SEASONAL DIETS OF THE COLLARED PECCARY (*PECARI TAJACU*) IN THE LLANO UPLIFT ECOLOGICAL REGION OF TEXAS

by

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ABSTRACT

I investigated the seasonal diets of the collared peccary (*Pecari tajacu*) at Mason Mountain Wildlife Management Area from June 2013 to April 2014 using microhistological analysis of fecal material. Eighty fecal samples were collected from summer 2013 to spring 2014. I identified and quantified 36 plant species consumed by the collared peccary. Prickly pear was consumed in all seasons with seasonal use of forbs, grasses and mast. Annually, the bulk of the diet was comprised of cactus 27.35%, browse 9.75%, forbs 32.75%, grasses 7.75% and mast 22.4%. Cactus species included prickly pear (*Opuntia* spp.), browse species included live oak/blackjack/post oak (*Quercus* spp.). Forbs, especially silver bladderpod (*Lesquerella argyraea*) and prickly fanpetals (*Sida spinosa*), were highly utilized as well. Vegetational surveys were conducted using the Daubenmire method to sample herbaceous species and line intercept method to sample woody species. Results of log-likelihood chi-square tests with Bonferroni corrected confidence intervals established that there were statistically significant differences between plant use and availability ($P<0.001$). Additionally, Manly's alpha preference indices indicated that collared peccaries foraged selectively on silver bladderpod in spring. Prickly pear was a selected food plant in the summer. Peccaries selectively foraged on live oak/blackjack/post oak and prickly pear in the fall and selected prickly fanpetals during winter.

I. INTRODUCTION

The collared peccary (*Pecari tajacu*) is a medium sized New World ungulate belonging to the family Tayassuidae and order Artiodactyla (Sowls 1997). During the Oligocene age, 35 million years ago, collared peccaries were evolving in the western hemisphere while true swine, members of the Suidae family, were developing in the eastern hemisphere. Both species share a common ancestor and are related, though it is unlikely that peccaries from the Americas have a direct phyletic relationship with true swine of the Old World (Sowls 1997). Taxonomically, collared peccaries are similar to true swine but their physical characteristics differ in many ways. Collared peccaries do not have a distinct tail, their ears are less upright and they only have 3 toes on hind feet. Internally, peccaries have a complex stomach whereas true swine have a simple monogastric stomach and the presence of a gallbladder.

Many peccary species have evolved and become extinct since the Oligocene millions of years ago (Sowls 1997). Fossil remains of early peccaries were reported in the Americas and give details about 34 species belonging to the genus Platygonus (Wright 1991). Platygonus peccaries were much larger with proportionately longer legs than present day peccaries. Modern day peccaries are much smaller and have a thin frame.

An adult collared peccary weighs approximately 15 kg and stands 457 mm tall. Both the female and male have white and black hairs around the neck and shoulder region giving the appearance of a collar. They have a poor sense of sight and hearing but their sense of smell is highly developed. Collared peccaries have a scent gland located on the dorsal side that emits a musky smell used for olfactory communications and to mark their home range boundaries (Sowls 1997).

Collared peccaries are primarily herbivores considered specialists that feed on various cacti (*Opuntia* spp.), mesquite beans (*Prosopis pubescens*), sotol (*Dasylirion texanum*), lechuguilla (*Agave lechuguilla*), forbs and other succulent vegetation (Taylor and Synatzske 2008). Sowls (1997) found that prickly pear cactus (*Opuntia* spp.) makes up as much as 80% of the collared peccary diet based on a food habits study using a microhistological technique. Although some might see prickly pear as unwanted, these resilient succulents serve as a source of food and cover for wildlife and livestock during times of drought (Agrilife 2013).

Feeding strategies of collared peccaries play a vital role in seed dispersal, which is an important aspect of the plant community (Clark and Clark 1981). Collared peccaries retain their food up to three days and sometimes move up to 10 km per day (Beck 2004), potentially dispersing seeds over a wide range of the habitat. Collared peccaries also contribute to the succession of plants by rooting up the soil causing changes in the plant composition of the ecological community (Sowls 1997). Collared peccaries could play a role in an effort to restore the land back to its natural state, especially on degraded sites.

The collared peccary has been extirpated from many parts of its historical geographic range due to extermination, habitat loss, commercial trade in hides, and due to the misconception that they are feral hogs (Sowls 1997). Historically, collared peccaries ranged from Texas, New Mexico, and Arizona in North America southward to Argentina. In Texas, collared peccaries ranged from the Red River on the north and the Brazos River to the east, southward to the Gulf Coast and westward into the Trans Pecos. Currently, the collared peccary's geographic range in Texas is relegated to the southern and western parts of its historical range.

Among the reasons for research on collared peccaries is its value as a game animal. Collared peccaries are considered an excellent game animal, documented as the number two big game animal in Texas according to hunter surveys (Taylor and Synatzske 2008). Also, they are popular among specialized hunts that involve handgun, archery, muzzleloading and youth hunting. According to the Safari Club International, collared peccaries are recognized as trophies due to their diverse habitats and limited range within the United States. The attributes of the collared peccary provide recreational opportunities for state and out of state hunters of any age regardless of hunting method. Collared peccaries are quickly becoming an ideal animal for young hunters due to their unique traits and tasty lean meat (Taylor and Synatzke 2008). In order to maintain a viable population of collared peccaries, harvest levels need to be appropriately managed in areas where they are prone to over-harvest due to high visibility, as seen in the Trans-Pecos region of Texas (Taylor and Synatzske 2008).

In 2004, efforts to restore the collared peccary to the Texas Hill Country began with the translocation of 29 collared peccaries to the 2,157 ha Mason Mountain Wildlife Management Area (Mason Mountain WMA) by Texas Parks and Wildlife Department (TPWD) biologists. Reintroduction was successful at Mason Mountain WMA (Richter 2012). The collared peccary has now expanded throughout the property establishing several distinct herds since the initial release. Mason Mountain WMA is located on the western part of the Llano Uplift Natural Region of Texas (Lyndon B. Johnson School of Public Affairs 1978). The collared peccary occupies a variety of habitats throughout Mason Mountain WMA. They utilize cover in the form of caves, rocks and dense brush such as white brush (*Aloysia gratissima*). The collared peccary feeds mostly at dawn or

dusk, although I witnessed them eating in the middle of the day during the summer when temperatures were at their highest.

Although collared peccaries have been successfully reintroduced at Mason Mountain WMA, knowledge of collared peccary dietary habits is lacking for this eco-region of Texas. Such knowledge is necessary to appropriately manage populations and to assess the potential to translocate or reintroduce this species to other areas in the region. Currently, the collared peccary's home range and habitat use has been studied at Mason Mountain WMA (Richter 2012). Results indicate that collared peccaries select for Mesquite (*Prosopis glandulosa*)- White Brush (*Aloysia gratissima*)- Prickly Pear (*Opuntia* spp.)- Texas persimmon (*Diospyros texana*)- Live Oak (*Q. fusiformis*)- Spanish Oak (*Q. falcata*)- Ashe Juniper (*Juniperus ashei*)- Nuttall's Stone Crop (*Sedum nuttallianum*)- Peruvian Spikemoss (*Selaginella peruviana*)- American Tripogon (*Tripogon spicatus*)- Grama Grass (*Bouteloua* spp.) vegetation associations (Richter 2012).

Knowledge of food habits of wild herbivores is a basic requirement for the management of rangeland resources (Shrestha et al. 2006). Dietary studies provide us with an understanding about the factors leading to competition between herbivores with the most important factors being similarities in diet and amount of consumption (Hosten et al. 2007). According to Everitt et al. (1981), determining the food requirements of the collared peccary can provide information about proper habitat improvement programs such as prescribed burning and mesquite control via herbicides. Well managed areas where brush is mechanically controlled benefit the collared peccaries diet by providing higher densities of prickly pear and forbs than undisturbed areas (Everitt et al. 1981).

Burning should be well managed to prevent adverse effects to prickly pear production and herbicides should be carefully chosen when controlling mesquite, since prickly pear and mesquite are part of the collared peccaries diet (Everitt et al. 1981).

There are several methods used to determine the food habits of herbivores (Holechek 1982). The most common methods used are stomach content analysis and fecal analysis (Holecheck et al. 1982). Examination of food items found in the stomach of an animal is a commonly used method. However, this involves the sacrifice of an animal, which poses a problem when researching an ungulate from a small population. I chose fecal analysis as the method for this study, which involves identification of food items in fecal material. Bissonette (1982) also used fecal analysis to estimate the food habits of collared peccaries. The major advantage to fecal analysis is the virtually unlimited sample size, ease of sampling, and sacrifice of the animal is not necessary. The major disadvantage of fecal analysis is the differential digestion of consumed plants resulting in some plant species or parts of plants to undergo greater destruction than others during digestion (Vavra et al. 1978). There is also variation in structural breakdown of a plant species during digestion, which influences identification of the particle found in the feces. In addition, digestion could make a diet sample more sensitive to destruction by sample preparation techniques (Vavra and Holechek 1980). Results from fecal analysis would then be biased toward the more indigestible diet components (Vavra and Holecheck 1980).

The objectives of my research project were to 1) Assess the diet and selective foraging of collared peccaries at Mason Mountain WMA, 2) compare the diet of collared peccaries at Mason Mountain WMA to diets in other regions of Texas, 3) provide

necessary data to managers for developing management plans and successfully reintroducing collared peccaries to other portions of their historical range.

II. MATERIALS AND METHODS

Study Site

My study area was Mason Mountain WMA, Mason County, Texas. Mason Mountain WMA is a 2,147 ha WMA owned and managed by Texas Parks and Wildlife Department (TPWD). The management area is located in the Llano Uplift region, also known as the Central mineral region. The Llano Uplift is characterized by large domes and granite outcroppings and predominately sandy soils and bedrock formed during the Pre-Cambrian Era (LBJ School of Public Affairs 1978). The region has a hilly topography with elevations reaching 686 m. Vegetation ranges from oak woodlands in sandy, well drained areas, to mesquite savannahs on loamier soils, with occasional grasslands interspersed (LBJ School of Public Affairs 1978). Prickly pear cactus is found throughout Mason Mountain WMA. The average annual rainfall is estimated at 66 cm (Hatch et al. 1990) and the average annual temperature is 19.7°C (Carter 1931). The property is home to several exotic grazing ungulates including scimitar horned oryx (*Oryx dammah*), sable antelope (*Hippotragus niger*), greater kudu (*Tragelaphus strepsiceros*), gemsbok (*Oryx gazelle*), Thomson's gazelle (*Eudoras thomsonii*), waterbuck (*Kobus ellipsiprymnus*) and axis deer (*Cervus axis*).

Vegetation Sampling and Analysis

I randomly selected 20 points from previously established points by Mason Mountain WMA personnel for sampling vegetation. These points were located throughout fifteen habitat types (Fig. 1). At each vegetational point, I randomly selected an azimuth for a 100-m transect. I used a Garmin 12 XL GPS receiver to enter the beginning and ending

point for each transect. I sampled herbaceous species throughout 20 vegetational transects each season from summer 2013 to spring 2014. I recorded woody plants during summer 2013. I identified plant species and estimated cover within 11 Daubenmire frames (100 cm X 25 cm, Daubenmire and Daubenmire 1959) by evenly placing a frame along each line-transect beginning with 0-m and ending with 100-m. I applied the Daubenmire method (Daubenmire and Daubenmire 1959) to estimate percent cover for each plant species.

I sampled woody plants on the 20 randomly chosen vegetational transects mentioned above along with 4 additional vegetational transects using the line intercept method (Gates 1949). I recorded the beginning and ending point of the canopy of each woody plant along the line-intercept. A total of 220 Daubenmire frames and 2400-m of line intercept were used to estimate percent composition of herbaceous and woody plant species, respectively, in all seasons.

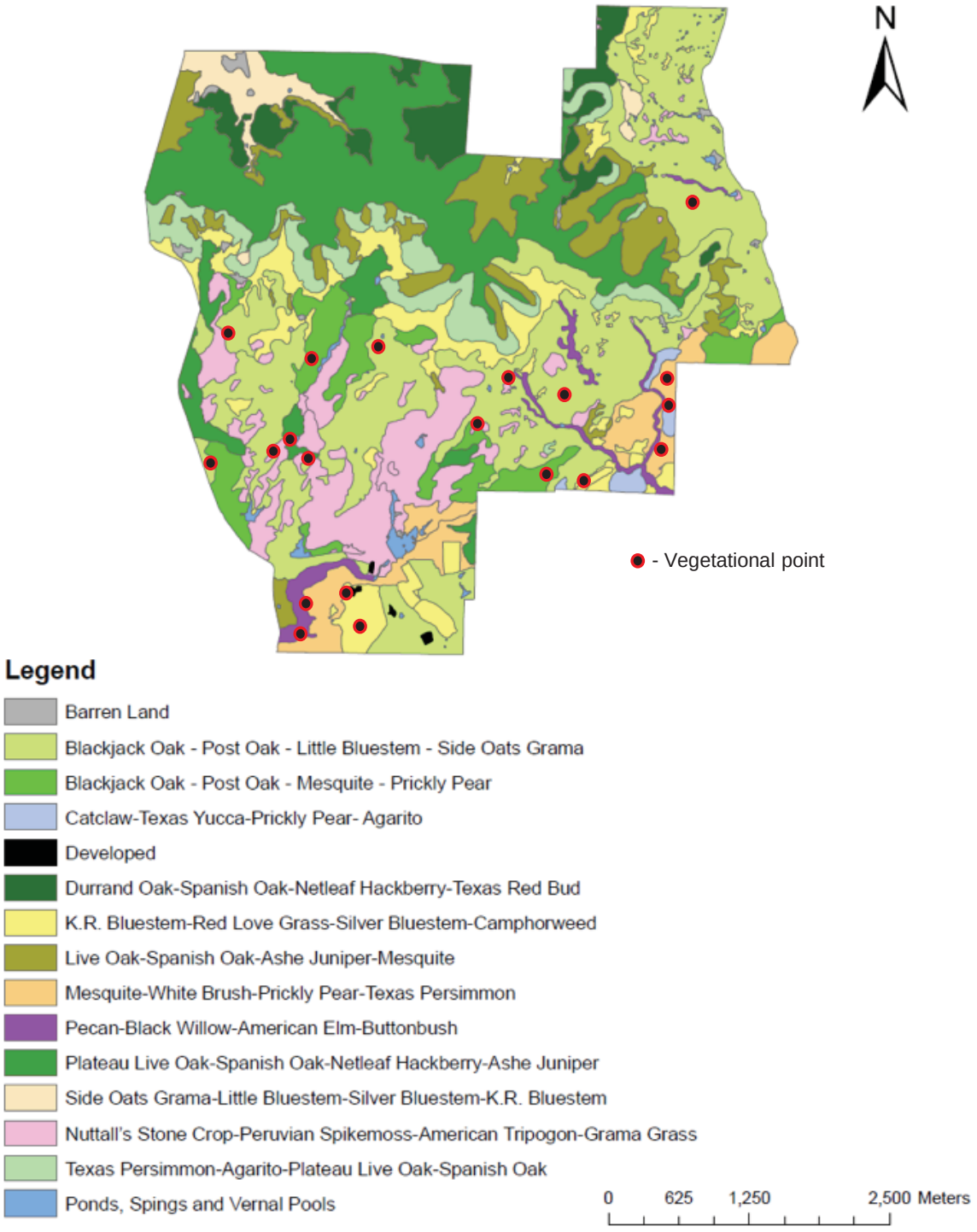

Figure 1. Habitat types and vegetational sampling points at Mason Mountain Wildlife Management Area, Mason County, Texas, 2013-2014. (Modified from Richter, 2012).

Fecal Sample Collection

I collected fecal samples seasonally. I collected only freshly deposited fecal samples < 24 hours old (based on relative moisture of the fecal material). The collared peccary uses discrete areas in the habitat to defecate, these areas are known as latrines (Elbroch 2003). Latrines were located under dense whitebrush patches and throughout rock outcropping(s) in both the middle and west pasture of Mason Mountain WMA (Figure 2). I removed fecal samples from distinct piles found in latrines to increase the chances that the sample came from different individuals. I immediately stored fecal samples in a freezer to preserve for laboratory analysis at a later date.

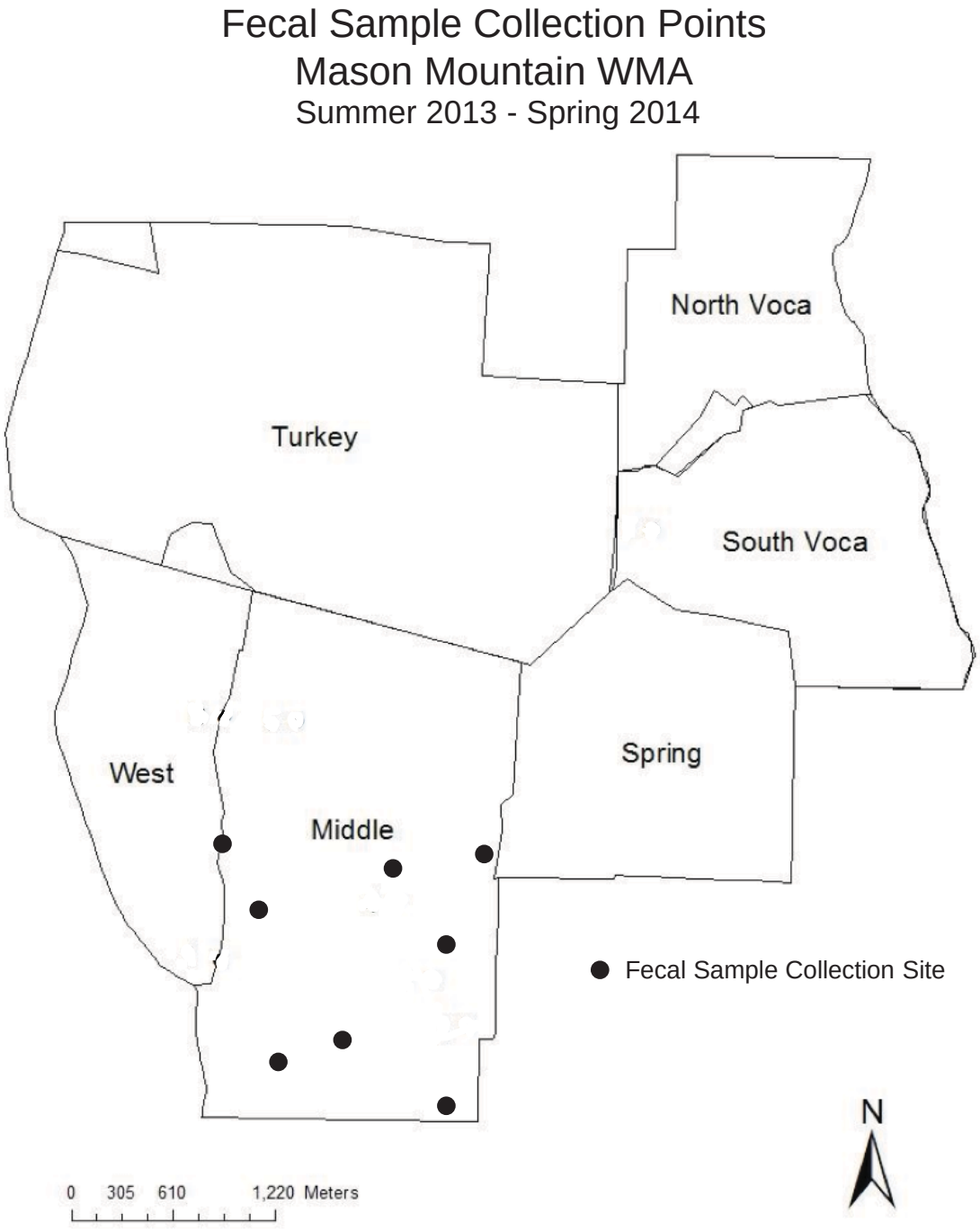

Figure 2. Fecal collection sites of the collared peccary at Mason Mountain Wildlife Management Area, 2013-2014.

Reference Slides

I made reference slides of leaves, flowers, fruits and seeds of plants found in the middle and spring pastures of Mason Mountain WMA in a manner similar to Gray et al. (2006) to assist in identification of epidermal fragments in the fecal samples. I used a razorblade to remove epidermal fragments from the reference plants collected. I cleared the lower and upper epidermis of the plant for several hours by soaking them in a 1:1 mixture of household bleach and water. Once the plant fragment was cleared, I placed it in isopropyl alcohol to dry before placing the fragment on a slide. Occasionally, I used Visikol ® (Phytosys LLC., New Brunswick, NJ) on the plant fragment if additional clearing was required. Next, I placed the epidermal fragment on a slide, mounted it with Mount-Quick "Aqueous" ® (Daido Sangyo Co. LTD., Tokyo, Japan) and placed a coverslip over the slide. Lastly, I sealed the edges of the coverslip with clear nail polish.

Fecal Analysis

After thawing each fecal sample, I removed a two gram subsample, filtered and washed the subsample with cold water through a series of sieves ranging from 4-mm to 2-mm to remove fragments too small to identify (Holecheck 1982). I then selected a small portion of the rinsed subsample and spread it thinly on five slides. I used Mount-Quick "Aqueous" ® solution to mount the fecal material under 22 X 22 mm cover slips. In some cases, Visikol ® solution was applied to fecal material that needed further clearing.

I used a Nikon binocular microscope ® (Nikon Instruments Inc., Zhejiang, China) to assist in plant identification. I identified 500 plant fragments per season (n= 2000 fragments) by randomly selecting five fields of view per slide and moving the

microscope stage accordingly. Initially, I focused the microscope with the 4x objective (40x) magnification. Most of the epidermal fragments were identified using the 10x objective (100X) magnification. I also used the 40x objective (400X) magnification when epidermal plant fragments were difficult to identify. I identified the plant fragment closest to the ocular pointer to the species level or to the lowest taxonomic category possible. I identified oak species to the genus level (*Quercus* spp.) because I found it difficult to distinguish differences among foliage and acorns of the several oak species (live oak, *Quercus fusiformis*; blackjack oak, *Quercus marylandica*; post oak, *Quercus stellata*) on Mason Mountain WMA. I relied on epidermal characteristics of plants to identify fragments on the fecal slides. These characteristics included: cell wall contour, silica cell variation, trichomes, stomata and crystal shaped structures. Reference slides, reference pictures and publications that contained epidermal plant photographs under magnification enabled me to correctly identify plant fragments on the fecal slides (Scott and Dahl 1980).

Plant Use

I defined plant use as the percent composition of the plant species found in fecal samples. I determined percent composition of each species through microhistological analysis and steps outlined in Gray et al. (2006). For each season, I summed the total number of epidermal fragments per species per season, divided that number by the total (500 per season) and multiplied by 100. I calculated the annual total by summing the number of plant fragments of each species and dividing it by the total number of fragments across seasons (2000). I considered a plant species to be a primary food item

if that item made up ≥ 3% of the diet by season. I set the cut-off point at ≥ 3% because the plants present at ≥ 3% collectively contributed more than 80% of the diet. I included species contributing < 3% of the diet by grouping them together in the "other" category. Plants included in the "other" category were: browse species – Catclaw mimosa (*Mimosa biuncifera*), mesquite, prickly ash (*Zanthoxylum americanum*) and whitebrush; mast - globeberry (*Ibervillea lindheimeri*) and Christmas cactus (*Cylindropuntia leptocaulis*) seeds; forbs - spiderwort (*Tradescantia virginiana*), sedges (*Carex* spp.), snake cotton (*Proelichia gracillis*), flame flower (*Phemeranthus aurantiacus*), primrose (*Oenothera biennis*), peppergrass (*Lepidium virginicum*), blue-eyed grass (*Sisyrinchium bellum*) and monkey flower (*Mimulus guttatus*); grasses - sideoats grama (*Bouteloua caurtipendula*), knotroot bristlegrass (*Setaria parviflora*), paspalum (*Paspalum* spp.), dropseed sporobolus (*Sporobolus heterolepis*), white tridens (*Tridens albescens*), jungle rice (*Echinochloa colona*), little bluestem (*Schizachyrium scorparium*), hairy crabgrass (*Digitaria sanguinalis*), scribners grass (*Dichanthelium oligosanthes*) and windmill grass (*Chloris* spp.).

Occurrence in Fecal Samples

Occurrence and percent occurrence tables were constructed to determine how many collared peccaries were consuming a particular food item seasonally and annually (Appendix 3) and to compare those results to the percent composition found in the diet (Table 1). Occurrence was calculated by counting the number of fecal samples in which a particular plant species occurred. Percent occurrence was calculated by dividing occurrence by the total # of fecal samples, (n = 80) for annual occurrence and (n = 20) for

seasonal occurrence.

Selective Foraging

I applied the chi-squared goodness of fit test with estimated proportions of available resources to test the null hypothesis that there was no difference between use and availability of plant species (Manly et al. 1993). I calculated availability of herbaceous species by the percentage of Daubenmire frames in which the species contributed ≥ 5% of the cover (Krebs, personal comm.). Charles J. Krebs published a book titled *Ecological Methodology* detailing methods for estimating abundance and density; it is the standard textbook used for ecology courses worldwide. Woody species were considered available by the percentage of 10-m intercept intervals in which a plant species contributed ≥ 5% of the line-intercept length.

I used the Bonferroni Z-Statistic (Neu et al. 1974) to calculate simultaneous confidence intervals for each season and annually (Tables 6-10) and Manly's alpha index (Tables 11-15) to determine which plants were used disproportionately. I calculated confidence intervals (95%) for observed use to indicate which plants were selected based on availability. I designated the plant as selected (S) if availability in the habitat fell below the 95% CI for use (percentage in diet). I determined avoidance (A) or no selection if availability in the habitat exceeded the 95% CI for use (percentage in diet) and use in proportion (IP) was designated if availability fell within the observed use confidence interval.

I also calculated Manly's alpha preference index (constant prey formula; Manly et al. 1972) for each plant species found in the collared peccary diet during a given season to

determine selection or avoidance of plants. If an index score had a value >1/m (m = total number of plant species eaten), I listed the plant as selected (S). If the value was <1/m, I listed the plant as avoided (A).

By comparing the overall results from Manly's alpha indices and chi-squared goodness of fit with Bonferroni corrected confidence intervals, I was able to designate a plant item as selected, avoided, or used in proportion. When both of the techniques above agreed, I considered a plant species selected or avoided. If the results from the two methods conflicted, I considered the plant used in proportion to its availability (Gray et al. 2006).

III. RESULTS

Annual Diet

I collected a total of 80 fecal samples, 20 per season, from June 2013 to April 2014. The collection periods throughout the year were as follows: summer (10 June to 31 July), fall (5 October to 12 October), winter (1 January to 12 January), spring (18 April to May 8). I examined 2,000 plant epidermal fragments, 500 per season, from 80 fecal samples to describe the annual and seasonal diet of the collared peccary in central Texas. I identified 36 plant species that collared peccaries consumed during one year (Table 1). Of these, 4 species comprised 80.95% of the annual diet. Prickly pear had the greatest use, making up 30.95% of the total. Live/blackjack/post oak (*Quercus* spp.) made up 23.05% of the total. Silver bladderpod (*Lesquerella argyraea*) made up 15.30% and prickly fanpetals (*Sida spinosa*) contributed to the remaining 12.1% (Table 3).

For annual diet comparisons, plants consumed by collared peccaries were arranged by forage classes: cactus, browse, mast, grasses, and forbs. Cactus (n = 1) and browse species (n = 6) were consumed year around and comprised 27.35 % and 9.75%, respectively, of the annual diet. Forbs (n = 12) contributed to 32.8% in the annual diet. Mast species (n = 5) and grasses (n = 14) were consumed in relatively smaller proportions, 22.4 % and 7.8%, respectively (Figure 3, Table 1).

According to occurrence and percent occurrence, six plant species were identified in ≥ 20% of collared peccary fecal samples. Prickly pear fruit and seeds were identified in 97.5% and 31.25%, respectively. Browse species: live/blackjack/post oak leaves were identified in 35%, acorns 48.75% and herbaceous species: silver bladderpod 37.5%, prickly fanpetals 70%, western horsenettle 26.5% and buffalo gourd 22.5% were found in

fecal samples (n = 80) annually. See Appendix 3.

Table 1. Plant species, identified plant fragments, and percent composition in fecal samples of plants consumed by collared peccaries (*Pecari tajacu*) from 2013-2014 at Mason Mountain Wildlife Management Area.

Species	Common Name	Identified Plant Fragments	Percent Composition
Cactus			
Opuntia spp.	Prickly pear	547.00	27.35
Total		**547.00**	**27.35**
Browse (leaves and shoots)			
Quercus spp.	Live/blackjack/post oak	145.00	7.25
Diospyros texana	Texas Persimmon	19.00	0.95
Mimosa biuncifera	Catclaw mimosa	18.00	0.90
Prosopis glandulosa	Mesquite	6.00	0.30
Zanthoxylum americanum	Prickly ash	5.00	0.25
Aloysia gratissima	Whitebrush	2.00	0.10
Total Browse		**195.00**	**9.75**
Grasses			
Eragrosis secundiflora	Red lovegrass	32.00	1.60
Setaria vulpiseta	Plains bristlegrass	35.00	1.25
Bouteloua hirsuta	Hairy grama	16.00	0.80
Bouteloua curtipendula	Sideoats grama	14.00	0.70
Setaria parviflora	Knotroot bristlegrass	5.00	0.25
Paspalum spp.	Paspalum	24.00	1.20
Sporobolus heterolepis	Dropseed sporobolus	16.00	0.80
Schizachyrium scoparium	Little bluestem	1.00	0.05
Digitaria sanguinalis	Hairy crabgrass	1.00	0.10
Dichanthelium oligosanthes	Scribners grass	7.00	0.35
Tridens albescens	White tridens	2.00	0.10
Echinochloa colona	Jungle rice	3.00	0.15
Phalaris canariensis	Canary grass	7.00	0.35
Chloris spp.	Windmill grass	1.00	0.05
Total Grasses		**164.00**	**7.75**

Table 1, Continued.

Forbs			
Lesquerella argyraea	Silver bladderpod	306.00	15.30
Sida spinosa	Prickly fanpetals	242.00	12.10
Solanum dimidiatum	Western horsenettle	45.00	2.25
Solanum elaeagnifolium	Silverleaf nightshade	16.00	0.80
Trandescantia virginiana	Spiderwort	6.00	0.30
Carex spp.	Sedge	1.00	0.05
Lepidium virginicum	Snake cotton	7.00	0.35
Phemeranthus aurantiacus	Flame flower	2.00	0.10
Oenothera biennis	Primrose	8.00	0.40
Froelichia gracilis	Pepper grass	7.00	0.35
Sisyrinchium bellum	Blue eyed grass	2.00	0.10
Mimulus guttatus	Monkey flower	13.00	0.65
Total Forbs		**655.00**	**32.75**
	Fruits, Nuts and Seeds		
Mast			
Quercus spp.	Acorns	316.00	15.80
Opuntia spp.	Prickly pear seed	72.00	3.60
Cucurbita foetidissima	Buffalo gourd	45.00	2.15
Ibervillea lindheimeri	Globeberry	3.00	0.15
Cylindropuntia leptocaulis	Christmas cactus	14.00	0.70
Total Mast		**450.00**	**22.40**

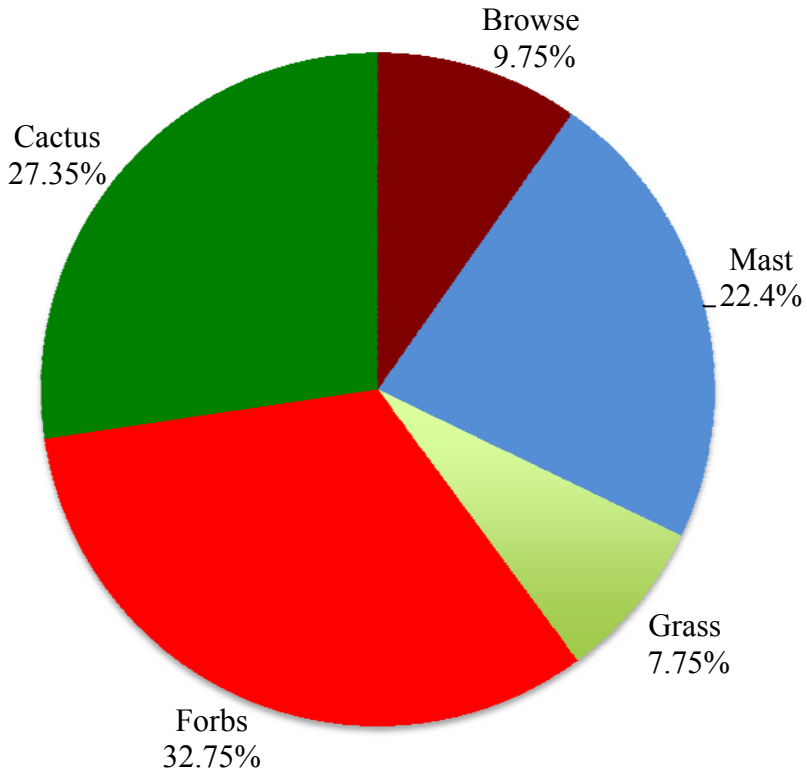

Figure 3.Percent composition of plants in the diet of collared peccaries from 2013-2014 at Mason Mountain Wildlife Management Area.

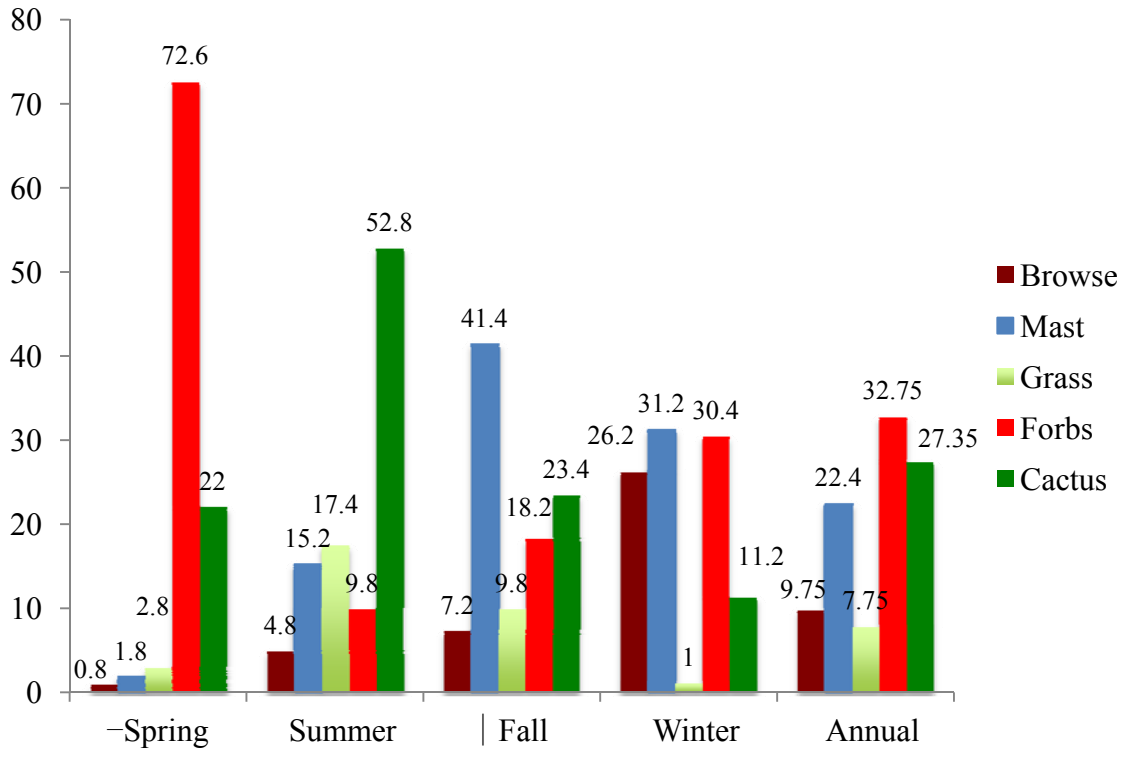

Figure 4. Percent composition of forage classes utilized seasonally and annually at Mason Mountain Wildlife Management Area, 2013-2014.

Spring Diet

I collected 20 fecal samples during spring from the 18 April to the 8 May. I made five slides per sample and observed five fields of view per slide. I identified a total of 500 plant fragments from the spring fecal sample slides. Fourteen plant species were identified in the spring fecal samples, of which four plants made up 88% of the identified fragments. These included three herbaceous species, silver bladderpod (56.8%), prickly fanpetals (6%), and silverleaf nightshade (3.2%) and prickly pear (22%, Fig. 5). The remaining ten food items were included in the "other" category (12%). These plants consisted of catclaw mimosa, buffalo gourd, plains bristlegrass, sideoats grama, western

horse nettle, primrose, peppergrass, blue-eyed grass, canary grass and monkey flower (Table 2.).

During spring, the occurrence and percent occurrence of plant species found in the collared peccaries diet was calculated. According to percent occurrence, prickly pear (100%), silver bladderpod (100%), prickly fanpetals (60%), silverleaf nightshade (30%), buffalo gourd (20%), and primrose (20%) occurred in ≥ 20% of the collared peccaries fecal samples (n = 20) during spring (Appendix 3).

Table 2. Plant species, identified plant fragments, and percent composition in fecal samples of plants consumed by collared peccaries (*Pecari tajacu*) during spring 2014 at Mason Mountain Wildlife Management Area.

Species	Common Name	Identified Plant Fragments	Percent Composition
Cactus			
Opuntia spp.	Prickly pear	110.00	22.00
Total Cactus		**110.00**	**22.00**
Browse (leaves and shoots)			
Mimosa biuncifera	Catclaw mimosa	4.00	0.80
Total Browse		**4.00**	**0.80**
Grasses			
Setaria vulpiseta	Plains bristlegrass	2.00	0.40
Bouteloua curtipendula	Sideoats grama	5.00	1.00
Total Grasses		**7.00**	**1.40**
Forbs			
Solanum dimidiatum	Western horsenettle	3.00	0.60
Sida spinosa	Prickly fanpetals	30.00	6.00
Lesquerella argyraea	Silver bladderpod	284.00	56.80
Oenothera biennis	Primrose	8.00	1.60
Lepidium virginicum	Pepper grass	7.00	1.40
Sisyrinchium bellum	Blue eyed grass	2.00	0.40

Table 2, Continued.

Phalaris canariensis	Canary grass	7.00	1.40
Mimulus guttatus	Monkey flower	13.00	2.60
Solanum elaeagnifolium	Silverleaf nightshade	16.00	3.20
Total Forbs		**370.00**	**74.00**
Mast			
Cucurbita foetidissima	Buffalo gourd	9.00	1.80
Total Mast		**9.00**	**1.80**

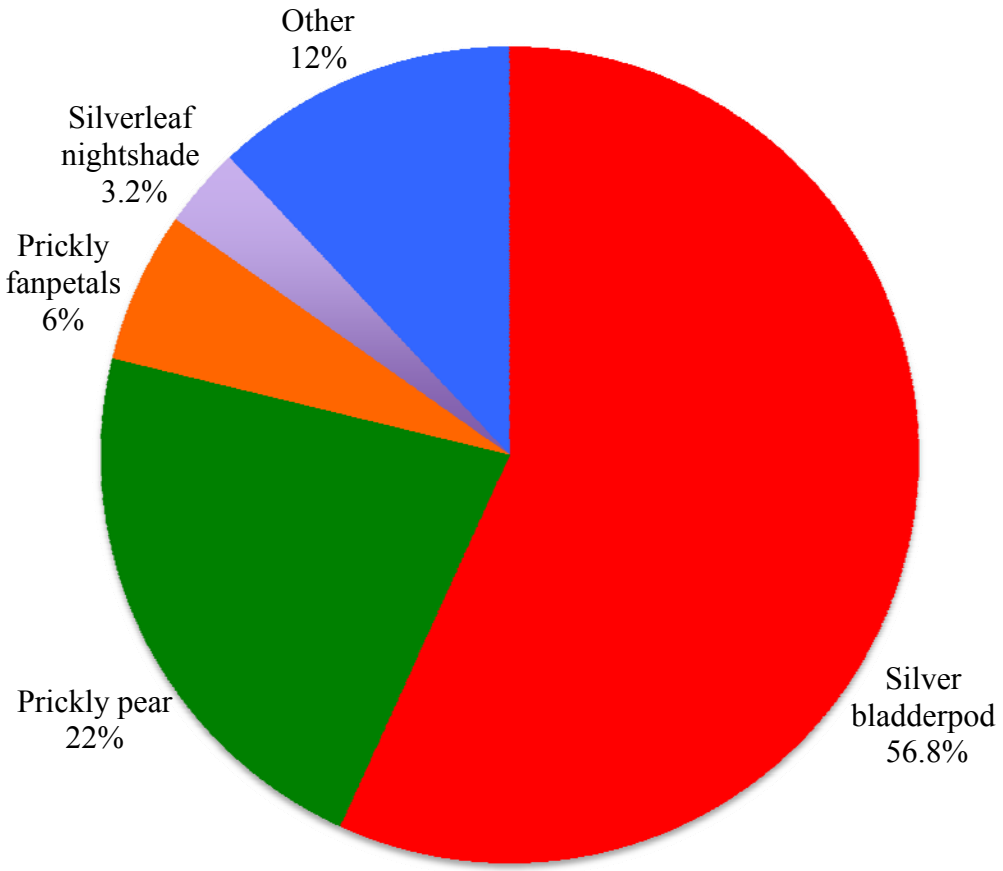

Figure 5. Percent composition of plants in the diet of collared peccaries during spring 2013 at Mason Mountain Wildlife Management Area.

Summer Diet

I collected 20 fecal samples during the summer from the 10 June to the 31 July. I made five slides per sample and observed five fields of view per slide. I identified a total of 500 plant fragments from the summer fecal sample slides. In summer, I identified fragments of 25 plants of which six made up 83.2% of the total identified. The six plants with the highest fragment count were prickly pear fruit and seeds (*Opuntia* spp.; 64.6%), red lovegrass (*Eragrosis secundiflora*; 4.2%), plains bristlegrass (*Setaria vulpiseta*; 3.8%), buffalo gourd (*Cucurbita foetidissima*; 3.4%), western horsenettle (*Solanum dimidiatum*; 4%), and prickly fanpetals (*Sida spinosa*; 3.2%) (Fig. 6). In addition to the high use species, I found several "other" species identified at < 3% in the total fragments. Collectively these species made up 16.8% of the fragments identified in the summer samples and consisted of browse, grasses, and forbs (Table 3). Browse species included: live/blackjack/post oak, Texas persimmon, catclaw mimosa, mesquite, prickly ash, and whitebrush. Grasses included: sideoats grama, knotroot bristlegrass, paspalum, dropseed sporobolus, little bluestem, hairy crabgrass, scribner's dichanthelium, white tridens and windmill grass. Forbs consisted of spiderwort, sedges (*Carex* spp.), snake cotton, and flame flower. Based on occurrence and percent occurrence data, 10 plant species occurred in ≥ 20% of collared peccaries fecal samples (n = 20) during summer. Prickly pear fruit (100%) and seeds (80%), red lovegrass (40%), plains bristlegrass (35%), sideoats grama (30%), paspalum (30%), dropseed sporobolus (20%), prickly fanpetals (40%), western horsenettle (35%) and buffalo gourd (35%) occurred during the season (Appendix 3).

Table 3. Plant species, identified plant fragments, and percent composition in fecal samples of collared peccaries (*Pecari tajacu*) during summer 2013 at Mason Mountain Wildlife Management Area.

Species	Common Name	Identified Plant Fragments	Percent Composition
Cactus			
Opuntia spp.	Prickly pear	264.00	52.80
Total Cactus		**264.00**	**52.80**
Browse (leaves and shoots)			
Mimosa biuncifera	Catclaw mimosa	7.00	1.40
Aloysia gratissima	Whitebrush	2.00	0.40
Diospyros texana	Texas persimmon	4.00	0.80
Quercus spp.	Live/blackjack/post oak	1.00	0.20
Prosopis glandulosa	Mesquite	6.00	1.20
Zanthoxylum americanum	Prickly ash	4.00	0.80
Total Browse		**24.00**	**4.80**
Grass			
Setaria vulpiseta	Plains bristlegrass	19.00	3.80
Bouteloua curtipendula	Sideoats grama	9.00	1.80
Setaria parviflora	Knotroot bristlegrass	5.00	1.00
Eragrosis secundiflora	Red lovegrass	21.00	4.20
Tridens albescens	White tridens	2.00	0.40
Paspalum spp.	Paspalum	13.00	2.60
Sporobolus heterolepis	Dropseed sporobolus	12.00	2.40
Schizachyrium scoparium	Little bluestem	1.00	0.20
Digitaria sanguinalis	Hairy Crabgrass	2.00	0.40
Dichanthelium oligosanthes	Scribners grass	2.00	0.40
Chloris spp.	Windmill grass	1.00	0.20
Total Grasses		**87.00**	**17.40**
Forbs			
Solanum dimidiatum	Western horsenettle	20.00	4.00
Tradescantia virginiana	Spiderwort	4.00	0.80
Sida spinosa	Prickly fanpetals	16.00	3.20
Carex spp.	Sedges	1.00	0.20
Froelichia gracilis	Snake cotton	7.00	1.40
Phemeranthus aurantiacus	Flame flower	1.00	0.20
Total Forbs		**49.00**	**9.80**

Table 3, Continued.

Mast			
Opuntia spp.	Prickly Pear Seeds	59.00	11.80
Cucurbita foetidissima	Buffalo Gourd	17.00	3.40
Total Mast		**76.00**	**15.20**

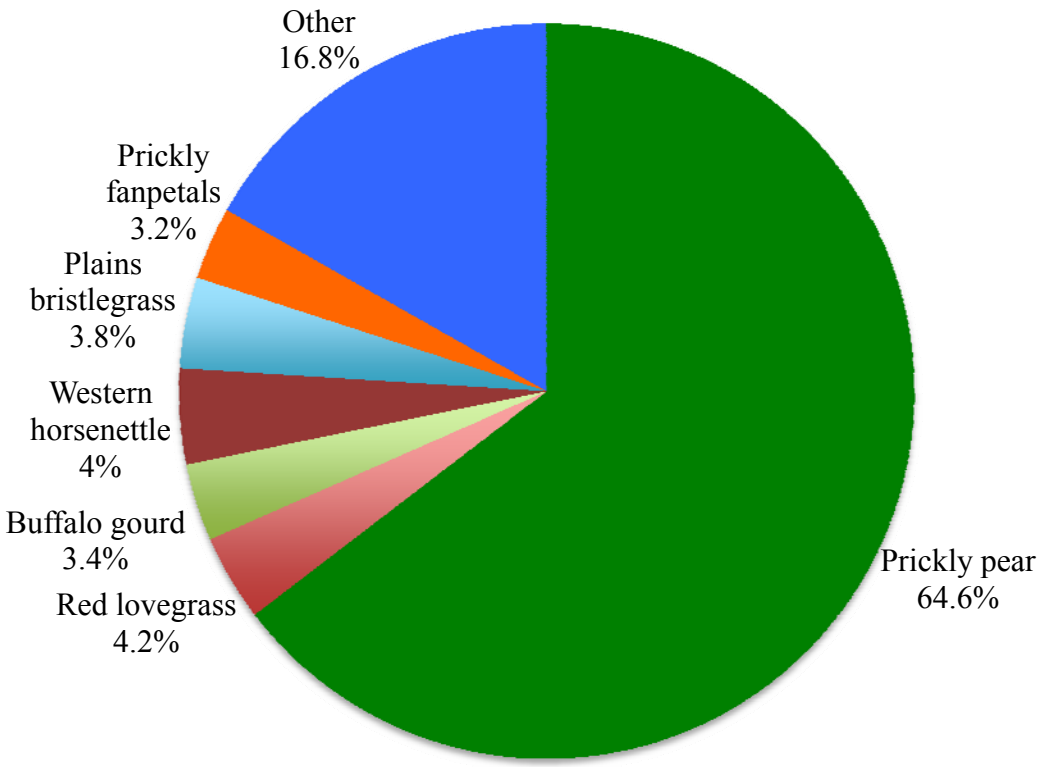

Figure 6. Percent composition of plants in the diet of collared peccaries during summer 2013 at Mason Mountain Wildlife Management Area.

Fall Diet

During fall, from the 5 October to the 12 October, I collected 20 fecal samples. I made five slides per sample and observed five fields of view per slide. I identified a total of 500 plant fragments from the fall fecal sample slides. Fall samples consisted of 17 identified food items. Six plants with the highest fragment count comprised 90.4% of the total identified: Live/blackjack/post oak leaves and acorns (38.4%) and prickly pear fruit as well seeds (26%). Texas persimmon (Diospyros texana; 3%), hairy grama (*Bouteloua hirsuta*; 3.2%), buffalo gourd (3.4%), and prickly fanpetals (16.4%) made up the primary diet (Fig. 7). Species listed under "other" made up 9.6%. These included: Catclaw mimosa, red lovegrass, plains bristlegrass, paspalum spp., dropseed sporobolus, scribner's grass, jungle rice, silver bladderpod, western horsenettle, spiderwort, and globeberry (Table 4). According to percent occurrence, several plant species were consumed by collared peccaries in the fall. Plants included: prickly pear fruit (95%) and seeds (45%), live/blackjack/post oak leaves (35%) and acorns (95%), hairy grama (40%), prickly fanpetals (85%) and buffalo gourd (35%) occurred in fall fecal samples (n = 20) (Appendix 3).

Table 4. Plant species, identified plant fragments, and percent composition in fecal samples of collared peccaries (*Pecari tajacu*) during fall 2013 at Mason Mountain Wildlife Management Area.

Species	Common Name	Identified Plant Fragments	Percent Composition
Cactus			
Opuntia spp.	Prickly pear	117.00	23.40
Total Cactus		**117.00**	**23.40**
Browse			
Mimosa biuncifera	Catclaw mimosa	3.00	0.60
Quercus spp.	Live/blackjack/post oak	18.00	3.60
Diospyros texana	Texas persimmon	15.00	3.00
Total Browse		**36.00**	**7.20**
Grass			
Setaria vulpiseta	Plains bristlegrass	1.00	0.20
Eragrosis secundiflora	Red lovegrass	10.00	2.00
Solanum dimidiatum	Western horsenettle	4.00	0.80
Paspalum spp.	Paspalum	10.00	2.00
Sporobolus heterolepis	Dropseed sporobolus	4.00	0.80
Dichanthelium oligosanthes	Scribners	5.00	1.00
Echinochloa colona	Jungle rice	3.00	0.60
Bouteloua hirsuta	Hairy grama	16.00	3.20
Total Grasses		**53.00**	**10.60**
Forbs			
Tradescantia virginiana	Spiderwort	2.00	0.40
Sida spinosa	Prickly fanpetals	82.00	16.40
Lesquerella argyraea	Silver bladderpod	3.00	0.60
Total Forbs		**87.00**	**17.40**
Mast			
Opuntia spp.	Prickly pear seeds	13.00	2.60
Quercus spp.	Acorns	174.00	34.80
Cucurbita foetidissima	Buffalo gourd	17.00	3.40
Ibervillea lindheimeri	Globeberry	3.00	0.60
Total Mast		**207.00**	**41.40**

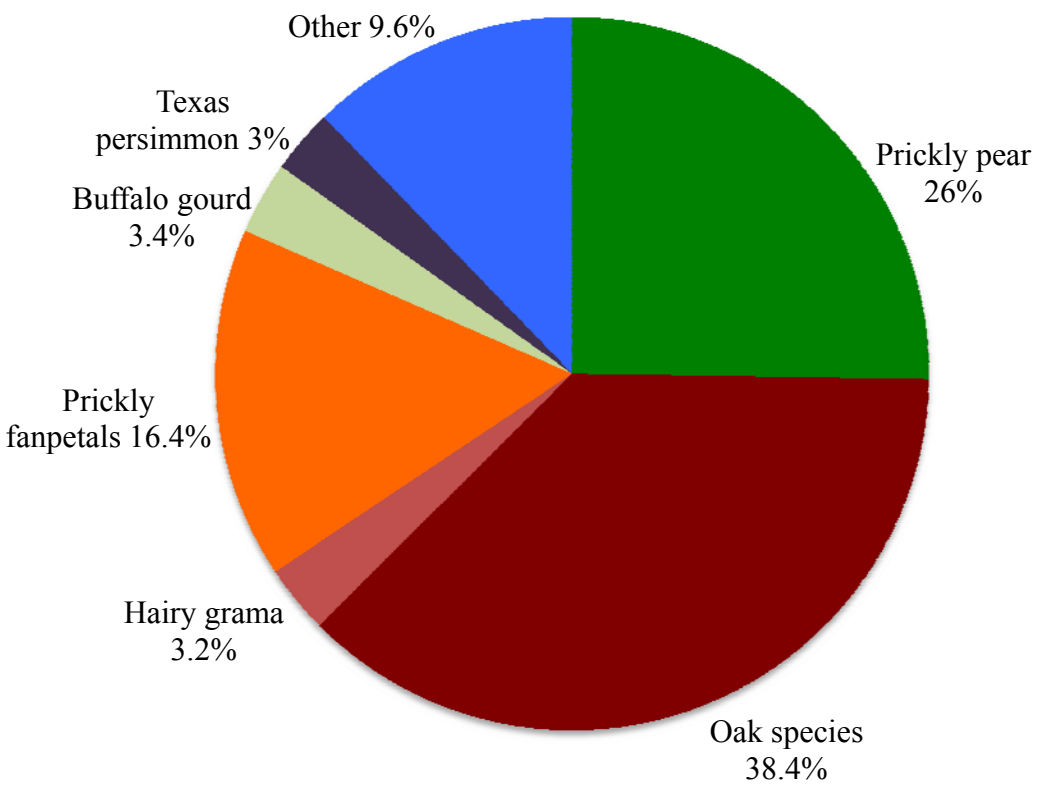

Figure 7. Percent composition of plants in the diet of collared peccaries during fall 2013 at Mason Mountain Wildlife Management Area.

Winter Diet

During winter, I collected 20 fecal samples from the 1st of January to the 12th of January. I made five slides per sample and observed five fields of view per slide. I identified a total of 500 plant fragments from the winter fecal sample slides. Twelve food items were identified in the winter samples. Of these 12 plants, I found five plants made up 91.2% of the total identified fragments. Browse: Live/blackjack/post oak (53.6%) and cactus: prickly pear fruit (11.2%) were highly utilized. Herbaceous species including: prickly fanpetals (22.8%), western horsenettle (3.6%) and silver bladderpod (3.8%) were

also consumed during the winter (Fig. 8). The remaining 7 items consisted of catclaw mimosa and prickly ash browse items. Pencil cactus seeds were also listed under mast items consumed. Primary grass species consisted of red lovegrass, plains bristlegrass and paspalum. Finally, flame flower was the remaining forb in the winter diet (Table 5). Percent occurrence data showed that live/blackjack/post oak leaves and acorns occurred in 100% of samples. Prickly pear and prickly fanpetals also occurred in a high percentage (95%) of winter samples. Silver bladderpod and Christmas cactus occurred in ≥ 20% of collared peccaries fecal samples (n = 20) during the winter (Appendix 3).

Table 5. Plant species, identified plant fragments, and percent composition in fecal samples of collared peccaries (*Pecari tajacu*) during winter 2013 at Mason Mountain Wildlife Management Area.

Species	Common Name	Identified Plant Fragments	Percent Composition
Cactus			
Opuntia spp.	Prickly pear	56.00	11.20
Total Cactus		**56.00**	**11.20**
Browse			
Quercus spp.	Live/blackjack/post oak	126.00	25.20
Zanthoxylum americanum	Prickly ash	1.00	0.20
Mimosa biuncifera	Catclaw mimosa	4.00	0.80
Total Browse		**131.00**	**26.20**
Grass			
Setaria vulpiseta	Plains bristlegrass	3.00	0.60
Eragrosis secundiflora	Red lovegrass	1.00	0.20
Paspalum spp.	Paspalum	1.00	0.20
Total Grasses		**5.00**	**1.00**
Forbs			
Sida spinosa	Prickly fanpetals	114.00	22.80
Phemeranthus aurantiacus	Flame flower	1.00	0.20
Lesquerella argyraea	Silver bladderpod	19.00	3.80
Solanum dimidiatum	Western horsenettle	18.00	3.60
Total Forbs		**152.00**	**30.40**

Table 5, Continued.

Mast			
Quercus spp.	Acorns	142.00	28.40
Cylindropuntia leptocaulis	Christmas cactus	14.00	2.80
Total Mast		**156.00**	**31.20**

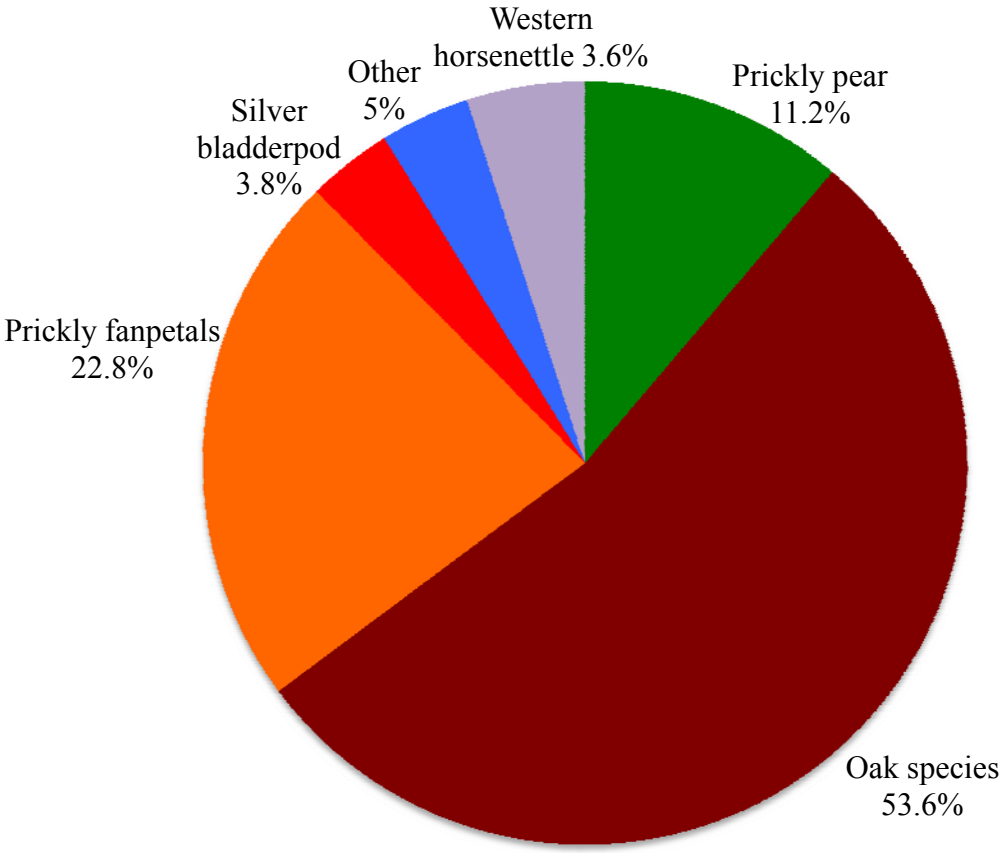

Figure 8. Percent composition of plants in the diet of collared peccaries during winter 2013 at Mason Mountain Wildlife Management Area.

Plant Selection

I performed a chi-square χ^2 goodness of fit test to determine if the proportion of plant species in the seasonal diets (use) differed significantly from the proportion available in the habitat (availability). I rejected the null hypothesis that use did not differ from availability based on the resulting values (spring: χ^2=337.822, df=4, p<0.001; summer: χ^2=426.180, df=6, p<0.001; fall: χ^2=184.735, df=6, p<0.001; winter: χ^2=378.786, df=5, p<0.001; annual: χ^2=162.626, df=4, p<0.001). In all cases I used the Bonferroni Z-Statistic (Neu et al. 1974) to calculate the simultaneous confidence intervals for each season (Tables 6-9). I calculated confidence intervals for observed use to determine which plants were selected (Figures 9-12). Comparing confidence intervals for each species of plant consumed to availability of each species in the habitat (Neu et al. 1974) I determined that prickly pear and silver bladderpod were both selected during the spring. Prickly fanpetals and silverleaf nightshade were consumed in proportion to their availability (Table 6).

During summer, plant consumption indicated that prickly pear was selected. Western horsenettle, red lovegrass, plains bristlegrass, buffalo gourd were consumed in proportion to their availability in the habitat while prickly fanpetals were avoided i.e. not selected (Table 7). The confidence intervals calculated for fall indicated that prickly pear and oak species were selected. Prickly fanpetals, buffalo gourd, hairy grama and Texas persimmon were consumed in proportion to their availability in the environment (Table 8). Finally, the winter confidence intervals I calculated suggested that oak species and prickly fanpetals were selected. Prickly pear, western horsenettle, silver bladderpod and were neither selected nor avoided, but used in proportion according to the expected use

estimate falling within the observed use confidence interval (Table 9). Annually, prickly pear, live/blackjack/post oak and silver bladderpod were selected while prickly fanpetals were used in proportion to their availability in the environment (Table 10).

Table 6. Comparison of the observed use and expected use of plants in the spring diet of collared peccaries (*Pecari tajacu*) at Mason Mountain Wildlife Management Area, 2014. Hypothesis of proportional use was rejected (χ^2= 337.822, p<0.001).

Plant Species	Expected Use (Availability)	Observed Use (In Diet)	95% Confidence Interval on Observed Use	Plants Selected (S) Avoided (A) or Used in Proportion (IP)
Prickly pear	0.0910	0.2200	0.1138<p<0.3264	S
Prickly fanpetals	0.0864	0.0600	-0.0009<p<0.1209	IP
Silver bladderpod	0.0772	0.5680	0.4392<p<0.6968	S
Silverleaf nightshade	0.0091	0.0320	-0.0133<p<0.0773	IP

Table 7. Comparison of the observed use and expected use of plants in the summer diet of collared peccaries (*Pecari tajacu*) at Mason Mountain Wildlife Management Area, 2014. Hypothesis of proportional use was rejected (χ^2=426.180, p<0.001).

Plant Species	Expected Use (Availability)	Observed Use (In Diet)	95% Confidence Interval on Observed Use	Plants Selected (S) Avoided (A) or Used in Proportion (IP)
Prickly pear	0.0910	0.6461	0.5107<p<0.7750	S
Plains bristlegrass	0.0270	0.0380	-0.0137<p<0.0897	IP
Red lovegrass	0.0045	0.0420	-0.0118<p<0.0958	IP
Buffalo gourd	0.0000	0.0340	0.0149<p<0.0829	IP
Western horsenettle	0.0045	0.0400	-0.0127<p<0.0927	IP
Prickly fanpetals	0.1045	0.0320	-0.0154<p<0.0794	A

Table 8. Comparison of the observed use and expected use of plants in the fall diet of collared peccaries (*Pecari tajacu*) at Mason Mountain Wildlife Management Area, 2014. Hypothesis of proportional use was rejected (χ^2=184.735, p<0.001).

Plant Species	Expected Use (Availability)	Observed Use (In Diet)	95% Confidence Interval on Observed Use	Plants Selected (S) Avoided (A) or Used in Proportion (IP)
Prickly pear	0.0910	0.2600	0.1420<p<0.3780	S
Buffalo gourd	0.0000	0.0340	-0.0147<p<0.0827	IP
Prickly fanpetals	0.2409	0.1640	0.0644<p<0.2636	IP
Live/blackjack/post oak	0.0790	0.3840	0.2522<p<0.5158	S
Hairy grama	0.0772	0.0320	-0.0154<p<0.0794	IP
Texas persimmon	0.0050	0.0300	-0.0159<p<0.0759	IP

Table 9. Comparison of the observed use and expected use of plants in the winter diet of collared peccaries (*Pecari tajacu*) at Mason Mountain Wildlife Management Area, 2014. Hypothesis of proportional use was rejected (χ^2=378.786, p<0.001).

Plant Species	Expected Use (Availability)	Observed Use (In Diet)	95% Confidence Interval on Observed Use	Plants Selected (S) Avoided (A) or Used in Proportion (IP)
Prickly pear	0.0910	0.1120	0.0289<p<0.3264	IP
Western horsenettle	0.0045	0.0360	-0.0133<p<0.0853	IP
Prickly fanpetals	0.0455	0.2280	0.1162<p<0.3398	S
Live/blackjack/post oak	0.0790	0.5360	0.4042<p<0.6678	S
Silver bladderpod	0.0000	0.0380	-0.0127<p<0.0887	IP

Table 10. Comparison of the observed use and expected use of plants in the annual diet of collared peccaries (*Pecari tajacu*) at Mason Mountain Wildlife Management Area, 2013-2014. Hypothesis of proportional use was rejected (χ^2=162.626, p<0.001).

Plant Species	Expected Use (Availability)	Observed Use (In Diet)	95% Confidence Interval on Observed Use	Plants Selected (S) Avoided (A) or Used in Proportion (IP)
Prickly pear	0.0910	0.3095	0.1915<p<0.4275	S
Live/blackjack/post oak	0.0790	0.2305	0.1212<p<0.3397	S
Prickly fanpetals	0.1193	0.1210	0.0356<p<0.2064	IP
Silver bladderpod	0.0216	0.1530	0.0602<p<0.2458	S

As another means to determine selection or avoidance of plant species by collared peccaries, I constructed Manly's alpha indices using constant prey proportion formula (Manly et al. 1972) annually and seasonally for each primary species consumed (Tables 11-15). Silver bladderpod and silverleaf nightshade were selected during the spring. Red lovegrass was selected during the summer as well as prickly pear. Buffalo gourd, prickly pear, oak species, and Texas persimmon were selected during the fall. Western horsenettle and prickly fanpetals were selected during the winter. On an annual basis, prickly pear and silver bladderpod were both selected food items according to Manly's alpha indices.

Table 11. Manly's alpha preference index scores for plants in the spring diet of collared peccaries (*Pecari tajacu*) at Mason Mountain Wildlife Management Area, 2014 (scores>0.200 indicate selection).

Plant Species	Manly's Alpha
Prickly pear	0.1579
Prickly fanpetals	0.0453
Silver bladderpod	0.2296
Silverleaf nightshade	0.4804
Other	0.0863

Table 12. Manly's alpha preference index scores for plants in the summer diet of collared peccaries (*Pecari tajacu*) at Mason Mountain Wildlife Management Area, 2013 (scores>0.140 indicate selection).

Plant Species	Manly's Alpha
Prickly pear	0.1867
Plains bristlegrass	0.0440
Red lovegrass	0.2455
Buffalo gourd	0.0894
Western horsenettle	0.2338
Prickly fanpetals	0.0081
Other	0.0120

Table 13. Manly's alpha preference index scores for plants in the fall diet of collared peccaries (*Pecari tajacu*) at Mason Mountain Wildlife Management Area, 2013 (scores>0.140 indicate selection).

Plant Species	**Manly's Alpha**
Prickly pear	0.1531
Buffalo gourd	0.1822
Prickly fanpetals	0.0365
Hairy grama	0.0222
Live/blackjack/post oak	0.2605
Texas persimmon	0.3216
Other	0.0241

Table 14. Manly's alpha preference index scores for plants in the winter diet of collared peccaries (*Pecari tajacu*) at Mason Mountain Wildlife Management Area, 2013 (scores>0.170 indicate selection).

Plant Species	**Manly's Alpha**
Prickly pear	0.0452
Western horsenettle	0.2936
Prickly fanpetals	0.1839
Live/blackjack/post oak	0.0367
Silver bladderpod	0.1395
Other	0.0895

Table 15. Manly's alpha preference index scores for plants found annually in the diet of collared peccaries (*Pecari tajacu*) at Mason Mountain Wildlife Management Area, 2014 (scores>0.200 indicate selection).

Plant Species	Manly's Alpha
Prickly pear	0.2238
Live/blackjack/post oak	0.1919
Silver bladderpod	0.4661
Prickly fanpetals	0.0667
Other	0.0512

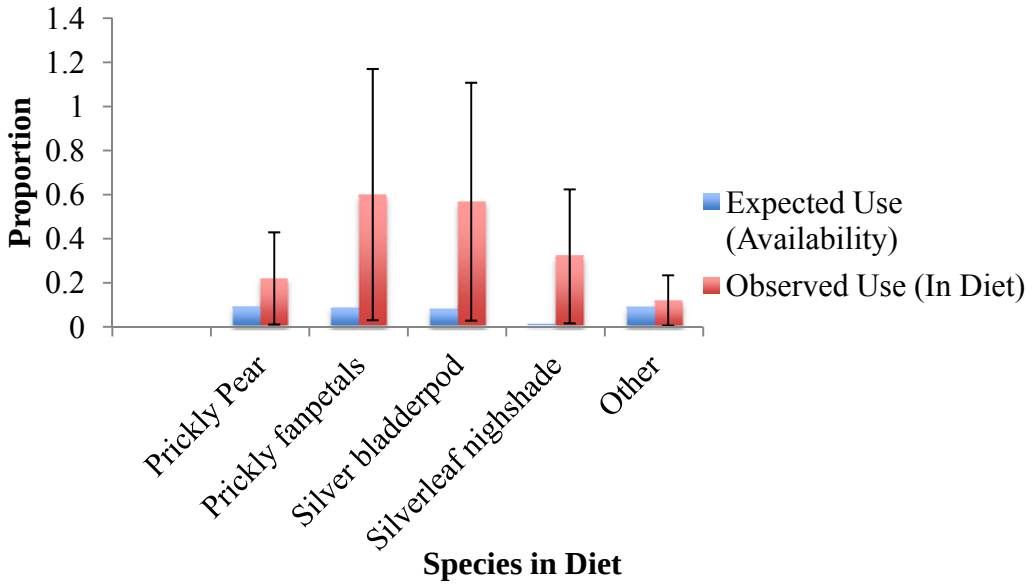

Figure 9. Comparison of use to availability of plants during spring 2014 at Mason Mountain Wildlife Management Area. Error bars represent 95% confidence intervals. Selection, avoidance, or use in proportion to availability was determined according to Neu et al. (1974).

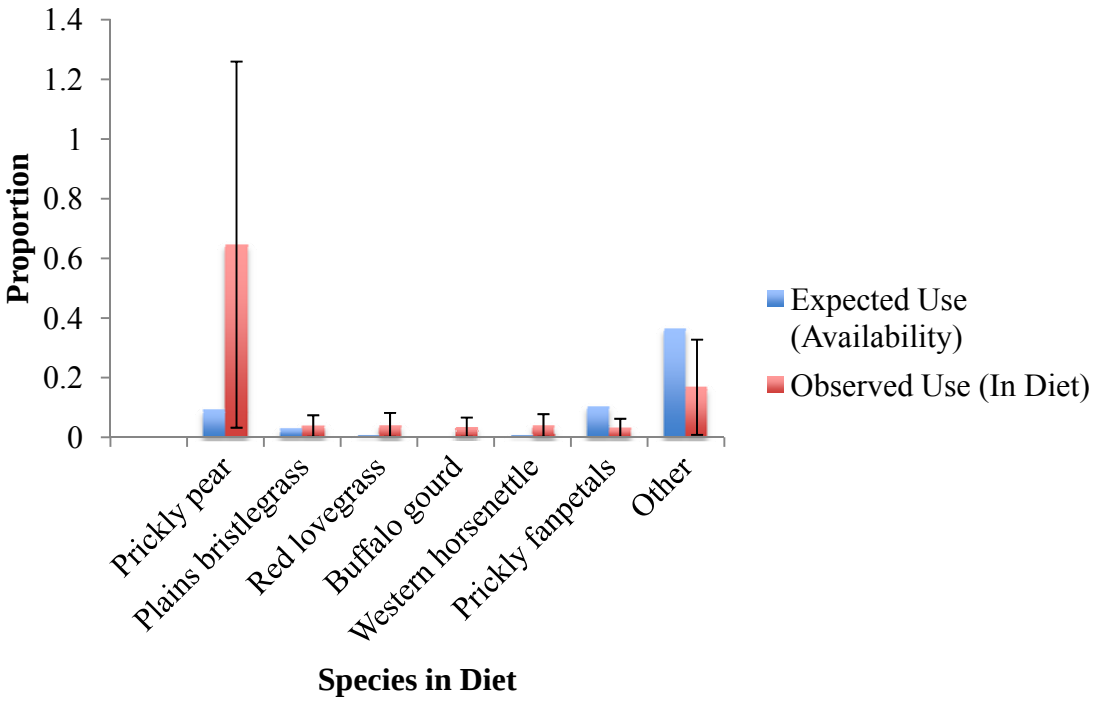

Figure 10. Comparison of use to availability of plants during summer 2013 at Mason Mountain Wildlife Management Area. Error bars represent 95% confidence intervals. Selection, avoidance, or use in proportion to availability was determined according to Neu et al. (1974).

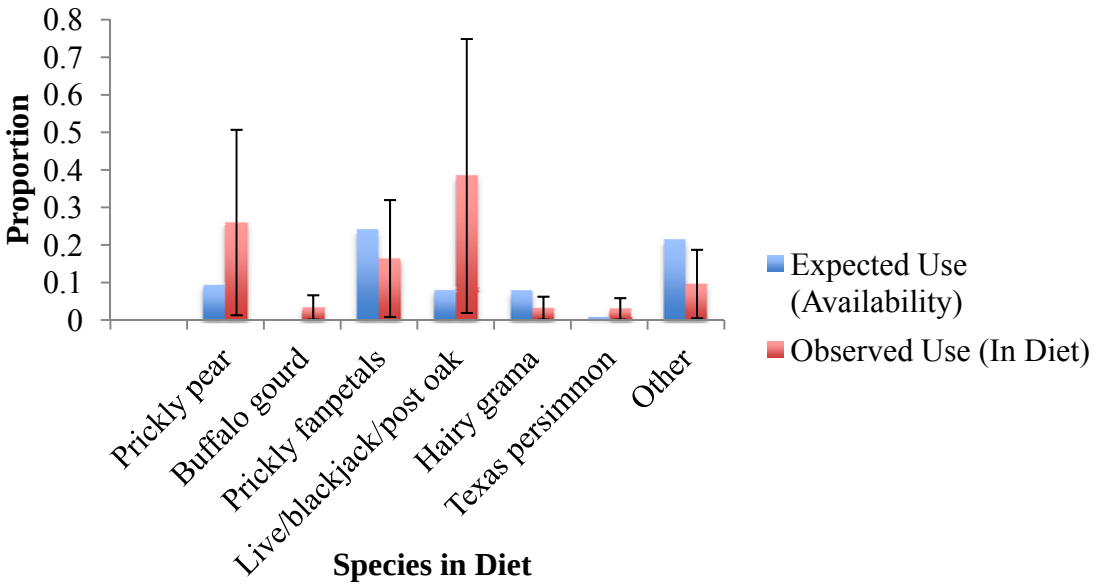

Figure 11. Comparison of use to availability of plants during fall 2013 at Mason Mountain Wildlife Management Area. Error bars represent 95% confidence intervals. Selection, avoidance, or use in proportion to availability was determined according to Neu et al. (1974).

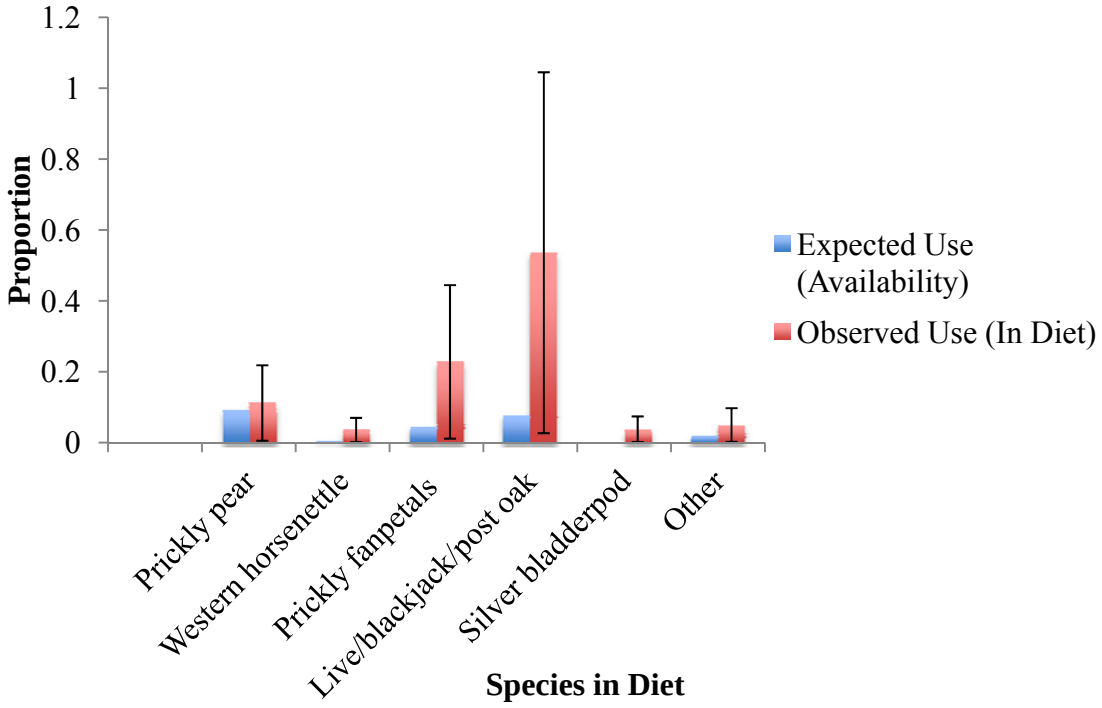

Figure 12. Comparison of use to availability of plants during winter 2013 at Mason Mountain Wildlife Management Area. Error bars represent 95% confidence intervals. Selection, avoidance, or use in proportion to availability was determined according to Neu et al. (1974).

IV. DISCUSSION

At Mason Mountain WMA, the composition of the annual diet showed that collared peccaries consumed forbs (32.75%) more than any other forage class (cactus, 27.35%); mast, 22.40%; browse 9.75%; grasses, 7.75%). Prickly pear fruit and seeds, live/blackjack/post oak leaves and acorns, silver bladderpod, prickly fanpetals, western horse nettle and buffalo gourd occurred in ≥ 20% of collared peccaries samples annually. Prickly pear cactus fruit and seeds were an important component of the diet seasonally and annually. Prickly pear was consumed by 97.5% of collared peccaries (Appendix 3) and selected for during the summer, fall and annually according to results from chi-square analysis and Manly's alpha analysis. However, the percent composition of prickly pear fruit and seeds found in epidermal fragments was 30.95%. This may be due to the surface area of prickly pear, which is small relative to its volume, and thus minimize the actual amount of prickly pear consumed. Jennings and Harris (1953) concluded that prickly pear was a "preferred" food item in South Texas. Eddy (1961) studied the collared peccary diet in Arizona and found prickly pear cactus to be the principal food item in the diet. Bissonette (1982) found prickly pear to be the dominant food item throughout the year in Big Bend National Park. Everitt et al. (1981) also reported prickly pear cactus at a major food item in South Texas rangelands. Often, prickly pear serves as an important source of water and high-energy carbohydrates (Taylor and Synatzske 2008). Prickly pear has the ability to retain high water content as dry seasons progress (Schmidt-Nielson 1964). Selection of prickly pear by collared peccaries may be related to the plant's ability to provide a valuable water source in the semi-arid climate at Mason

Mountain WMA.

Live/blackjack/post oak leaves and acorns were also an important food item in the diet of collared peccaries during fall and winter at Mason Mountain WMA. Oak leaves were consumed by 35% of collared peccaries and acorns from oak species were eaten by 48.75% of individuals (n = 80). See Appendix 3. Collared peccaries selected live/blackjack/post oak during the fall and annually according to chi-squared analysis and Manly's alpha analysis. Based on their research, Jennings and Harris (1953) considered acorns from (*Quercus* spp.) to be an important food item in the diet. Acorns are high in carbohydrates and fat and provide necessary vitamins and minerals to animals that consume them (Goodrum et al. 1971).

Forbs constituted a large portion of the collard peccaries diet seasonally and annually, this is not a commonly reported finding for collared peccaries. Prickly fanpetals were selected for during the winter and silver bladderpod was selected annually and during the spring, according to chi-squared analysis and Manly's alpha analysis. Prickly fanpetals were a common component of the diet and consumed each season, 70% of collared peccaries consumed this herbaceous species suggesting that it is a dominant food item in their diet (Appendix 3). Silver bladderpod was selected during the spring and occurred in 100% of spring fecal samples implying that it serves as a staple food item during the season. Western horse nettle was also a fairly important component of the collared peccaries diet, 26.25% of individuals (n = 80) ate it and it was selected for during summer concurring with results from Manly's alpha analysis.

Collared peccaries selected buffalo gourd during the fall according to Manly's alpha analysis and it was commonly foraged on during the spring, summer and fall growing

season. In Arizona, field observers indicated that collared peccaries are able to locate these edible gourds by smell (Eddy 1961).

During spring at Mason Mountain WMA, forbs made up 72.6% of the diet (Fig. 4). Forbs included; silver bladderpod (56.8%), prickly fanpetals (6%) and silverleaf nightshade (3.2%). Low (1970) found that forbs were preferentially consumed compared to other plants whenever they were available. Forbs provide the collared peccary with necessary nutrition based on their nutritional value (Taylor and Synatzske 2008). Based on my data, herbaceous cover was high during the spring fecal collection period at Mason Mountain WMA. Prickly pear cactus (22%) was also considered a primary food item during the spring and occurred in 100% of the samples collected (n = 20). Grasses (2.8%), mast (1.8%) and browse (0.8%) made up the remaining 5.4% of the spring diet. Results from the chi-square analysis suggest that collared peccaries selected for prickly pear and silver bladderpod. Results of the Manly's alpha analysis also suggested that silver bladderpod was selected as well as silverleaf nightshade. Unlike the chi-squared analysis, prickly pear was not considered a selected food item (Table 10).

In the summer, collared peccaries primarily fed on prickly pear cactus 64.6% of the time, possibly because succulents provide a valuable water source, which is very important during periodic drought cycles and in semi-arid regions (Taylor and Synatzske 2008). During summer 2013, Mason County experienced a drought cycle. Browse, grass, mast from prickly pear seeds and buffalo gourd were also consumed during the summer. Chi-square analysis suggested prickly pear was selected during the summer and prickly fanpetals were avoided. Results from Manly's alpha analysis indicated that prickly pear, red lovegrass and western horsenettle were selected during the season.

According to Chi-squared analysis, red lovegrass and western horsenettle were used in proportion to their availability in the habitat.

Collared peccaries utilized mast (41.4%) to the greatest extent during the fall. Acorns, prickly pear seeds and buffalo gourd were consumed in the greatest amounts. Jennings and Harris (1953) believed that acorns (from *Quercus* spp.) were important in the diet of collared peccaries at certain times. Leopold (1959) studied collared peccaries over a large part of Mexico and found that acorns (from Quercus spp.) were favorite foods in the pine-oak uplands. Browse items including live oak, blackjack oak and post oak were consumed 7.2% of the time and may have been incidentally consumed while foraging for acorns. Prickly pear cactus (23.4%) was also highly utilized in the fall.

Mast was also the dominant forage class during winter (31.2%). Acorns made up the bulk of the mast (28.4%) as well as pencil cactus seeds (2.8%). Browse (30.4%) and forbs (30.4%) contributed to a large portion of the winter diet. Cactus (prickly pear) comprised 11.2% and grasses made up a small amount (1%) of the winter diet. Chi-squared analysis suggested that prickly fanpetals and oak species were selected during the winter. Results from Manly's alpha analysis agreed that prickly fanpetals were selected as well as western horsenettle (3.6%). According to Manly's alpha analysis live/blackjack/post oak were not selected during the season.

Results of my research on collared peccary diets are similar to those of Corn and Warren (1985). They determined the seasonal diet of the collared peccary in South Texas using similar methodology such as microhistological techniques. They found that browse plants (10 species), forbs (18 species), grasses (5 species) and one species of prickly pear cactus were consumed by the collared peccary.

Fecal Analysis

Due to limiting factors such as time and cost, I decided that fecal analysis involving microhistological techniques was the best method for determining the food habits of the collared peccary at Mason Mountain WMA. Holecheck (1982) suggested that error may occur due to degradation of the fecal sample, incorrect identification of plant species, or preparation of the slide itself. I took all possible precautions to insure that samples were fresh, prepared properly and identified correctly. Genetic analysis of fecal material in the diets of wild animals (Bradley et al. 2007) would provide an alternative method to fecal analysis. Paired fecal analysis as well as DNA analysis of plant species and fecal material may give a more accurate account of species found in the collared peccary diet.

Plant Selection

When an animal is faced with a variety of possible food items, it will select some and avoid others (Krebs 1999); this notion is behind the framework of selection. In many instances, a plant made up a large percentage of the seasonal diet but was not considered a principal food item based on my post-hoc analyses. Furthermore, a plant may be plentiful in the environment, consumed by collared peccary, but not utilized in proportion to its availability in the habitat. According to Neu et al. (1974), the chi-square test does not determine selection for or avoidance of individual categories, so the data needs to be inspected to determine which observations contribute most to the calculations. I calculated Manly's alpha indices and the Bonferroni z-statistic correction for confidence intervals seasonally and annually. Overall, I considered a plant species as a selected food item when both of the methods agreed. When results from both tests differed, I

considered the plant species used in proportion to its availability in the habitat. According the chi-square analysis and Manly's alpha analysis, silver bladderpod was selected during the spring and annually. Prickly pear was selected during the summer, fall and annually. Live/blackjack/post oak species were selected during the fall and prickly fanpetals were selected during the winter.

Management Implications

Successful management of the collared peccary at Mason Mountain WMA has been demonstrated by the increase in number and expansion throughout the property following the initial release of 29 individuals in 2004 (Richter 2012). The expanding collared peccary population suggests that the area serves as a suitable habitat providing ample food and cover. When looking for locations to reintroduce the collared peccary, it would be prudent to look for sites with similar vegetation, cover and size. Cactus (prickly pear) and herbaceous species were frequently consumed by the collared peccary seasonally and annually. Persons seeking to reintroduce collared peccaries need to ensure that cacti as well as forbs are available in adequate amounts at the desired location. Future locations should be able to provide similar cover such as whitebrush and rock outcroppings, as these places were often utilized by the collared peccary at Mason Mountain WMA. Also, when evaluating a site as a potential habitat for collard peccary reintroduction, a landowner needs to consider competition with other species for food and water. My findings suggest that cactus, forbs, and mast from browse species were important components of the collared peccaries diet.

APPENDIX SECTION

Appendix 1. Percent composition identified plant species found in the diet of collared peccaries at Mason Mountain Wildlife Management Area.

	Number of Identifications					
Plant Species	**Summer**	**Fall**	**Winter**	**Spring**	**Total # of ID's**	**% Composition**
Opuntia spp.	264.00	117.00	56.00	110.00	547.00	27.35
Opuntia seeds	59.00	13.00	0.00	0.00	72.00	3.60
Setaria vulpiseta	19.00	1.00	3.00	2.00	25.00	1.25
Bouteloua curtipendula	9.00	0.00	0.00	5.00	14.00	0.70
Setaria parviflora	5.00	0.00	0.00	0.00	5.00	0.25
Cucurbita foetidissima	17.00	17.00	0.00	9.00	43.00	2.15
Eragrosis secundiflora	21.00	10.00	1.00	0.00	32.00	1.60
Mimosa biuncifera	7.00	3.00	4.00	4.00	18.00	0.90
Solanum dimidiatum	20.00	4.00	18.00	3.00	45.00	2.25
Aloysia gratissima	2.00	0.00	0.00	0.00	2.00	0.10
Prosopis glandulosa	6.00	0.00	0.00	0.00	6.00	0.30
Paspalum spp.	13.00	10.00	1.00	0.00	24.00	1.20
Sporobolus heterolepis	12.00	4.00	0.00	0.00	16.00	0.80
Zanthoxylum americanum	4.00	0.00	1.00	0.00	5.00	0.25
Sida spinosa	16.00	82.00	114.00	30.00	242.00	12.10
Schizachyrium scoparium	1.00	0.00	0.00	0.00	1.00	0.05
Digitaria sanguinalis	2.00	0.00	0.00	0.00	2.00	0.10
Dichanthelium oligosanthes	2.00	5.00	0.00	0.00	7.00	0.35
Chloris spp.	1.00	0.00	0.00	0.00	1.00	0.05
Tradescantia virginiana	4.00	2.00	0.00	0.00	6.00	0.30
Carex spp.	1.00	0.00	0.00	0.00	1.00	0.05
Froelichia gracilis	7.00	0.00	0.00	0.00	7.00	0.35
Diospyros texana	4.00	15.00	0.00	0.00	19.00	0.95
Phemeranthus aurantiacus	1.00	0.00	1.00	0.00	2.00	0.10
Quercus spp.	1.00	18.00	126.00	0.00	145.00	7.25
Tridens albescens	2.00	0.00	0.00	0.00	2.00	0.10
Quercus acorns	0.00	174.00	142.00	0.00	316.00	15.80
Lesquerella argyraea	0.00	3.00	19.00	284.00	306.00	15.30
Bouteloua hirsuta	0.00	16.00	0.00	0.00	16.00	0.80
Ibervillea lindheimeri	0.00	3.00	0.00	0.00	3.00	0.15
Echinochloa colona	0.00	3.00	0.00	0.00	3.00	0.15
Cylindropuntia leptocaulis	0.00	0.00	14.00	0.00	14.00	0.70
Oenothera biennis	0.00	0.00	0.00	8.00	8.00	0.40
Lepidium virginicum	0.00	0.00	0.00	7.00	7.00	0.35
Sisyrinchium bellum	0.00	0.00	0.00	2.00	2.00	0.10
Phalaris canariensis	0.00	0.00	0.00	7.00	7.00	0.35
Mimulus guttatus	0.00	0.00	0.00	13.00	13.00	0.65
Solanum elaeagnifolium	0.00	0.00	0.00	16.00	16.00	0.80

Appendix 2. List of scientific names and common names of food plants, found in the diet of collared peccaries.

Scientific Name	Common Name
Aloysia gratissima	Whitebrush
Bouteloua curtipendula	Sideoats grama
Bouteloua hirsuta	Hairy grama
Carex spp.	Carex spp.
Chloris spp.	Windmill grass
Cucurbita foetidissima	Buffalo gourd
Cylindropuntia leptocaulis	Christmas cactus
Dichanthelium oligosanthes	Scribners
Digitaria sanguinalis	Hairy crabgrass
Diospyros texana	Texas persimmon
Echinochloa colona	Jungle rice
Eragrosis secundiflora	Red lovegrass
Froelichia gracilis	Snake cotton
Ibervillea lindheimeri	Globeberry
Lepidium virginicum	Pepper grass
Lesquerella argyraea	Silver bladderpod
Mimosa biuncifera	Catclaw acacia
Mimulus guttatus	Monkey flower
Oenothera biennis	Primrose
Opuntia spp.	Prickly pear
Paspalum spp.	Paspalum
Phalaris canariensis	Canary grass
Phemeranthus aurantiacus	Flame flower
Prosopis glandulosa	Mesquite
Quercus spp.	Live/blackjack/post oak
Schizachyrium scoparium	Little bluestem
Setaria parviflora	Knotroot bristlegrass
Setaria vulpiseta	Plains bristlegrass
Sida spinosa	Prickly fanpetals
Sisyrinchium bellum	Blue eyed grass
Solanum dimidatum	Western horsenettle
Solanum elaeagnifolium	Silverleaf nightshade
Sporobolus heterolepis	Dropseed sporobolus
Tradescantia virginiana	Spiderwort
Tridens albescens	White tridens
Zanthoxylum americanum	Prickly ash

Appendix 3. Occurrence and percent occurrence of plant species found in the collared peccary diet seasonally and annually at Mason Mountain WMA 2013-2014.

	Annual Diet		Spring Diet		Summer Diet		Fall Diet		Winter Diet	
Plant Species	**Occurrence**	**% Occurrence**	**Occurrence**	**% Occurrence**	**Occurrence**	**% Occurrence**	**Occurrence**	**% Occurrence**	**Occurrence**	**% Occurrence**
Browse										
Quercus spp.	28.00	35.00	0.00	0.00	1.00	5.00	7.00	35.00	20.00	100.00
Diospyros texana	6.00	7.50	0.00	0.00	2.00	10.00	4.00	20.00	0.00	0.00
Mimosa biuncifera	10.00	12.50	1.00	5.00	3.00	15.00	3.00	15.00	3.00	15.00
Prosopis glandulosa	4.00	5.00	0.00	0.00	3.00	15.00	0.00	0.00	0.00	0.00
Zanthoxylum americanum	4.00	5.00	0.00	0.00	3.00	15.00	0.00	0.00	1.00	5.00
Whitebrush	1.00	1.25	0.00	0.00	1.00	5.00	0.00	0.00	0.00	0.00
Grasses										
Eragrosis secundiflora	13.00	16.25	0.00	0.00	8.00	40.00	4.00	20.00	1.00	5.00
Setaria vulpiseta	11.00	13.75	1.00	5.00	7.00	35.00	1.00	5.00	2.00	10.00
Bouteloua hirsuta	8.00	10.00	0.00	0.00	0.00	0.00	8.00	40.00	0.00	0.00
Bouteloua curtipendula	9.00	11.25	3.00	15.00	6.00	30.00	0.00	0.00	0.00	0.00
Setaria parviflora	2.00	2.50	0.00	0.00	2.00	10.00	0.00	0.00	0.00	0.00
Paspalum spp.	11.00	13.75	0.00	0.00	6.00	30.00	4.00	20.00	1.00	5.00
Sporobolus heterolepis	6.00	7.50	0.00	0.00	4.00	20.00	2.00	10.00	0.00	0.00
Schizachyrium scoparium	1.00	1.25	0.00	0.00	1.00	5.00	0.00	0.00	0.00	0.00
Digitaria sanguinalis	2.00	2.50	0.00	0.00	2.00	10.00	0.00	0.00	0.00	0.00
Dichanthelium oligosanthes	4.00	5.00	0.00	0.00	1.00	5.00	3.00	15.00	0.00	0.00
Tridens albescens	1.00	1.25	0.00	0.00	1.00	5.00	0.00	0.00	0.00	0.00
Echinochloa colona	1.00	1.25	0.00	0.00	0.00	0.00	1.00	5.00	0.00	0.00
Phalaris canariensis	4.00	5.00	4.00	20.00	0.00	0.00	0.00	0.00	0.00	0.00
Chloris spp.	1.00	1.25	0.00	0.00	1.00	5.00	0.00	0.00	0.00	0.00
Forbs										
Lesquerella argyraea	30.00	37.50	20.00	100.00	0.00	0.00	2.00	10.00	8.00	40.00
Sida spinosa	56.00	70.00	12.00	60.00	8.00	40.00	17.00	85.00	19.00	95.00
Solanum dimidiatum	21.00	26.25	2.00	10.00	7.00	35.00	2.00	10.00	10.00	50.00
Solanum elaeagnifolium	6.00	7.50	6.00	30.00	0.00	0.00	0.00	0.00	0.00	0.00
Trandescantia virginiana	5.00	6.25	0.00	0.00	3.00	15.00	2.00	10.00	0.00	0.00
Carex spp.	1.00	1.25	0.00	0.00	1.00	5.00	0.00	0.00	0.00	0.00
Lepidium virginicum	2.00	2.50	0.00	0.00	1.00	5.00	0.00	0.00	1.00	5.00
Sisyrinchium bellum	1.00	1.25	1.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
Oenothera biennis	4.00	5.00	4.00	20.00	0.00	0.00	0.00	0.00	0.00	0.00
Froelichia gracilis	1.00	1.25	1.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
Phemeranthus aurantiacus	1.00	1.25	0.00	0.00	0.00	0.00	0.00	0.00	1.00	5.00
Mast										
Quercus spp.	39.00	48.75	0.00	0.00	0.00	0.00	19.00	95.00	20.00	100.00
Opuntia spp.	25.00	31.25	0.00	0.00	16.00	80.00	9.00	45.00	0.00	0.00
Cucurbita foetidissima	18.00	22.50	4.00	20.00	7.00	35.00	7.00	35.00	0.00	0.00
Ibervillea lindheimeri	1.00	1.25	0.00	0.00	0.00	0.00	1.00	5.00	0.00	0.00
Cylindropuntia leptocaulis	10.00	12.50	0.00	0.00	0.00	0.00	0.00	0.00	10.00	50.00
Cactus										
Opuntia spp.	78.00	97.50	20.00	100.00	20.00	100.00	19.00	95.00	19.00	95.00

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