LaPlata Transect Survey, 2004

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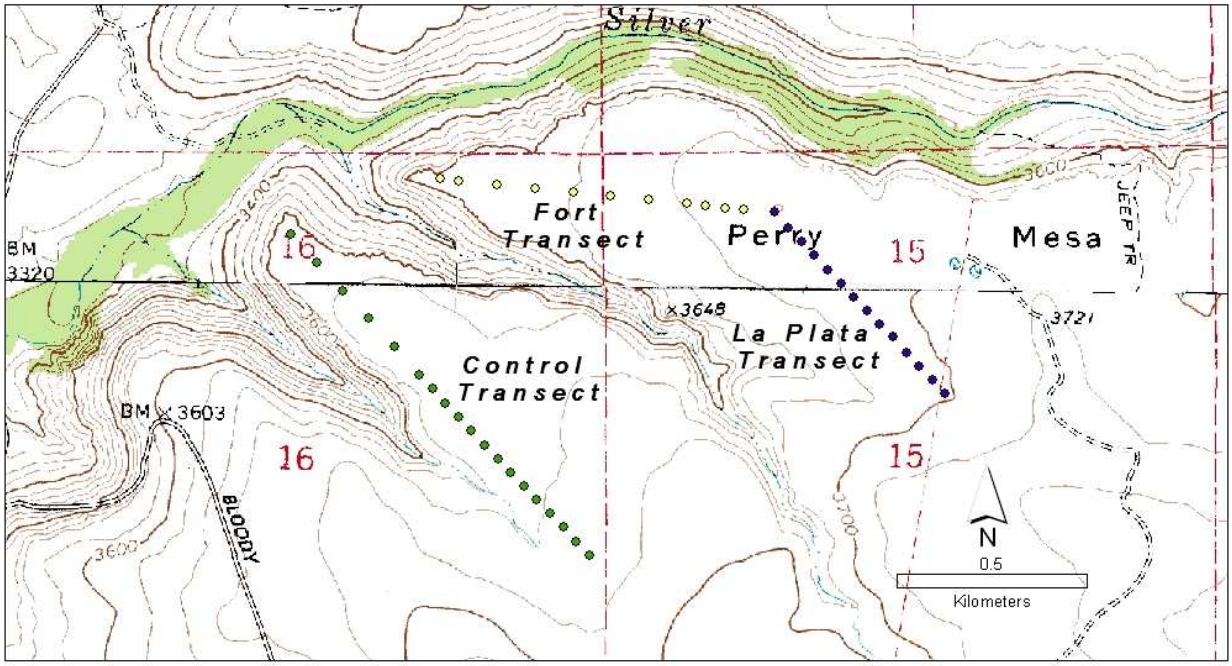
While the archaeological work at Pueblo La Plata has begun to provide critical data concerning prehistoric demography, ceramic accumulations, and use of plants and animals, it was on the transect surveys that the collaboration between archaeological and ecological research came to fruition in the 2004 field season. This report discusses the data collection protocol that was developed to collect archaeological, small mammal, plant, and rock cover data on these transects, and presents preliminary findings concerning each of these data classes. Although we had intended to collect soils data, this was not accomplished during the spring 2004 field season.

The aim of the transect surveys was to begin to investigate the degree to which the legacies of prehistoric human action may be influencing contemporary ecological parameters. Under the assumption that the intensity of prehistoric human action would have decreased with increasing distance from Pueblo La Plata, two of the transects radiated out from the pueblo (Figure 1). The La Plata transect ran from ASU's site mapping datum on Pueblo La Plata to a point 700 m away, along a bearing of 123°. We used a GPS to locate points along this line spaced at 50-meter intervals. The Fort transect ran from the same starting point to a point 900 m away next to the rock wall at the western edge of the mesa.

A "control" transect was established on the next mesa about 1 km to the south. It was designed to provide complementary data from an area with a similar environment to Pueblo La Plata, but with lower levels of prehistoric human impact. Residents of Pueblo

Figure 1. Map showing location of the three Spring 2004 survey transects.



La Plata did visit this area, particularly the western end of the transect where a prehistoric agave field was found during data collection. They would have spent less time on this mesa, however, than in the area immediately around Pueblo La Plata. The control was also laid out along a bearing of 123°, in order to match the La Plata transect as closely as possible. It ran for a distance of 1.15 km.

Data collection points for plant, animal, archaeological, and rock cover data were established systematically along these transects. On the La Plata transect, data collection points were spaced 50 m apart. On the Fort transect, within the 200 m closest to the pueblo data collection points were spaced at 50-meter intervals. Because of the length of this transect, data collection points along the remaining 700 m were spaced at 100-meter intervals. The eastern 650 m of the control transect corresponded to the La Plata transect, and data collection points were spaced at 50-meter intervals. The western 500 m of the

control transect corresponded in topography to the Fort transect, and data collection points were spaced 100 m apart. On two of the three transects (Control and La Plata) each data collection point was marked with a numbered wooden stake.

The same data collection protocol was used on each of the three transects (Figures 2 and 3). The protocol, described below, was designed to collect all types of data at the same spatial locations (data collection points) along the transect. Ecologists and archaeologists jointly participated in all data recording. Archaeological data collected on the survey included artifact counts and the recording of agricultural and other archaeological features. These data allow us to link patterns in the ecological data with indicators of human land use intensity. The ecological data that we collected included the presence, abundance, and distributions of various species of woody plants, herbaceous plants, and small mammals in the area. We also collected information on rock cover, as this it was thought to affect the distribution of vegetation types. The following discussion provides details on the data collection protocols and the preliminary results from analyses of these data.

Figure 2. Archaeology-ecology survey sampling scheme.

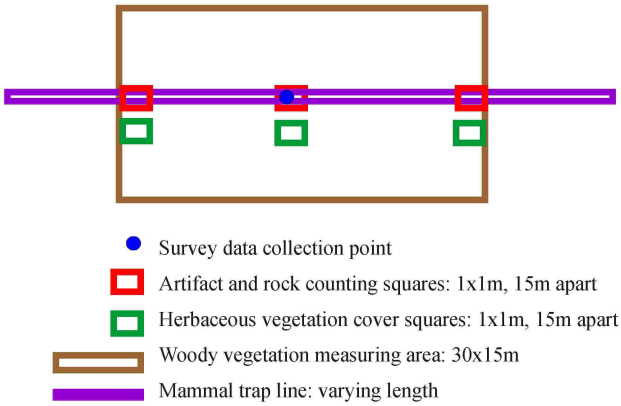
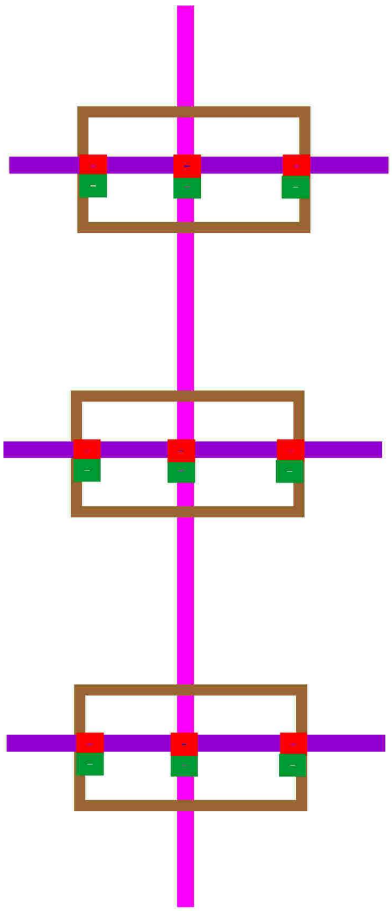


Figure 3. Distribution of sampling units along a transect.



Data Collection Protocols

Archaeological Survey

Archaeological survey data were important for assessing the relative intensity of human action along the three transects. In order to provide data on artifact density complementary to the ecological data, a set of three 1 x 1 m counting squares was located at each data collection point along each of the three transects (Figures 2 and 3). One square was positioned at the marked collection point, with additional squares located 15 m from each side of this center point as measured perpendicular to the direction of the transect. Artifacts within each square were counted by material type (ceramic and lithic) and information was recorded on a form (Appendix 1). While all artifacts were counted, only one potentially diagnostic artifact likely to be picked up by casual site visitors (an obsidian projectile point) was collected from a square on the La Plata transect.

In addition, researchers surveyed along the entire length of each transect in order to gather a background count of artifacts in the area. One person walked along the marked transect, while additional surveyors walked parallel to it at intervals of 15 m. The number of additional surveyors varied with each transect, and thus these data need to be divided by the number of personnel to be comparable. Each person kept a count of lithics, ceramics, and other artifacts seen along their survey line, and totals for each line were recorded when the next marked data collection point was reached. This running total provided information on artifact numbers and distribution between the artifact counting squares, in order to ensure that any artifact concentrations that fell between data collection points were not missed.

In addition to artifact counts, we noticed some archaeological features and potential features. The function of many of these features (such as rock piles) was uncertain, however, and in some cases it was difficult to determine whether a feature was archaeological or geological. Because of this and the additional time that would have been required, features (including rock piles, clearings, and cobble masonry rooms) were not systematically recorded in 2004. Instead, the locations of these were noted for future recording after we have gained more experience in recognizing human-constructed features on this landscape.

Rock Distribution Survey

Initial examinations suggested that the sizes, numbers, and concentrations of rocks varied considerably across the survey area, particularly along the La Plata and Fort transects. This variability appeared in part to be due to geological variation and in part due to the fact that people had cleared or piled rocks in some areas. We hypothesized that these differences in rock distribution may significantly influence vegetation and small mammal distribution. In order to include the effects of this variability in rock distribution in our analyses, rock data were collected from the same 1x1 m counting squares used for the artifact counts (Figure 2). In each of these areas, rocks were classified by size using geological criteria. The size classes were termed gravel, cobbles, stones, and boulders (Schoenenberger et al. 2002). Gravel was any rock smaller than 7.6 cm in its greatest dimension; cobbles ranged from 7.6 to 25 cm, stones from 25 to 60 cm, and a boulder was any rock 60cm or longer in its greatest dimension. The rocks (other than gravel) were counted, and the percent area of the square covered by each size class was estimated to the nearest 5% (e.g., 1-5%, 5-10%, etc).

Herbaceous Plants

Like the artifact and rock surveys, three herbaceous plant 1 x 1 m sampling squares were located at each data collection point (Figure 2). In order to avoid areas that had been trampled in the course of artifact and rock data collection, separate vegetation quadrats were established 5 m further along the transect than the rock/artifact squares. Plants were identified to the species level, and the percent area of the square covered by each species was recorded. In a few cases the sample quadrat fell in large cacti or other dense cover and a new location was selected nearby.

A team of two people conducted sampling at each quadrat. One person recorded the data and both engaged in plant identification and cover estimates. The percent cover was estimated as falling into one of 6 categories, the smallest being <1%, and the rest divided as follows: 1-10%, 10-25%, 25-50%, 50-75%, and 75-100%. The cover assessment included anything that was visible within the quadrat, including bare ground and dead plants. Areas that were covered by trees or larger shrubs were noted. Due to multiple layers in the plant community, a total quadrat cover greater than 100% was possible, as the cover of each plant species was considered independently of all other plant species.

Woody Vegetation

At the data collection points on all three transects, a 15 x 30 m bar transect was established perpendicular to the main transect (Figure 2) to sample the woody vegetation. Within the boundaries of these bar transects, woody plant species density and species type was determined by recording the species, dimensions (longest length, perpendicular width and height), and status (alive, dead, or resprouted) of each individual.

Small Mammals

At the beginning of the field season, to explore the nature and diversity of small mammals on the Agua Fria landscape, two different sets of small mammal live traps were distributed in the area on and around La Plata pueblo. Our three transects were not established until March, coinciding with spring plant growth. The first set of live mammal traps (N=80) was laid out January 14 on a line running from several hundred meters east of Pueblo La Plata, across the pueblo, and west into the silty clay surrounding the site. A second set of 80 was laid February 6 in the silty clay surrounding the pueblo and on the pueblo itself. Formal data collection occurred once the transects were established, and it is the data from the transects that are reported here. Small mammal data were collected at ten of the data collection points on each transect. The lines of live traps centered on the data collection points, and ran perpendicular to the transect (Figure 2), with four traps on each side. Traps were set approximately 10 m apart

Since most of the small mammal species at Agua Fria are nocturnal, the traps were left out overnight. In the morning the small mammals collected from each trap line were examined and their species, sex, reproductive status, and weight were recorded. All animals were then released where they had been originally collected.

Discussion

By jointly designing the sampling protocol and organizing the data collection so that both ecologists and archaeologists not only collected data in the same loci, but also participated in collecting one another's data, we began to develop a truly interdisciplinary perspective on the Agua Fria landscape. Although the results of the preliminary data analyses, discussed below, focus primarily on individual sources of data, our continued

research this semester (Fall 2004) will be combining these data to investigate interrelations among data patterns.

Preliminary Results of Data Analyses

During the last month of the spring 2004 semester, undergraduate and graduate students enrolled in the Legacies seminar undertook preliminary analyses of the data we had collected. Their reports are included here.

Rock and Artifact Distributions, Lisa Baldwin and Caitlin Wichlacz

Artifact and rock distributions were noticeably different across the landscape surrounding Pueblo La Plata. Through an analysis of the artifact and rock density data from the three transects, we investigated whether there was a correlation between artifact and rock densities across the site. We expected to see a drop in artifact densities farther from the pueblo, where less human activity may have taken place, and a drop in rock densities nearer the site, where rocks might have been removed for pueblo construction or to clear an area for human activities. The data analyzed here from the control transect are from the 50-m interval portion of that transect, and not the extension of the transect towards the mesa edge.

Artifact Distributions

On the La Plata transect, the quantity of artifacts dropped dramatically from the first data collection point, 50 m from the pueblo, to the second point, 100 m from the pueblo. At the first data collection point 404 artifacts were counted from the three 1 x 1 m units. This number dropped to two artifacts for the next data collection point and then remained low across the remainder of the transect (Table 1). This pattern is corroborated by the walking count data, as the quantity of artifacts recorded between data collection

points steadily decreased as one moved away from the pueblo (Table 2). At 425 m to 525 m from the pueblo, however, there was an increase in the number of artifacts observed. This was followed by another decrease in artifact density.

Table 1. Artifact counts by transect and 1 x 1 m data collection units.

LA PLATA TRANSECT

	North		Middle (Transect)		South	
Number	Ceramics	Lithics	Ceramics	Lithics	Ceramics	Lithics
(Site) 1						
2	114	12	240	26	8	4
3	0	0	2	0	0	0
4	2	0	0	1	0	1
5	0	0	0	2	0	1
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	0	0	0	0	0	0
9	0	0	0	0	0	0
10	0	0	0	0	0	0
11	1	0	0	2	0	0
12	0	1	0	0	0	0
13	0	0	1	0	0	0
14	0	0	0	0	0	0

FORT TRANSECT

	North		Middle (Transect)		South	
Number	Ceramics	Lithics	Ceramics	Lithics	Ceramics	Lithics
(Site) 11	26	3	37	4	28	3
10	0	1	1	0	0	1
9	0	0	0	0	0	0
8	0	0	0	0	0	0
7	0	3	0	0	0	0
6	0	0	0	0	1	1
5	0	0	0	1	0	1
4	0	0	0	0	1	1
3	0	0	0	0	1	0
(Fort) 2	0	0	0	0	0	0

CONTROL TRANSECT

	North		Middle (Transect)		South	
Number	Ceramics	Lithics	Ceramics	Lithics	Ceramics	Lithics
1	0	0	0	0	0	0
2	0	0	0	0	0	**1**
3	0	0	0	0	0	0

4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	**1**	0	0	**1**	0
8	0	**1**	0	0	0	0
9	0	0	0	0	0	0
10	0	0	0	**1**	0	0

Table 2. Walking counts for artifacts by transect and collection unit intervals.

LA PLATA TRANSECT

Walking Count

Number	Ceramics	Lithics	Totals
3.5 (Site)	174	166	340
4.5	62	84	146
5.5	10	35	45
6.5	3	26	29
7.5	0	24	24
8.5	0	9	9
9.5	0	7	7
10.5	18	11	29
11.5	13	14	27
12.5	0	8	8
13.5	2	9	11

FORT TRANSECT

Walking Count

Number	Ceramics	Lithics	Totals
10.5 (Site)	26	33	59
9.5	12	15	27
8.5	1.1	0	1.1
7.5	3	12	15
6.5	1.1	11	12.1
5.5	0	0	0
4.5	9	8	17
3.5	3	3	6
2.5	0	0	0
1.5 (fort)	1.1	0	1.1

Table 3. Total artifact counts by transect.

La Plata Transect Totals

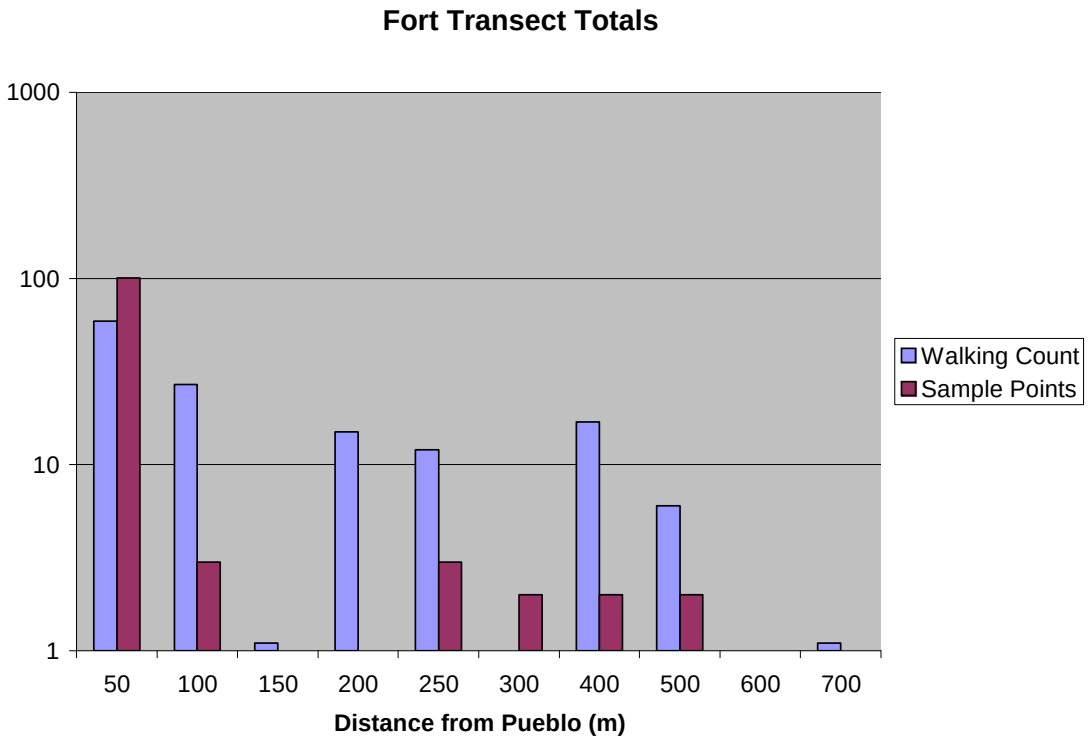
Number	Ceramics	Lithics	Total Artifacts
2	362	42	404
3	0	2	2
4	2	2	4
5	0	3	3
6	0	0	0
7	0	0	0
8	0	0	0
9	0	0	0
10	0	0	0
11	1	2	3
12	0	1	1.1
13	1	0	1.1
14	0	0	0

Fort Transect Totals

Number	Ceramics	Lithics	Total Artifacts
11	91	10	101
10	1	2	3
9	0	0	0
8	0	0	0
7	0	3	3
6	1	1	2
5	0	2	2
4	1	1	2
3	1	0	1
2	0	0	0

The Fort transect displayed a similar pattern of artifact distribution (Figure 4). The data collection point nearest the pueblo, at a distance of 50 m, produced a total of 101 artifacts (Table 3). This dropped to three artifacts at the next point farther along the transect. The walking count on the Fort transect displayed a different pattern from that observed on the La Plata transect. Although artifacts were most abundant near the pueblo, their numbers varied across the Fort transect, rather than decreasing (Table 2).

Figure 4. Fort Transect Artifact Counts als



The Control transect, true to expectations, produced very few artifacts (a total of 5; Table 1). This suggests that very little artifact-related prehistoric human activity took place in that area.

Patterns in Rock Distribution

In the absence of much evidence for human activity across the control transaction, the pattern of rock distribution here may be representative of the natural distribution of rock on this landscape. The data collected along this transect showed that rock distribution was highly variable along both the length and width of the mesa finger (Table 4c, Figure 5). There was a slight trend toward greater rock cover further from the mesa

edge, though data from the extended portion of the transect may alter this pattern once they are analyzed.

Table 4a. Percents of rock cover on La Plata Transect

LP1 plot #	North %	Middle %	South %	Total %	Avg. ttl %
1	-	-	-	-	-
2	7.5	7.5	3	18	6
3	3	3	3	9	3
4	0	10.5	50	60.5	20.16
5	10.5	25.5	15	51	17
6	43	10.5	57.5	111	37
7	35.5	28.5	48.5	112.5	37.5
8	13.5	13.5	93	120	40
9	82.5	35	35	152.5	50.83
10	15	42.5	32.5	90	30
11	45	20.5	23	88.5	29.5
12	15.5	10.5	6	32	10.67
13	42.5	47.5	40	130	43.33
14	7.5	18	30	55.5	18.5

Table 4b. Percents of rock cover on Fort Transect.

FT plot #	North %	Middle %	South %	Total %	Avg ttl %
1	-	-	-	-	-
2	33	50	53	136	45.33
3	30.5	15.5	3	49	16.33
4	0	0	28	28	9.33
5	10.5	18.5	15.5	44.5	14.83
6	27.5	35	20.5	83	27.67
7	25	23	27.5	75.5	25.16
8	33	43	28	104	34.67
9	20.5	15.5	10.5	46.5	15.5
10	10.5	0	3	13.5	4.5
11	12.5	12.5	12.5	37.5	12.5

Table 4c. Percents of rock cover on Control Transect.

Ctrl plot #	North %	Middle %	South %	Total %	Avg ttl %
-1	6	10.5	15	31.5	10.5
0	13.5	7.5	28	49	16.33
1	13.5	3	7.5	24	8
2	20	27.5	32.5	80	26.67

3	15.5	15.5	15.5	46.5	15.5
4	10.5	25	6	41.5	13.83
5	15	10.5	48.5	74	24.67
6	10.5	15	20	45.5	15.16
7	6	18.5	10.5	35	11.67
8	33	23	15	71	23.67
9	27.5	18	55.5	101	33.67
10	10.5	15.5	55	81	27

Along the La Plata Transect, estimated rock cover percentages were kept separate between the north, middle, and south sample squares at each point in order to investigate variations in distribution across the width of the mesa finger as well as the length (Table 4a, Figure 6). Rock cover near the pueblo was sparse, amounting to less than 10% cover for all sample squares within 100 m of the site. Nowhere else on the transect were percentages this low, except for one sample square 600 m from the pueblo. Away from the pueblo, there was a general increase in rock cover, peaking at around 80-90% 400 m from the pueblo, after which there was a sharp decline to 20-30%. This was followed by fluctuations of about 20% until the end of the transect. As Figure 7 illustrates, there was a significant relationship between distance from the pueblo and rock cover ($p = 0.01$) while there was no significant relationship on the control transect.

Figure 5. Percent Rock Cover, Control Transect

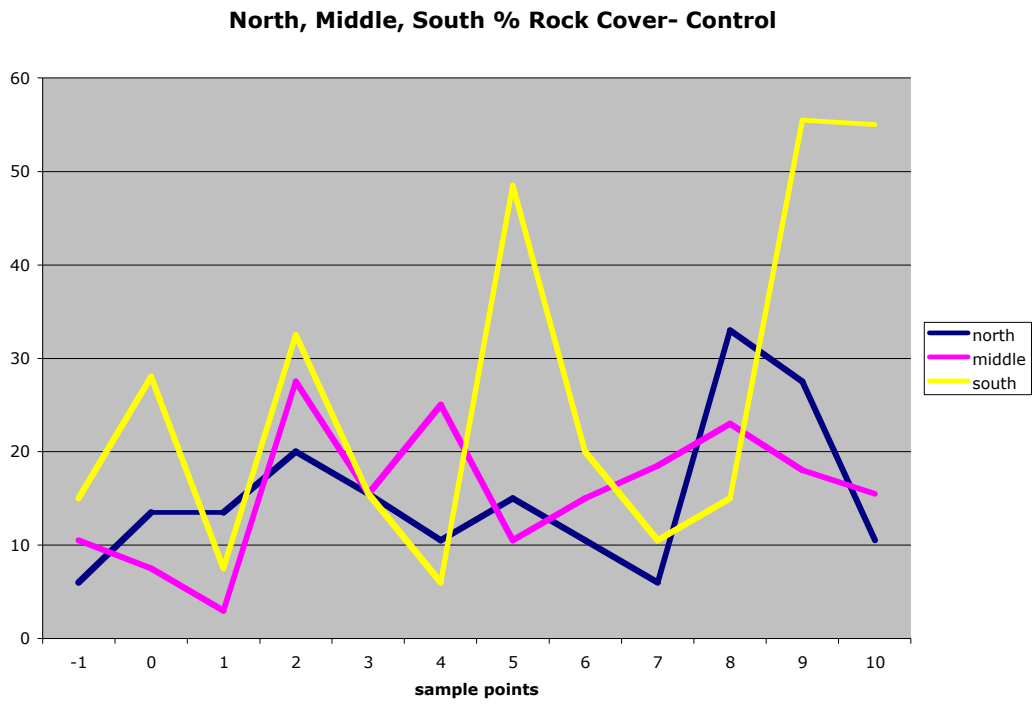
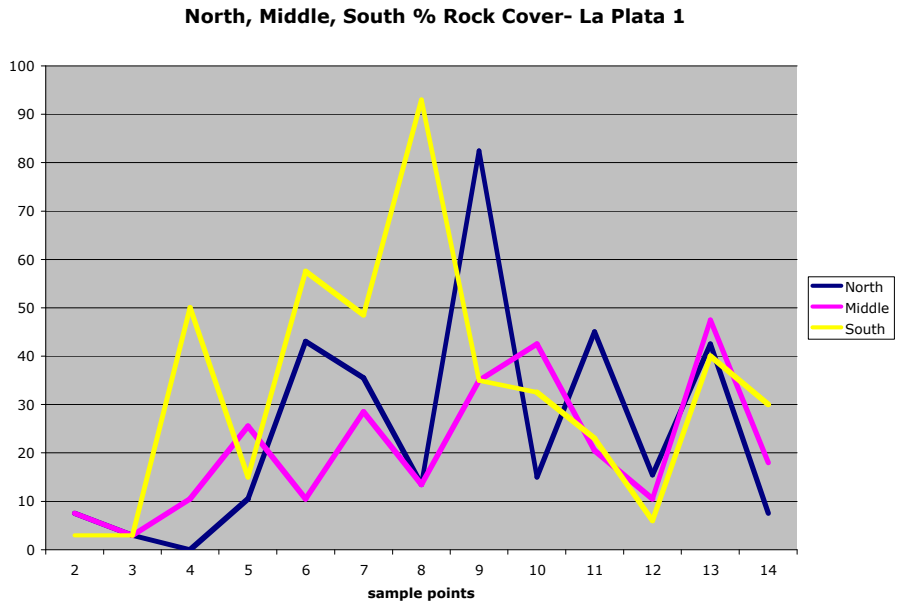


Figure 6. Percent Rock Cover, La Plata Transect.



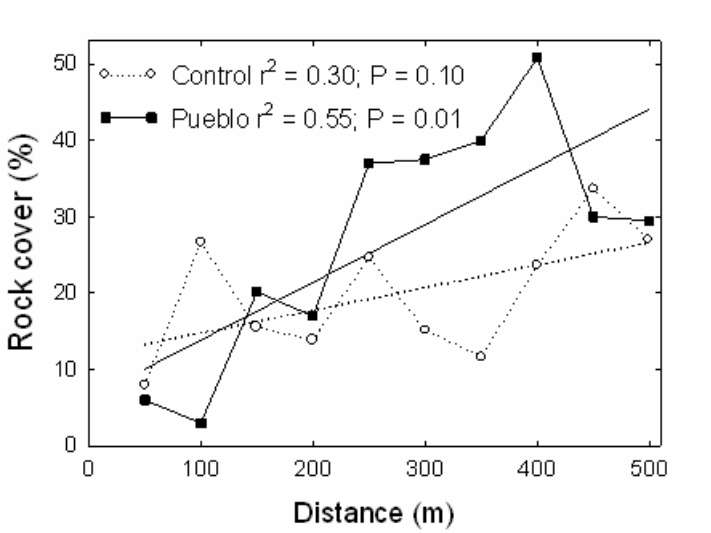


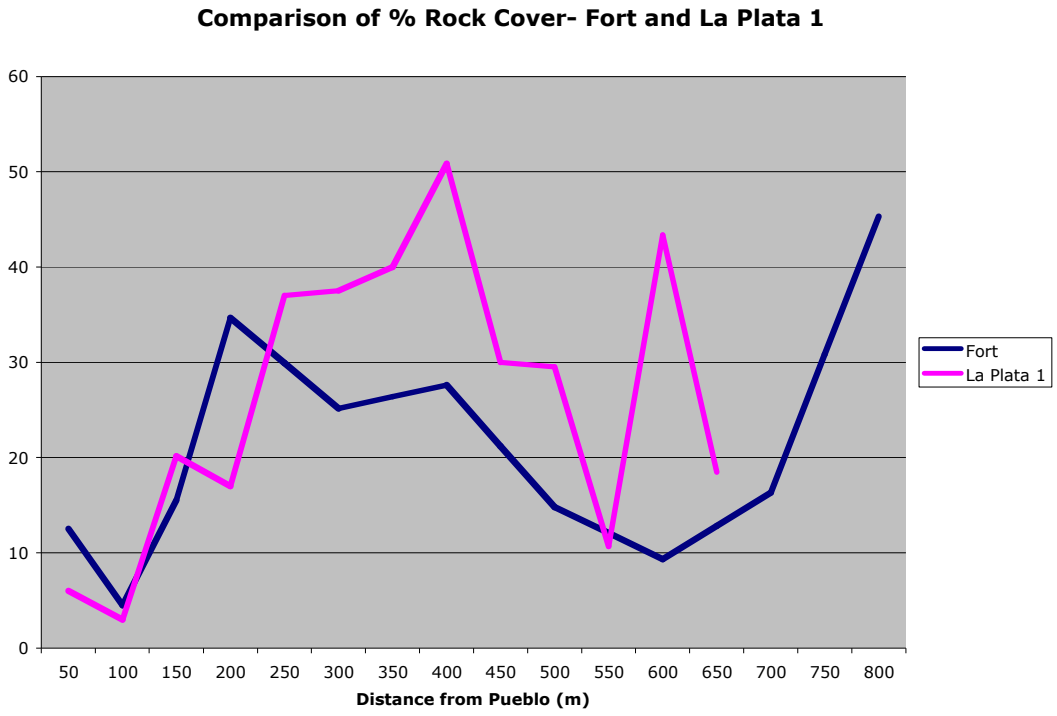
Figure 7. The percentage of rock cover plotted against the distance from the edge of the pueblo and the start of the control transect.

The Fort transect showed much less variation in rock cover across the width of the mesa finger (Table 4b, Figure 8). Along the length of the transect, low percentages of cover (0-12%) were recorded for the two data collection points nearest the pueblo. Further out from the pueblo, there was an increase in cover to between 30 and 40% at a distance of 200 m. Rock cover then increased rapidly over the 300 m approaching the Fort.

The rock cover data from the Control and La Plata transects were compared to see what effect human occupation at Pueblo La Plata may have had on rock distribution patterns (Figure 7). The differences between the data sets were not great, and both transects showed the same general trend of increasing rock cover further from the mesa tip. Rock cover was greater on the La Plata transect, which may be due to local geologic variation.

The rock data from along the La Plata and Fort transects were compared to investigate how rock cover changed with proximity to the pueblo (Figure 9). What emerged was a pattern of low rock cover near the pueblo followed by an increase further out. This was in line with our original expectations. Beyond the rise in rock cover was another decrease, however, that was evident on both the Fort and La Plata transects.

Figure 9. Percent Rock Cover, Fort and La Plata Transects



Relationships Between Artifacts and Rock Cover

The comparison of artifact and rock cover data revealed roughly the pattern we had expected to see on the landscape. Artifact counts were highest near the pueblo, where human activity would have been most intense. In these same areas, rock cover was quite low. As artifacts dropped off in numbers farther from the pueblo, rock cover increased (Figures 10 and 11).

The patterns visible in this comparison between two sources of data suggest that other such relationships likely exist on the landscape. Analysis and comparison of the size class data collected for rocks in relation to biological data patterns should prove to be quite interesting.

Figure 10. Rock cover and artifact distributions, La Plata transect.

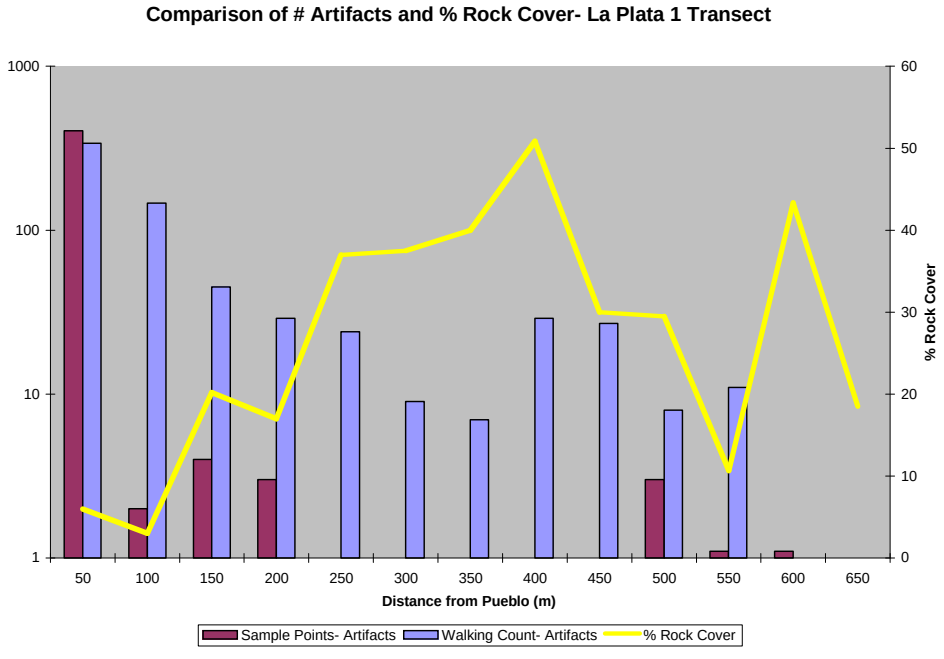
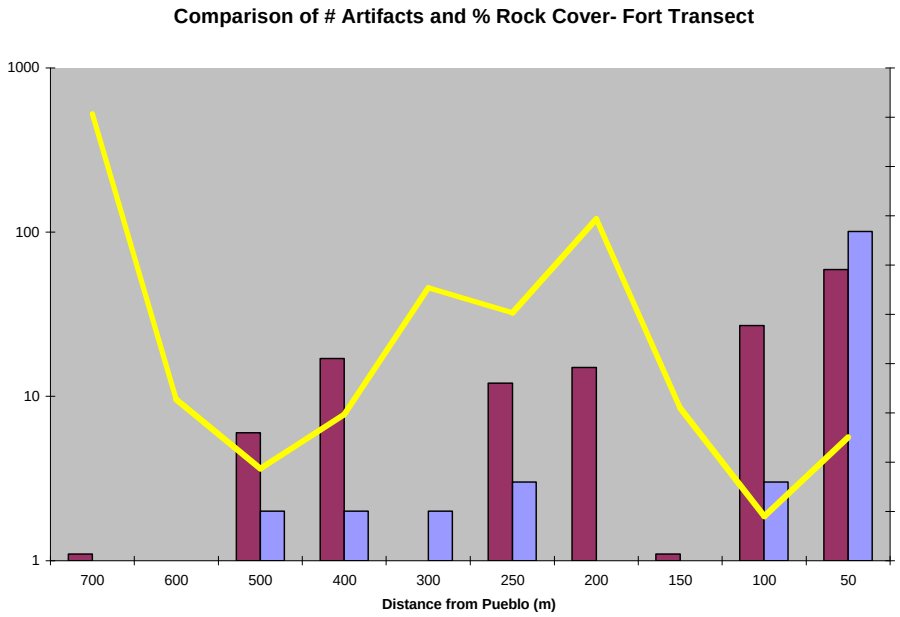


Figure 11. Rock cover and artifact distributions, Fort transect.



Herbaceous Plants, Hoski Schaafsma and Kari Horn

Table 5 (see also Figure 12) lists the species documented during the Spring 2004 field season on the La Plata and Control transects. Numerous similarities between herbaceous communities on the two transects were documented. These data indicate that species richness is similar between the locations, with 21 species recorded on the La Plata transect and 26 species on Control transect. The five dominant species on each transect are similar, with four out of five species shared between locations. The species area curve of each transect is similar (Figure 13). Although the species richness is similar, the overall community compositions showed some differences when rare species are counted. There are five species unique to the La Plata transect and ten species unique to the Control transect. Also, the number of species encountered on the pueblo transect shows a drop-off within 300 m of the pueblo site (Figure 14).

Overall the density of herbaceous plant cover appears to be influenced by the rock cover on the Control transect but the pattern is less obvious on the La Plata transect (Figure 15). It would be useful also to investigate the patchiness of rock cover in relation to plant distributions.

In sum, although some similarities exist between the herbaceous communities on the two transects, there are also some overall differences in community composition. There is some evidence that the herbaceous community structure is impacted by the presence of the pueblo as far out as 250-300 m. At approximately 400 m from the pueblo, the number of species on the La Plata transect increases to match the number of species on the control transect.

Further analyses of these data should include a regression of rock cover and total plant cover data from the control and La Plata transects, and a comparative analysis of the distribution of exotic and native species. Further data collection needs to be carried out during other portions of the growing season. To better understand the interactions of prehistoric anthropogenic influences and the modern plant communities sampling at a finer resolution and several replicate pueblo sites are recommended.

Table 5. Plants identified on the Spring 2004 transects.

Amsinkia intermedia	Coast Fiddleneck
Accacia gregii	
Ambrosia deltoidea	Bursage
Astragalus didymocarpus	Dwarf White Milk Vetch
Astragalus nuttalianusNuttall Milk Vetch	Nuttall Milk Vetch
Avena fatua	Wild oats

Bothriochloa barbinodis	Cane bluestem
Bouteloua curtipendula	Sideoats gramma
Bromus rubens	Red Brome
Castilleja chromosa	Desert Paintbrush
Caulanthus lasiophyllus or Guillenia lasiophylla (two names-same plant)	California Mustard
Chorizanthe brevicornu	Brittle spineflower
Crassula connata	Sand pygmyweed
Cryptantha sp	
Daucus pusillus	American wild carrot
Dichelostemma pulchellum	Blue Dick
Eriastrum diffusum	Miniature woollystar
Erigeron divergens	Spreading fleabane
Eriogonum wrightii	Bastardsage
Erodium cicutarium	Red-stem stork's bill
Erodium texanum	Texas stork's bill
Erysimum repandum	Spreading wallflower
Euphorbia capitellata	Head sandmat
Herniaria cinerea	Hairy rupturewort
Hilaria mutica	Tobosa grass
Hordeum pusillum	Little barley
Lasthenia californica	California goldfields
Layia glandulosa	Whitedaisy or Tidytips
Lepidium Lasiocarpum	Shaggyfruit Pepperweed
Lesquerella gordonii	Gordon's bladderpod
Linum lewisii	Prairie flax
Lotus rigidus	Shrubby deervetch

Lupinus arizonicus	Arizona Lupine
Lupinus concinnus	Scarlet lupine
Malva parviflora	Cheeseweed mallow
Matricaria matricarioides	Pineapple weed
Monolepis nuttalliana	Nuttall's Povertyweed
Orthocarpus purpureoalbu	Purplewhite owl's clover
Pectocarya recurvata	Curvenut combseed
Plantago elongata	Prairie Plantain
Plantago ovata or Plantago insularis (two names-same plant)	desert Indianwheat
Plantago patagonica	Wooly plantain
Poa bigelovii	Bigelow's bluegrass
prickly pear	Opuntia sp.
Primrose 1	
Sage-1	
Calochortus kennedyi	Sago lilly
Sisymbrium irio	London Rocket
Sphaeralcea rushbyi	Rushbyi globemallow
Sphaeralcea sp.	
Trifolium albopurpureum	
Trifolium gracilentum	
uropappas lindleyi	
Vicia ludoviciana ssp. Ludoviciana	

Figure 12a. Percent of species on La Plata and Control transects.

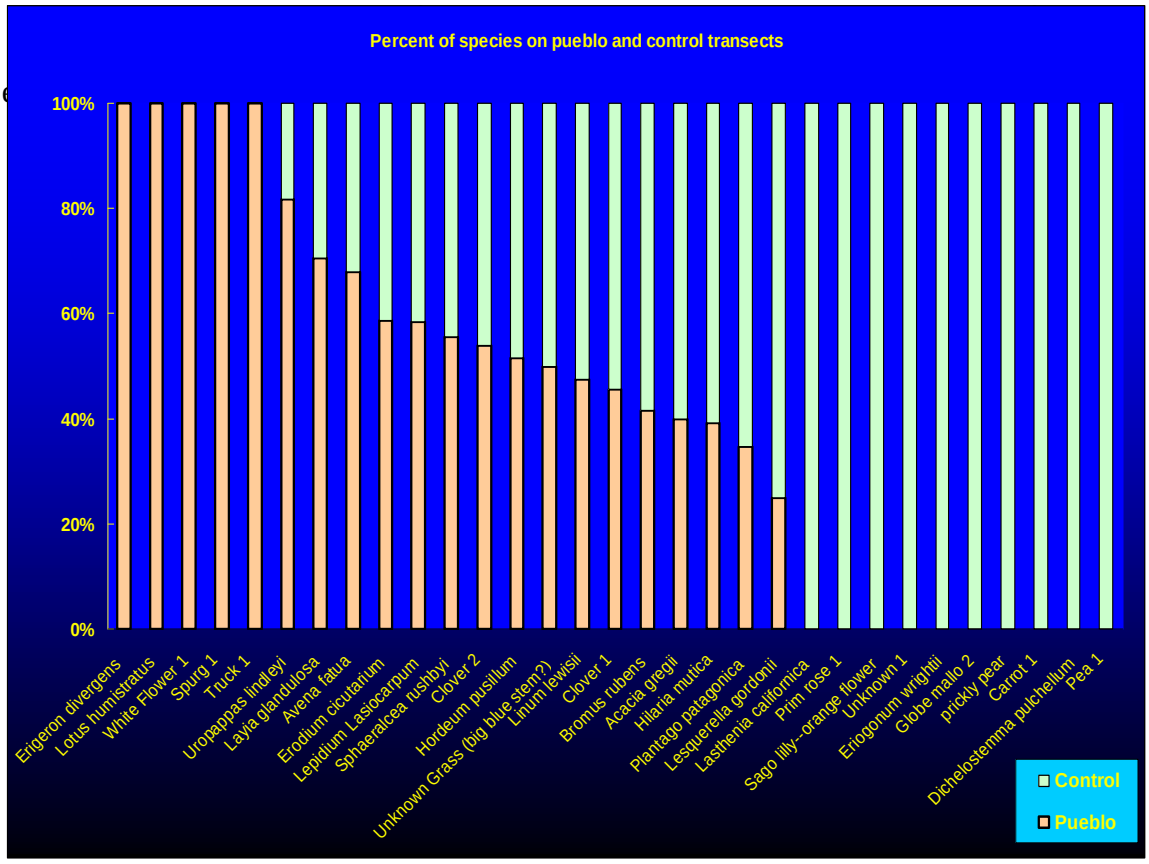
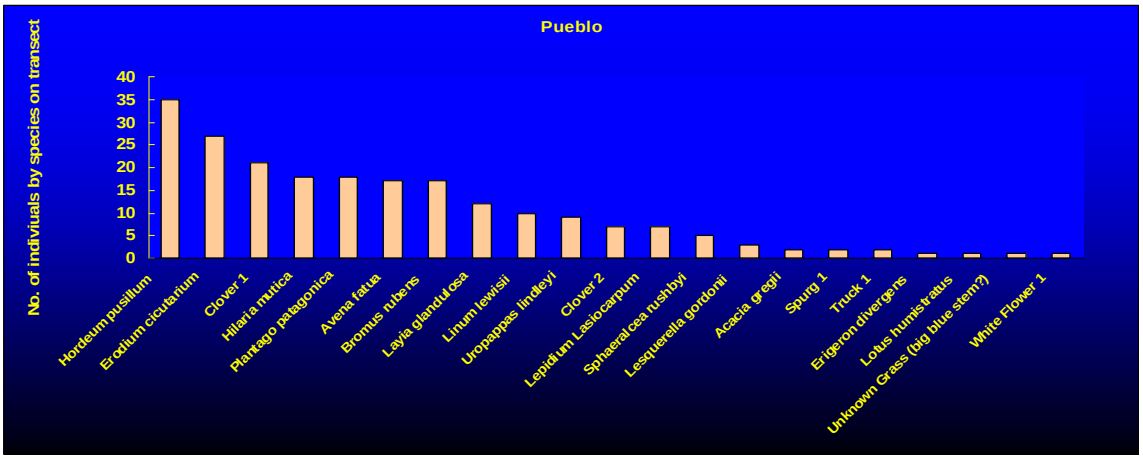


Figure 12b. Number of individuals by species on La Plata and Control transects.



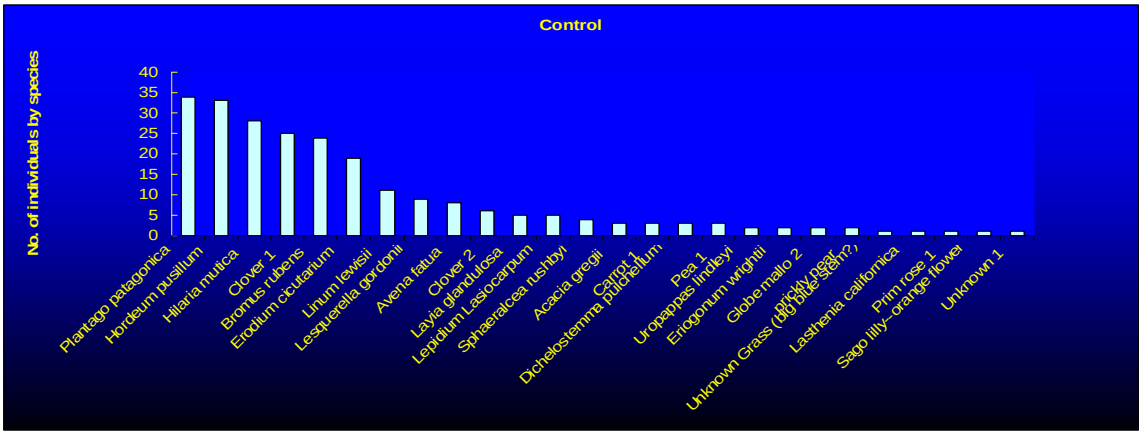


Figure 13. Species area curve on La Plata and Control transects.

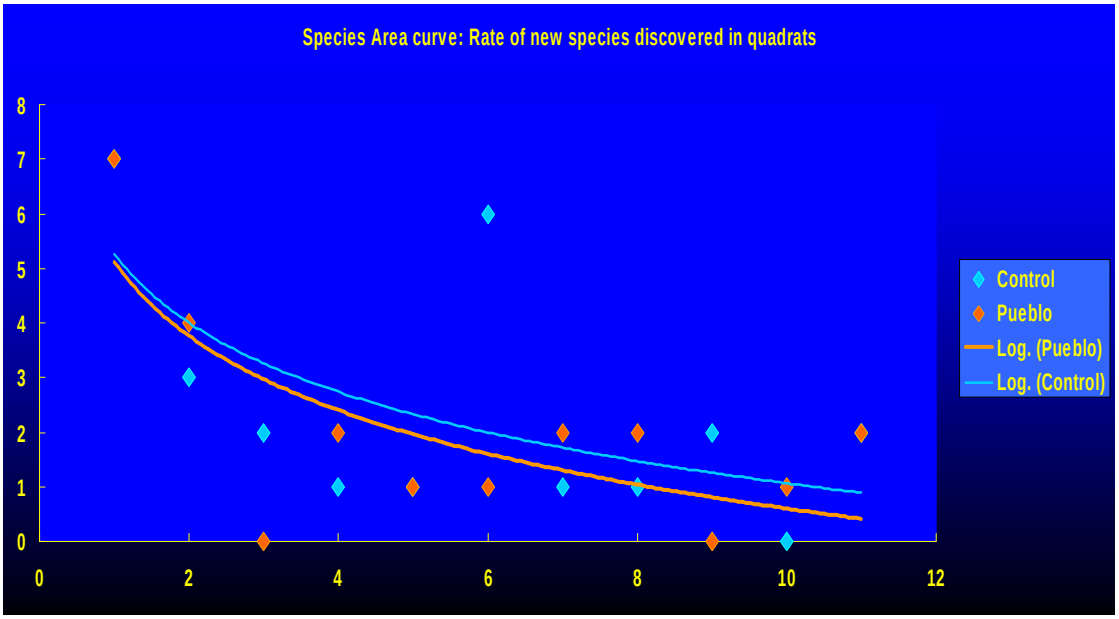
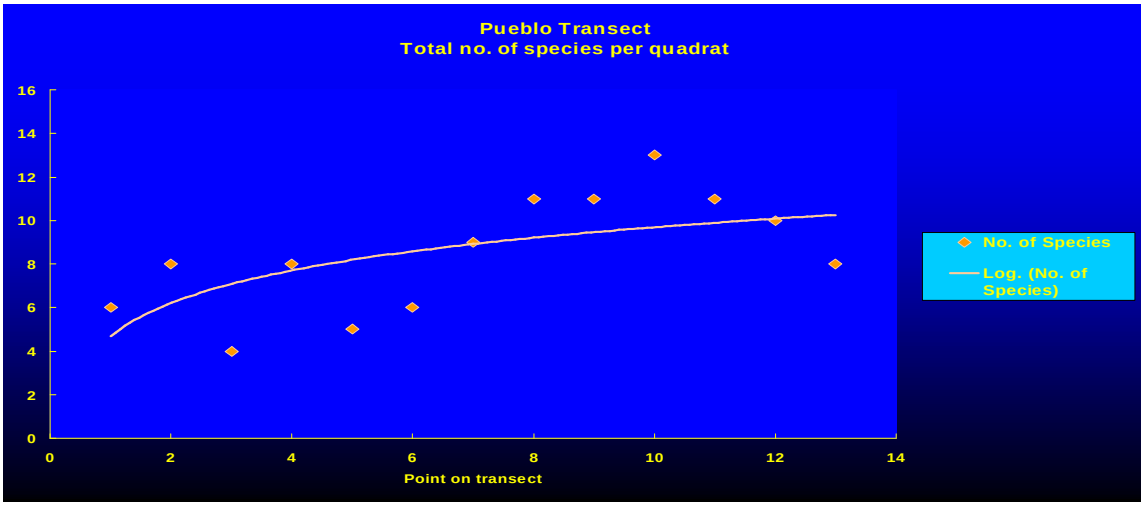


Figure 14. Number of species per collection point, La Plata and Control transects.



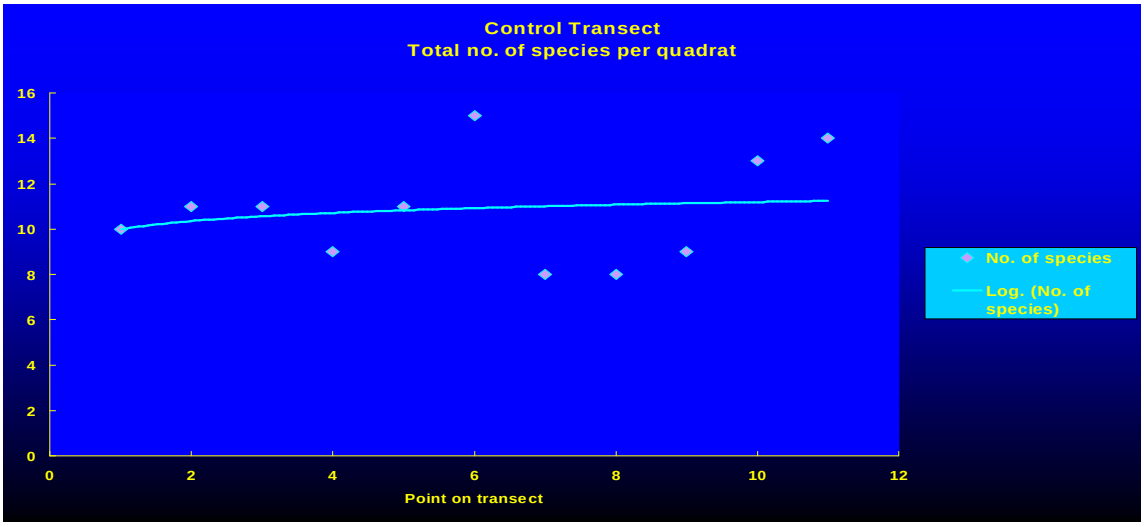
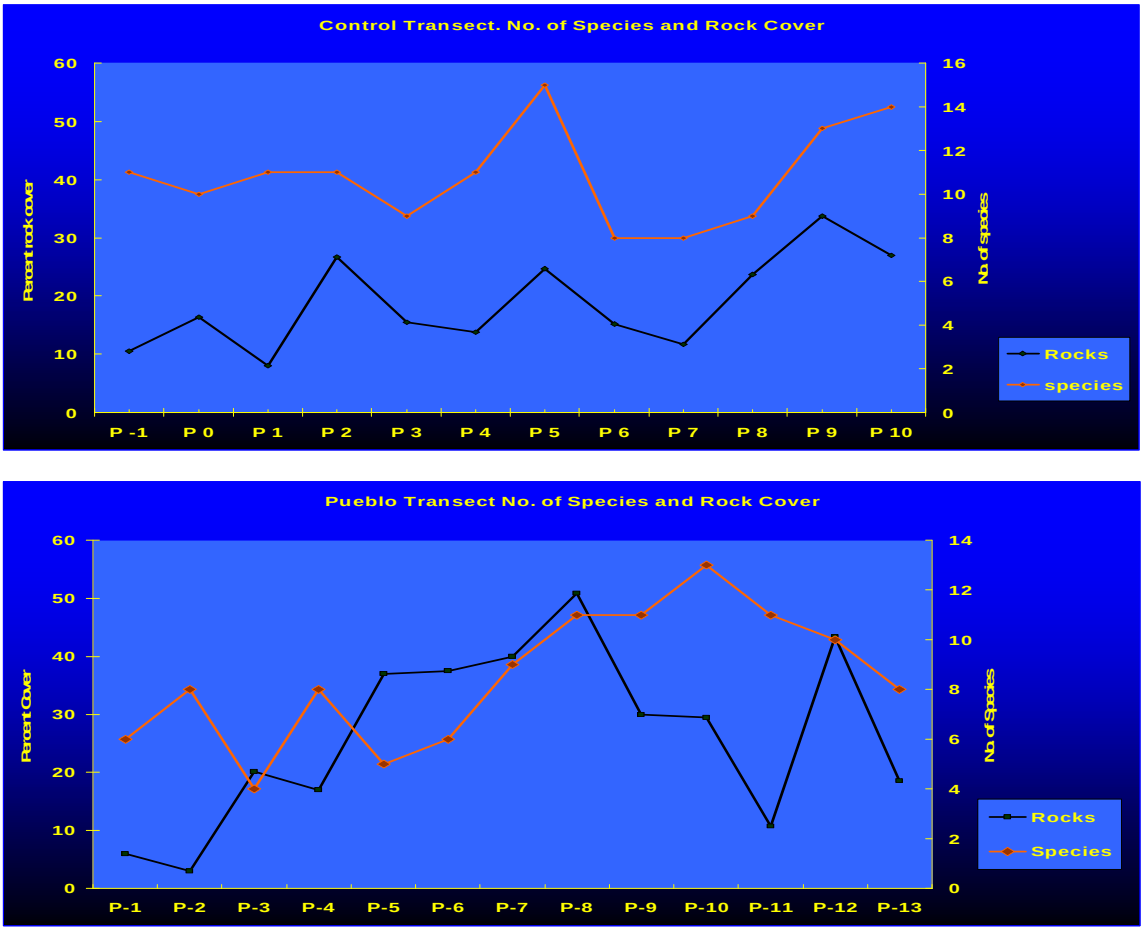


Figure 15. Density of herbaceous plant cover in relation to rock cover.



Woody Plant Distributions, Kari Horn and Hoski Schaafsma

There were three main species of woody plants on both the La Plata and Control transects. These include *Acacia greggii* (catclaw acacia), Opuntia and *Prosopis velutina* (velvet mesquite) (Figure 16). Taking the sum of individuals of each species found on these transects, the Control transect had more Opuntia than did the La Plata transect, the La Plata transect had more *P. velutina* than the Control transect, and *A. greggii* was the dominant woody plant in both transects.

On the La Plata transect, as distance from the pueblo increased, the number of individuals of woody plant species increased as well (Figure 17). On the Control transect, with increasing distance from the starting point, the number of individuals of woody species declines. The reasons for this are not clear, but changes in the number of individual woody plants does seem to be correlated with percent rock cover.

As can be seen from Figures 18 and 19 rock cover and cover of woody vegetation seem to be correlated in both transects. Percent rock cover and number of woody species individuals increases as distance from the pueblo is increased on the La Plata transect. Percent rock cover is more variable on the Control transect, initially increasing, decreasing, and then increasing again, but it is correlated with number of woody species individuals as well.

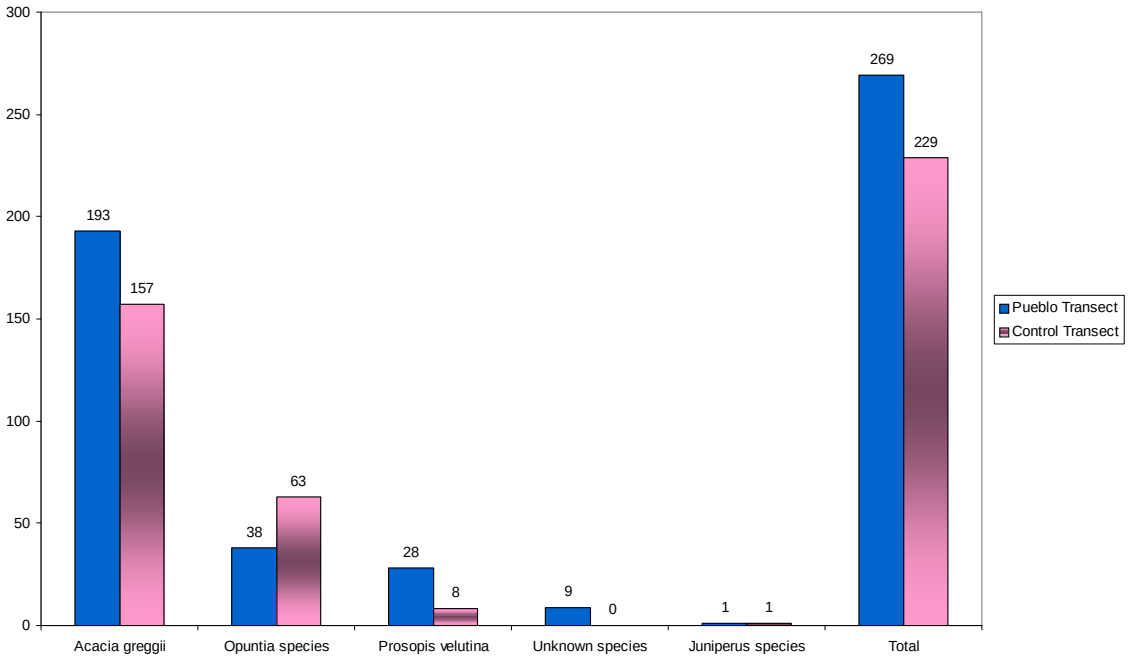


Figure 16. Number of individuals vs. woody plant species for La Plata and Control transects

transects.

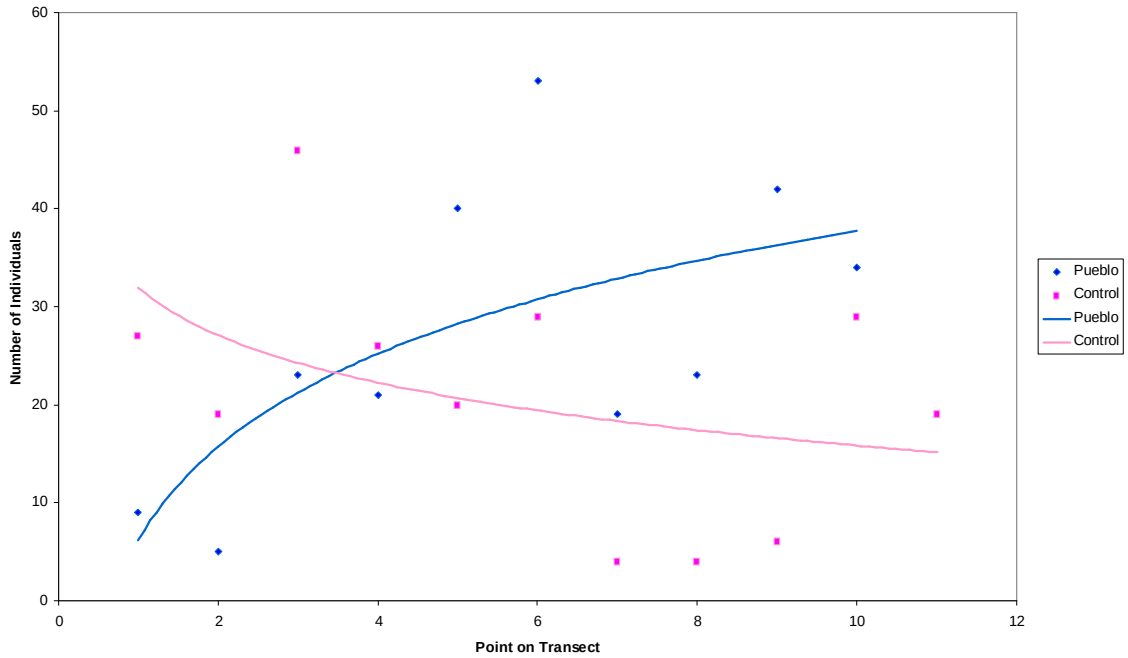


Figure 17. Number of woody individuals vs. distance from transect starting point.

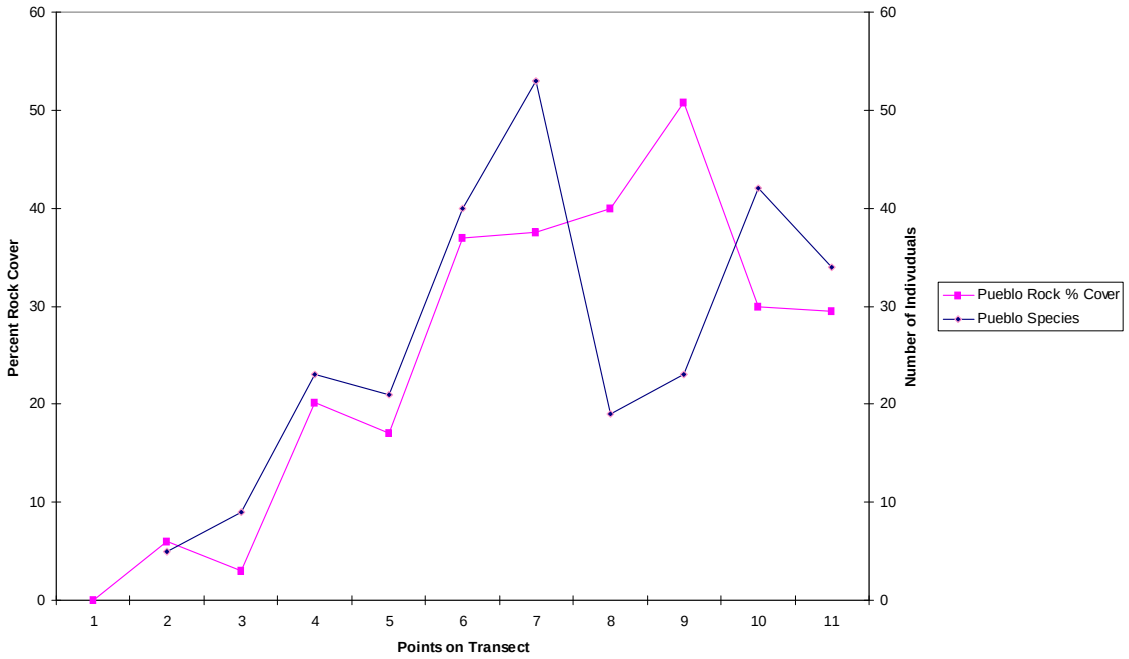


Figure 18. La Plata transect--percent rock cover and number of woody species found at each point on transect.

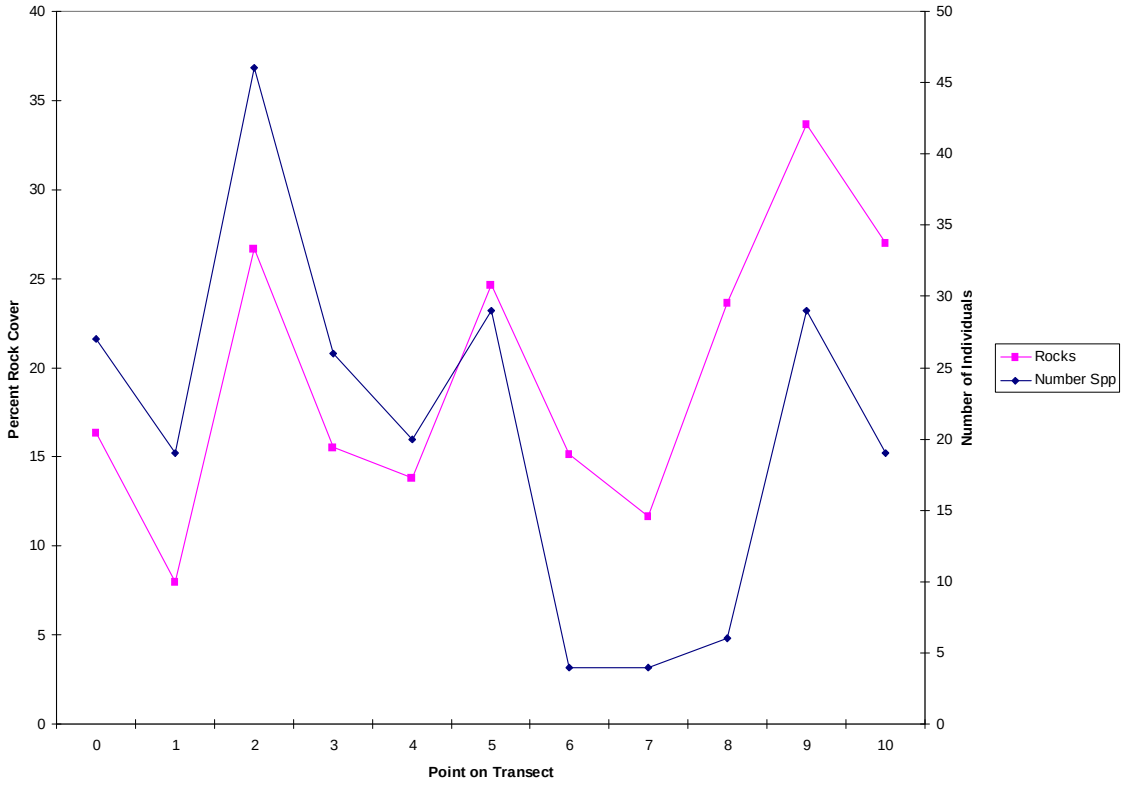


Figure 19. Control transect—percent rock cover and number of species found at each point on transect.

As Figure 20 indicates, there is a statistically significant relationship between woody plant cover and rock cover on the La Plata transect, but not on the control.

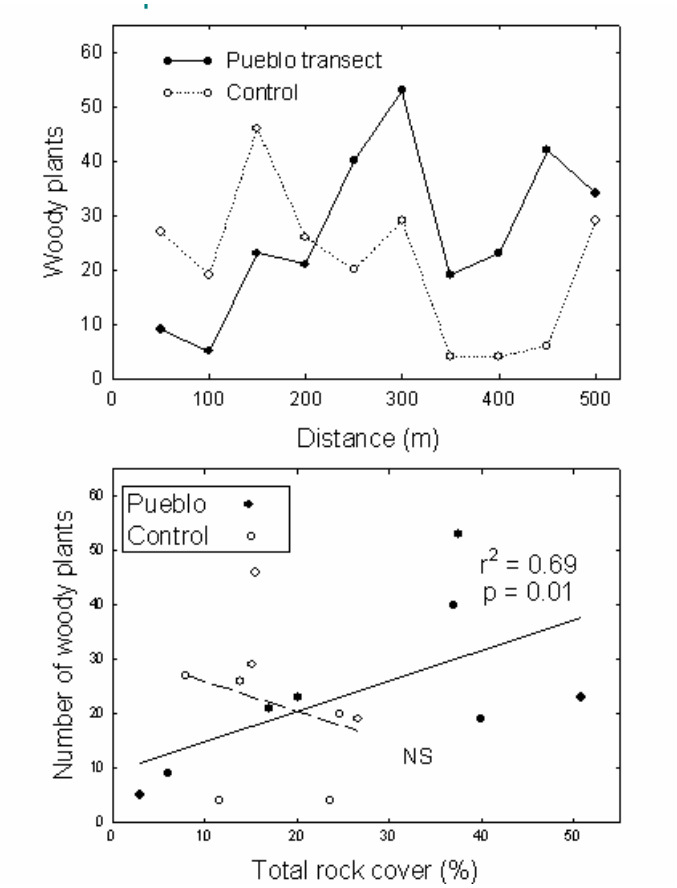


Figure 20. Top panel. The number of woody plants on the La Plata and Control transects at each transect point.

Bottom panel. The relationship between the amount of rock cover on both transects and the number of woody individuals for the first 400 meters.

Small Mammal Distributions, Chien Lai

As the data in Table 6 indicate, capture rates for small mammals were relatively low. This may be attributed in part to the on-going drought in Arizona, as most of these small mammal species are facultative reproducers.

Table 6. Small mammal capture rates, Spring 2004

Location	No. nights	No. traps	No. animals	Capture rate
La Plata	2	160	20	12.5%
Fort	2	160	15	9.4
Control	3	280	13	4.6

The species recovered from the traps include: *Peromyscus eremicus, Peromyscus leucopus, Peromyscus maniculatus, Reithrodontomys megalotis,* and *Chaetodipus baileyi*. These species vary in size and habitat preferences (see Table 8).

Table 7. Common names of small mammal species trapped at Agua Fria National Monument, Spring 2004

Species	Common Name
Peromyscus eremicus	Cactus deermouse
Peromyscus leucopus	White-footed deermouse
Peromyscus maniculatus	North American deermouse
Reithrodontomys megalotis	Western harvest mouse
Chaetodipus baileyi	Bailey's pocket mouse

Although our capture rates were very low, within the sample that we obtained in the spring of 2004, species diversity and population density seem to be higher in the La Plata transect and in the fort transect, areas of greater prehistoric human impact, than they are in the control transect (Table 9).

Table 8. Measurement and habitat preferences of small mammal species trapped at Agua Fria National Monument, Spring 2004

	Size and Weight	**Habitat preference**
P. leucopus	91 – 107mm 14 – 31g	Prefers wooded or brushy areas. Sometimes in open areas.
C. baileyi	91 – 107mm 24 – 38g	Favors pebbly soils making transition from sandy flats to rock slopes.
P. eremicus	81 – 91mm 17 – 40g	Low desert areas and rocky foothills with scattered vegetation.
P. maniculatus	70 – 100mm 10 – 30g	Widespread distribution. Found in diverse habitat types.
R. megalotis	71 – 76mm 9 – 17g	Uses open mesa habitats dominated by herbaceous vegetation and dnse litter.

Table 9. Species distribution across transects.

	Control transect	Fort transect	La Plata transect
P. eremicus	0	2	5
P. leucopus	11	5	3
P. maniculatus	0	3	9
R. megalotis	0	4	0
C. baileyi	2	1	3

Hypotheses derived from these results that should be evaluated with further data collection are two-fold:

- Habitat structure may be more diverse along the La Plata transect and the fort transect.
- Vegetation may be more diverse along the La Plata transect and fort transect, resulting in the production of a more diverse food supply.

Future data collection should be stratified by habitat types along the transects, rather than being tied to fixed intervals.

Conclusions

The exploratory phase of the data analyses has revealed the potential importance of rock cover in structuring habitats across the Agua Fria landscape. Through building activities and the creation of agricultural fields (by clearing, aligning rocks, and piling rocks), the people who occupied the Agua Fria landscape 700-800 years ago have altered the abiotic factors in ways that still have an impact on the modern day landscape . The relationships among human actions involving rock movement, and their impacts on plant and animal communities will be one focus of continued research on the Agua Fria landscape.

The alteration of soils through farming and water control remains a second critical area of inquiry that we will investigate through further research. The reduction of plant cover on many of the cleared areas but not on others suggests variable land use in the past. One hypothesis that we can evaluate through soils and pollen analyses is whether prehistoric farming depleted nutrients in fields to the point that vegetation cover and growth were lower on the fields.

Livestock grazing by domestic animals has occurred on the Agua Fria landscape for roughly the past 150 years. An understanding of how the legacies of prehistoric

actions “shine through” the impact of grazing will require systematically positioned small grazing exclosures to evaluate the relative contributions of grazing and legacies to current ecosystem structure and function on the Agua Fria landscape.

Understanding prehistoric legacies will also require further research concerning the relationship between fire regimes and variability in vegetation. Experiments that compare vegetation before and after prescribed burns will provide crucial data to evaluate the relationship between contemporary fire management, prehistoric legacies, and vegetation type and cover.

In sum, our research during the Spring 2004 field season has resulted in the creation of a strong interdisciplinary team of archaeologists and ecologists and a successful protocol for data collection on the Agua Fria landscape. Our preliminary data have revealed interesting patterns worthy of further investigation and have highlighted areas in need of new research. We look forward to continuing our partnership with the BLM in conducting mutually beneficial research on the Agua Fria National Monument landscape.