Amaranthaceae *Chenopodium*	1
224	2424	Poaceae *Maize*	2
242	1060	*Amaranthaceae Amaranthus*	1
242	1060	Amaranthaceae *Chenopodium*	2
242	1060	Unidentified	1
249	1437	Amaranthaceae *Chenopodium*	2
249	1899	*Amaranthaceae Amaranthus*	4
249	1899	Poaceae *Maize*	1
395	6148	Amaranthaceae *Chenopodium*	1
395	6148	Fabaceae *Type*	1
395	6148	Poaceae *Maize*	2
395	6894	Amaranthaceae *Chenopodium*	1
395	6894	Poaceae *Maize*	17
405	2572	Amaranthaceae *Amaranthus*	1
405	2572	Amaranthaceae *Chenopodium*	1
405	2572	Juncaceae?	1
430	2845	Cactaceae *Opuntia*	6
638	5493	*Amaranthaceae Amaranthus*	3
638	5493	Amaranthaceae *Chenopodium*	8

638	5493	Portulacaceae *Portulaca*	2
638	5556	*Amaranthaceae Amaranthus*	1
638	5556	*Asteraceae Helianthus*	1
864	6906	*Amaranthaceae Amaranthus*	1
864	6906	Poaceae *Maize*	11
864	6929	*Amaranthaceae Amaranthus*	9
864	6929	Amaranthaceae *Chenopodium*	1
864	6929	*Asteraceae Helianthus*	1
864	6929	Poaceae *Maize*	2