The Vascular Flora

of the Eagletail Mountain Region

by

Douglas R. Newton

A Thesis Presented in Partial Fulfillment
of the Requirement for the Degree
Master of Science

Approved April 2012 by the
Graduate Supervisory Committee:

Leslie Landrum, Co-Chair
John Alcock, Co-Chair
Elizabeth Makings

ARIZONA STATE UNIVERSITY

August 2012

ABSTRACT

This study identifies the flora of the Eagletail Mountain Region, an area covering approximately 100,600 acres, located in west-central Arizona that includes the Eagletail Mountains, Granite Mountains, portions of the Harquahala Valley, and Cemetery Ridge near Clanton Well. The region is located about 129 km (80 mi) west of Phoenix and 24 km (15 mi) south of Interstate 10. Plants were collected over a six-year period, beginning September, 2004 and ending May, 2010, including two wet winters and two wet summers. A total of 702 collections were made covering 292 species that represented 63 families.

Additional information on the region included in the thesis are: 1) an analysis of the climate, based on 20 years of rainfall records; 2) a description of the geology and its influence on plant distribution; 3) a prehistory and history identifying archeological sites; 4) an analysis of food plants used by the Native Americans that suggests how they were able to live in the region; 5) a paleo-botanical history based on an evaluation of pack-rat midden collections from mountain ranges around the region; 6) a comparison of the trees, shrubs, and perennials of the Eagletail Mountain Region with those of the Sierra Estrella and Kofa Mountains; and 7) a survey of non-native species. The habitats that the plants occupied based on climate and soils included were: 1) the bottoms and sides of sandy/ gravelly washes, 2) bajada slopes-volcanic soils, 3) bajada slopes-granitic sandy soils, 4) slot canyons/rock outcrops, 5) desert pavement, and 6) open valleys. Each habitat has its own characteristic species composition and distribution.

ACKNOWLEDGEMENTS

I have been visiting the Eagletail Mountain region for the last 22 years and wish to thank ASU and my committee members; Dr. Leslie Landrum, Dr. John Alcock and Elizabeth Makings; for the opportunity to share my observations about this wonderful place. Their help in collecting and identifying the plants found on our field trips was much appreciated. I also want to thank the graduate office, especially Wendi Simonson, for providing help and advice.

I wish to thank my wife Jane, parents, family, and friends for their encouragement and help and for allowing me the freedom to visit this place repeatedly over the years.

To the many friends who accompanied me on my field trips to collect and take photographs, I appreciate your friendship. I would especially like to thank John Unruh, John Anderson, Karen Reichhardt, John Mainieri, Bob Harvey, Dwight Newton, and others who made the trips more interesting and enjoyable. I also appreciate the help provided by Elizabeth Makings and Dawn Schroeder in technical support.

The Bureau of Land Management and staff were very helpful in providing permits, financial support, field work, and plant identification. I wish to thank various authors of floristic studies and others that I referred to, including Tom Van Devender, Richard Felger, David Brown, Joe McAuliffe, Mary Butterwick, Wendy Hodgson, Boma Johnson, Dr. Don Pinkava and Connie Stone.

TABLE OF CONTENTS

Page

LIST OF TABLES v

LIST OF FIGURES vi

VASCULAR FLORA OF EAGLETAIL MOUNTAIN REGION 1

Introduction 1

Biogeography of region 2

Biotic communities 4

Paleobotany of region 8

Habitats of the region 14

Non-native species in the region 26

Riparian species in the region 28

Comparison of flora 29

CLIMATE OF EAGLETAIL MOUNTAIN REGION 38

GEOLOGY OF EAGLETAIL MOUNTAIN REGION 46

PREHISTORY AND HISTORY OF EAGLETAIL MOUNTAINS 50

Introduction to the prehistory of the region 50

Archeological findings of the region 51

Living off the land 57

Sources of water 58

Use of plants 59

Use of animals 71

Agriculture in the region 73

Conclusion 73

Historic use of this region by non-native people 75

Page

REFERENCES 77

APPENDICES

A. . EAGLETAIL MOUNTAIN FLORA 81

B. EAGLETAIL MOUNTAIN RAINFALL 128

LIST OF TABLES

Table Page

1. Species Occurring in the Eagletail Mountain Region but not in the Sierra Estrella Mountains 29
2. Species Occurring in the Sierra Estrella Mountains but not in the Eagletail Mountain Region 30
3. Species Occurring in the Eagletail Mountain Region but not in the Kofa Mountains 31
4. Species Occurring in the Kofa Mountains but not the Eagletail Mountain Region 32
5. Climatic Data for Selected Stations in Southwestern Arizona 39
6. Plants of Eagletail Mountain Region Used by Native Americans 60
7. Plant Parts Used as Food 66
8. Description of Plants Used as Food 67
9. *Salix gooddingii* Localities in Southwestern Arizona 71

LIST OF FIGURES

Figure		Page
1.	Google Earth image of the Eagletail Mountain Region	1
2.	Locations of specific sites within Eagletail Mountain Region	2
3.	Arizona upland and lower Colorado Desert subdivisions of Sonoran Desert	4
4.	Bottom of sandy wash	15
5.	Side of wash	16
6.	Bajada slopes-volcanic soils-lower slopes	18
7.	Bajada slopes-volcanic soils-upper elevations	19
8.	Bajada slopes – granitic sandy soils	20
9.	Slot canyon/rock outcrop	22
10.	Desert pavement	24
11.	Open valley, Harquahala Valley	25
12.	Range of *Celtis pallida*	34
13.	Range of *Tetracoccus hallii*	35

THE VASCULAR FLORA OF THE EAGLETAIL MOUNTAIN REGION

Introduction. This study is an inventory of all the plant species growing wild in an area that includes the Eagletail Mountain Wilderness and adjacent public lands managed by the Bureau of Land Management (BLM), (Figure 1).

Figure 1**.** Google Earth Image of the Eagletail Mountain Region.

The study area covers approximately 407 square km (100,600 acres) with elevations ranging from 347 m (1,138 ft) to 1,005 m (3,330 ft). It includes portions of the Harquahala Valley to the north and east of the Eagletail Mountain range, the Granite Mountains on the northeast side of the range, Cemetery Ridge to the south and southwest of the range, and the Eagletail Mountains, (Figure 2).

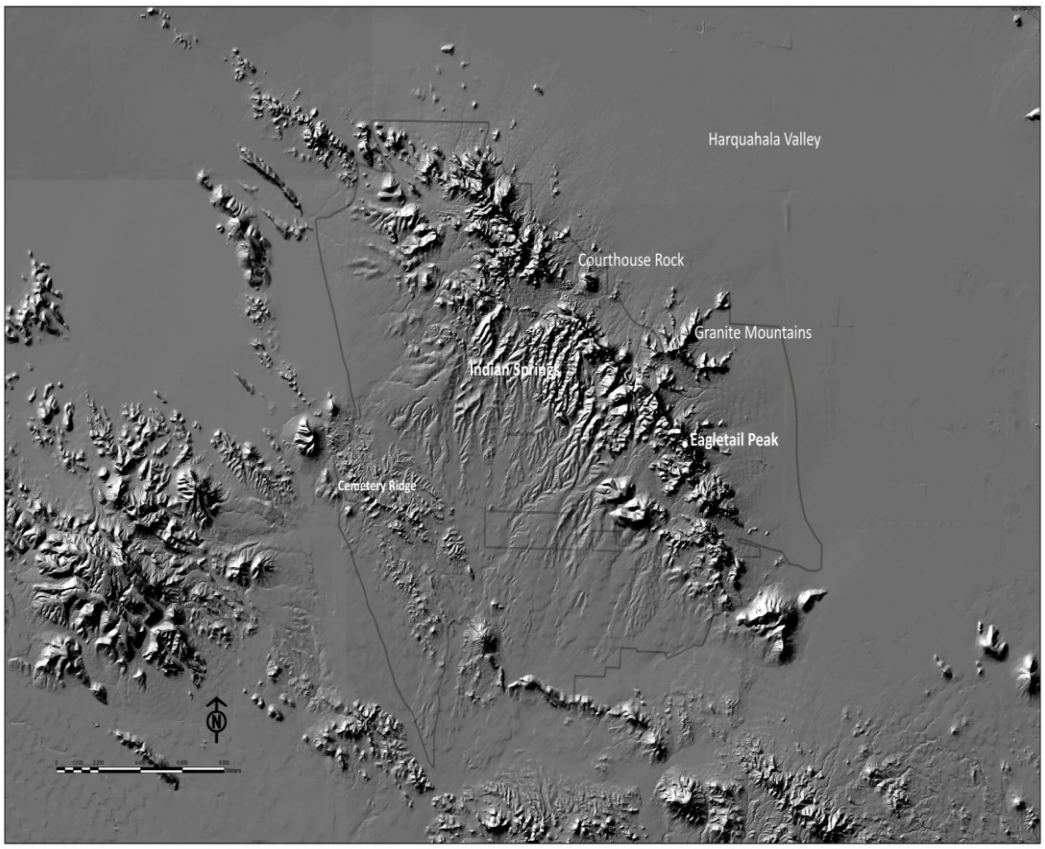

Figure 2**.** Locations of specific sites within Eagletail Mountain Region.

This mountain range is located in west central Arizona approximately 129 km (80 mi) west of Phoenix and 24 km (15 mi) south of Interstate 10. The western half of the range is in La Paz County and the eastern half is in Maricopa County. The area on the north side of the range drains into Centennial Wash which runs into the Gila River near Gillespie Dam and the area on the south side of the range drains into Clanton Wash which runs into the Gila River near Agua Caliente.

Biogeography of region. Floristic elements are defined as groups of taxa with broadly overlapping geographic ranges that are determined by analyzing local floras to see how they share species, genera, and families

(McLaughlin 2007). In Arizona, these floristic elements include the Colorado Plateau, Great Basin, Rocky Mountains, Mohavean, Sonoran, Apachian, Sierra Madre Occidental, and Chihuahuan. Each of these elements represents a broadly overlapping group of species whose center of distribution is distinctive, as determined by analyzing and comparing local floras of various areas.

The Eagletail Mountain Region contains attributes of three of these elements: Mohavean, Sonoran, and Chihuahuan. As an example, the shrub *Celtis pallida* is subtropical in nature and common in the Sonoran Desert in locations south and east of the region that receive dependable monsoonal rainfall. In the Eagletails, it is found only in the far eastern part of the range at locations east of Eagletail Peak where it represents a species of the Sonoran element. Another example is the cactus, *Opuntia basilaris*, which is common in the Mohave Desert and depends on winter rainfall as its source of moisture. In the Eagletail Mountains it is found only in the western third of the range and represents a Mohavean element species. There is also evidence of some minor influence from the Chihuahuan element in southwestern Arizona (McLaughlin 2007). An example of this element, found in the Eagletail Mountain Region, is *Acacia constricta*.

The dominant floristic element in southwestern Arizona is the Mohavean which is mainly composed of species that bloom in the spring as a result of winter precipitation. The Sonoran element also influences the region and is made up of species that mainly bloom in the summer and fall as a result of precipitation that comes with the summer monsoon season. The majority of species in this floristic element are sub-shrubs, herbaceous perennials, and winter annuals. The genera *Camissonia, Gilia,* and *Opuntia* reach their maximum richness here, and

Atriplex, Cryptantha, Mentzelia, and *Phacelia* also have a high degree of species richness (McLaughlin 2008).

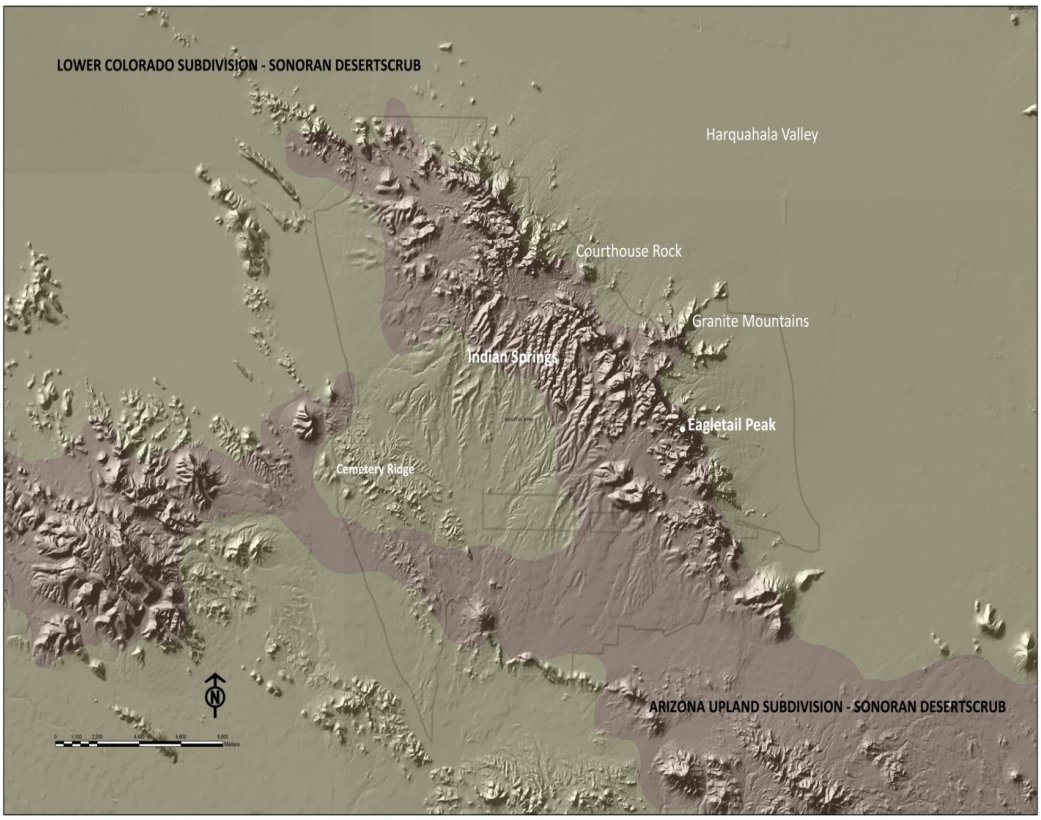

Figure 3**.** Arizona Upland and Lower Colorado Desert subdivisions of Sonoran Desert (Brown 1994).

Biotic communities. Within the biotic communities of the southwestern United States the Eagletail Mountain Region lies in the Sonoran Desertscrub division. Within that division, parts of the region are included in the Lower Colorado River Valley subdivision, which includes the Harquahala Valley to the north and east of the Eagletail Mountains range and the open valley immediately to the south of the range (Figure 3). The Eagletail Mountains, Granite Mountains,

and Cemetery Ridge are included in the Arizona Upland subdivision (Brown 1994).

The Lower Colorado River Valley subdivision is the driest subdivision in the Sonoran Desert due to a combination of high temperatures and low precipitation. This subdivision includes mainly the large open valleys and lower elevation bajada slopes of southwestern Arizona. The majority of vegetation grows along the washes that intersect the valleys. The difference between this subdivision and the Mohave Desertscrub division to its north is that winter temperatures in the Mohave Desertscrub division average 4 degrees C colder than in the Sonoran Desert. The difference between the Lower Colorado River Valley subdivision and the Arizona Upland subdivision is that the Arizona Upland has higher summer rainfall and lower winter temperatures.

Species common to the Lower Colorado River Valley subdivision that occur in washes include *Chilopsis linearis, Olneya tesota, Parkinsonia florida, Prosopis velutina,* and *Psorothamnus spinosus* (Brown 1994). In the Eagletail Mountain Region all these species are common except that *C. linearis and P. spinosus* are found only in washes at lower elevations near Cemetery Ridge on the southern edge of the region. They do not occur in the Eagletail Mountains.

Shreve (1951) reports that in the Lower Colorado River Valley subdivision, *Larrea* and *Ambrosia* represent 90 – 100% of all vegetation found in open areas with trees such as *Olneya tesota, Parkinsonia florida*, and *Prosopis* spp. growing along washes. Moreover, Shreve noted that that *Ambrosia dumosa* is dominant at lower levels on the bajada slopes and valleys but is replaced by *Ambrosia deltoidea* on higher bajada slopes.

The Arizona Upland subdivision usually occurs on higher elevation slopes, broken ground, and multidissected sloping plains. The vegetation consists of scrubland or low woodland leguminous trees with layers of shrubs and perennial succulents in contrast to the Lower Colorado River Valley subdivision in which the woodland species are found only along the drainages. The woodland species are the same as those found in the Lower Colorado River Valley subdivision and include *Acacia greggii, Carnegiea gigantea, Olneya tesota, Parkinsonia florida, Parkinsonia microphylla,* and *Prosopis* spp. In southwestern Arizona this subdivision covers the higher elevations whereas in the valleys the Lower Colorado River Valley subdivision predominates (Brown 1994).

In the Arizona Upland subdivision, the *Larrea/Ambrosia* plant series is common along the margins of the valleys as they make contact with the bajada slopes. As elevation increases, *Ambrosia dumosa* is replaced by *Ambrosia deltoidea* (Brown 1994*)*. In the Eagletail Mountain Region the opposite occurs in that the valleys have a mix of *A. dumosa* and *A. deltoidea* and the higher bajada elevations have only *A. dumosa*.

The Interior Chaparral division within the biotic communities in Arizona is normally found between 1,050m (3,445 ft) and 2,000 m (6,562 ft), runs below the Mogollon Rim, and receives rainfall averaging 350 mm (13.8 in). The dominant plants in this area have small evergreen sclerophyllous leaves with a deep tap root and they sprout from a root crown, so can be quite old. Common species in the more xeric parts of this division include *Acacia greggii, Bouteloua curtipendula, Canotia holacantha, Quercus turbinella, Simmondsia chinensis,*

and *Eriogonum wrightii* among others (Brown 1994). These species are also found in the Eagletail Mountains.

Brown (1978) studied the occurrence of interior chaparral and woodland flora found in mountains in the Sonoran Desert in Arizona. He looked at only those mountain ranges with an elevation of at least 1,300 m (4,265 ft) and found that 17 of 22 of these ranges included in their flora some typical species found in the Interior Chaparral division such as species of *Berberis, Ceanothus, Cercocarpus, Juniperus, Quercus, Rhus*, and *Vauquelinia*. He considered these plant groups to possibly represent relictual populations of Interior Chaparral. Van Devender and colleagues (Van Devender et al. 1987) also considered *Quercus turbinella* to be relictual in southwestern Arizona ranges as this oak is capable of regeneration by basal sprouting. Moreover, these plants can persist as clones for thousands of years (Neilson & Wullstein 1983). In the Eagletail Mountains, *Q. turbinella* was collected in nine locations and seen in other locations, but only once was this species seen with acorns, so it is most likely maintaining its population by cloning from the root crown.

Brown (1978) did not include the Eagletail Mountains in the ranges he evaluated as its highest elevation is only 1,005 m (3,300 ft), but he did mention them in his report. The flora of the Eagletail Mountains includes several possible relictual species: *Berberis haematocarpa, Bouteloua curtipendula, Canotia holacantha, Eriogonum wrightii, Juniperus coahuilensis, Quercus turbinella, Rhus aromatica,* and *Simmondsia chinensis*. These species are found in slot canyons, rock outcrops, and upper bajada slopes on the north-facing side of the Eagletail Mountains at elevations from 609 m – 702 m (1,998 ft – 2,303 ft). These plants are found at higher elevations between 1,050 m – 1,850 m (3,445 ft – 6,070 ft) in

the taller mountain ranges in the Sonoran Desert and in their typical Interior Chaparral habitat. With the exception of *Q. turbinella* and *S. chinensis,* the other relictual species found in the Eagletail Mountains are rare; only a few individuals are present in a small number of locations. *Simmondsia chinensis* is also relatively common, found in more than one habitat and at lower elevations than the other species.

Paleobotany of region. A paleobotanical history of the southwestern United States was conducted by collecting and analyzing the content of packrat middens at various locations (Betancourt et al. 1990). While packrat middens were not collected in the Eagletail Mountain Region, some locations in the surrounding area were explored including the Kofa Mountains and New Water Mountains to the west and Eagle Eye Mountain to the northeast of the Eagletail Mountains. Findings and conclusions that resulted from an analysis of these collections would probably apply to the Eagletail Mountain Region as well.

During the late Wisconsin (22,000 – 11,000 years before present, YBP) lands now characterized as the Sonoran Desert in southwestern Arizona were covered by a Pinyon – Juniper woodland at elevations as low as 550 m (1,804 ft). Other plants such as *Artemisia tridentata, Atriplex confertiflora, Larrea tridentata,* and *Yucca brevifolia* were also present.

During the early Holocene (11,000 – 8,000 YBP) the Pinyon – Juniper woodland was replaced by a Juniper – Oak woodland. This woodland was found at elevations down to 600 m (2,000 ft). Also during this period, the *Ambrosia dumosa/ Larrea* sp. plant community became established below 300 m (900 ft) around the mouth of the Colorado River. Species collected during this time period from the New Water Mountains, which are west of the Eagletail Mountain

Region, include *Acacia greggii, Ferocactus acanthoides, Larrea tridentata,* and *Quercus turbinella* (Van Devender & Spaulding 1979). *Yucca whipplei* and *Nolina bigelovii* were also present as low as 305 m (1,000 ft) (Van Devender et al. 1987).

In the middle to late Holocene (8,000 YBP – present) the woodlands were rapidly replaced with modern desert vegetation. The species *Acacia greggii, Parkinsonia florida,* and *Prosopis velutina* had been growing on south-facing rocky bajada slopes prior to this time but then retreated to become riparian species that grew only along the washes (Van Devender et al. 1987). *Fouquieria splendens* invaded the southwest and *Carnegiea gigantea, Olneya tesota*, and *Parkinsonia microphylla also* moved north from the Mexican lowlands (Van Devender et al. 1979).

The climate of southwestern Arizona has changed over the last 22,000 years, becoming hotter and drier. During the late Wisconsin the climate was one of significant summer cooling and winter precipitation with mild winter temperatures. There may have been some sign of moderate summer rainfall in the eastern half of Arizona. Overall, precipitation during this period was greater than it is today. During the early Holocene winter precipitation continued to be greater than today, but summer temperatures were beginning to increase and the summer monsoon was strengthening but not as strong as it is presently. The middle Holocene resulted in a climate essentially like that of today with the summer monsoon stronger than it is now. In contrast, winter freezes were more frequent and severe in southern Arizona than they are today. In the late Holocene, which began 4,000 YBP, the modern climate was in effect with a

reduction in freezing winter temperatures. The deserts of North America expanded to their greatest size during this time (Van Devender et al. 1979).

Eagle Eye Mountain, one of the locations in which packrat middens were collected and studied, is on the east side of the Harquahala Mountains and is 60 km (36 mi) northeast of the Eagletail Mountains. Like the Eagletail Mountains it is located in the Arizona Upland subdivision of the Sonoran Desertscrub division. Its highest point is 850 m (2,788 ft) and average annual rainfall is 200 mm (7.9in) which is slightly more than the Eagletails at 179mm (7 in).

Eleven packrat middens were collected at Eagle Eye Mountain covering 22,000 years of botanical history (McAuliffe &Van Devender 1998). The elevations at which these middens were collected ranged between 800-825 m (2,600 – 2,700 ft). A summary of the species collected from five of these middens follows. Those species with an asterisk (*) have been collected in the Eagletail Mountain Region and grow there presently.

Wisconsin-22,000 YBP:

*Allionia incarnata**
Artemisia tridentata
Ephedra nevadensis
Ericameria cuneata
Ericameria laricifolia
*Juniperus osteosperma**
*Keckiella antirrhinoides**
*Quercus turbinella**
Sphaeralcea spp.*
*Thysanocarpus curvipes**
Yucca baccata

Early Holocene-10,400 YBP:

*Acacia greggii**
Agave deserti
*Anemone tuberosa**
Ericameria laricifolia
Euphorbia revolta
*Ferocactus cylindraceus**

Artemisia ludoviciana
*Boerhavia. wrightii**
*Boerhavia erecta**
Bouteloua repens
*Carnegiea gigantea**
Cirsium sp.
*Crossosoma bigelovii**
*Cryptantha barbigera**
*Daucus pusillus**
Ditaxis sp.*
Ephedra nevadensis
*Juniperus osteosperma**
*Keckiella antirrhinoides**
Lotus sp.*
Lupinus sp.*
*Opuntia chlorotica**
*Parietaria hespera**
*Quercus turbinella**
*Rhus aromatica**
*Sphaeralcea** sp.
*Thysanocarpus curvipes**
Yucca baccata

Middle Holocene-6,400 YBP:

*Acacia greggii**
*Allionia incarnata**
*Boerhavia wrightii**
Brickellia atractyloides
*Cylindropuntia acanthocarpa**
*Cylindropuntia bigelovii**
*Encelia farinosa**
Ephedra nevadensis
Eriochloa acuminata
*Eriogonum fasciculatum**
*Erioneuron pulchellum**
*Ferocactus cylindraceus**
*Gallium stellatum**
*Hyptis emoryi**
*Janusia gracilis**
Kallstroemia sp.*
*Larrea tridentata**
Lotus sp.*
Lupinus sp.*
*Parkinsonia florida**
*Phoradendron californicum**
Physalis sp.*
Setaria leucopila
Sphaeralcea sp.*
*Trixis californica**
*Viguiera deltoidea**

Middle Holocene-4,500 YBP:

*Acacia greggii**
*Allionia incarnata**
*Boerhavia wrightii**
*Larrea tridentata**
Lotus sp.*
Lupinus sp.*

*Boerhavia erecta**
*Carnegiea gigantea**
*Caulanthus lasiophyllus**
*Cylindropuntia acanthocarpa**
*Dalea mollis**
*Draba cuneifolia**
*Encelia farinosa**
Ephedra nevadensis
Eriochloa acuminata
*Ferocactus cylindraceus**
*Gallium stellatum**
*Hyptis emoryi**
*Janusia gracilis**
Kallstroemia sp.*
*Machaeranthera pinnatifida**
*Mammillaria grahamii**
*Parietaria hespera**
*Parkinsonia florida**
*Parkinsonia microphylla**
*Phoradendron californicum**
Physalis sp.*
*Prosopis velutina**
*Senna covesii**
Setaria leucopila
*Silene antirrhina**
Sphaeralcea sp.*
*Trixis californica**
*Viguiera deltoidea**

Late Holocene-1,900 YBP:

*Acacia greggii**
*Boerhavia wrightii**
*Carnegiea gigantea**
*Chaenactis stevioides**
*Cryptantha maritima**
*Dalea mollis**
*Daucus pusillus**
*Draba cuneifolia**
*Encelia farinosa**
Ephedra nevadensis
*Erioneuron pulchellum**
*Gallium stellatum**
*Hyptis emoryi**
*Larrea tridentata**
Lepidium sp.*
Lotus sp.*
*Machaeranthera pinnatifida**
*Mammillaria grahamii**
*Muhlenbergia microsperma**
*Parkinsonia microphylla**
*Pectocarya recurvata**
*Phacelia crenulata**
*Phoradendron californicum**
Physalis sp.*
*Plantago fastigiata**
Sphaeralcea sp.*
*Tridens muticus**
*Trixis californica**
*Viguiera deltoidea**

In summary, a total of ninety-five species were identified from the middens, and eighty-one of those species, 85% of the total, have been collected in the Eagletail Mountain Region. A significant number of the species that have been found over the last 22,000 years continue to grow in the region.

Six of the species identified in the Wisconsin are found in the Eagletail Mountain Region today. but there are some major exceptions,*Artemisia tridentata* (big sage brush), and *Yucca baccata*. The species *A. tridentata* is currently found in the vicinity of Flagstaff and *Yucca baccata* is found at higher elevations north and east of Eagle Eye Mountain along the Mogollon Rim and in the Sedona area.

Beginning in the early Holocene, *Acacia greggii* occurred on Eagle Eye Mountain but its habitat was on south-facing bajada slopes and not in the washes as presently found in the Eagletail Mountain Region. Also, *Agave deserti* was found on Eagle Eye Mountain but disappeared in subsequent periods.

In the middle Holocene, *Acacia greggii* accompanied by *Parkinsonia florida* were the principal large trees on bajada slopes and hillsides (McAuliffe et al. 1998). Presently, they have retreated to large washes at lower elevations. In the Eagletail Mountains *A. greggii* is currently found in two habitats, the edge of large washes at lower elevations, as expected, and north-facing bajada slopes around the 610 m (2,001 ft) level whereas *P. florida* is only found along major washes. The species *Setaria leucopila* (streambed bristlegrass) was also found on Eagle Eye Mountain during the middle Holocene. This species no longer occurs there, which may indicate that the summer monsoon was stronger during the middle Holocene than it is today as this species is presently found in southeastern Arizona, which has a strong summer monsoon (McAuliffe et al. 1998). In the Eagletail Mountains this species is not found; however, in two

locations, deep canyons with extra runoff, *Bouteloua curtipendula* grows. This species is also normally found in areas that receive more monsoon rain than what occurs in the Eagletail Mountain Region presently. At the end of the middle Holocene, *Parkinsonia microphylla* shows up in the region. This contrasts with *Carnegiea gigantea* which appears in the early Holocene, at least 6,000 years earlier than *P. microphylla*. The reasons for these time differences may be related to different modes of seed dispersal. *Carnegiea gigantea* seeds are small and are dispersed by birds that cover long distances. The seeds of the species *A. greggii* and *P. florida*, whose pods stay on the plant for several months after maturity, can also be dispersed by birds and also appear much earlier than *P. microphylla. P. microphylla* pods fall off the plant soon after maturity and its seeds are mainly dispersed by rodents, a much slower dispersal agent (McAuliffe et al. 1998).

It is interesting that *Olneya tesota* does not occur in the midden collections of Eagle Eye Mountain nor does it appear in collections of the existing flora from the region. It should be found on south-facing locations along washes.

Habitats of the region. The habitats and locations in which I found the plant species became a key part of this project. To identify these habitats I looked at various environmental parameters such as climate, aspect, soils, and slope. I was able to identify eight habitat types and their characteristic plant associations. The plant species that I found in these habitats may have occurred in only one or two locations, so to be able to identify where a plant can be found one must look at both the habitat and location in which it grows.

Figure 4**.** Bottom of sandy wash. Photo credit: Liz Makings, April, 2008.

1. Bottom of sandy/gravelly washes (Figure 4). This habitat covers the deep coarse sandy or gravelly bottoms of the drainages that usually run to the south from the Eagletail Mountains. The majority of plant species found in this habitat are annuals. However, three perennial species are found here as well. The species *Asclepias nyctaginifolia* and *Proboscidea parviflora* grow in these soils, have very large leaves in comparison to most desert plants, and grow during the warm season. *Penstemon subulatus* grows in cracks in exposed volcanic ash bedrock in wash bottoms during the winter/spring season where water and sediments accumulate. The species listed below commonly grow in this habitat.

Argemone gracilenta
Asclepias nyctaginifolia
Astragalus nuttallianus
Boerhavia wrightii
Camissonia boothii
Camissonia chamaenerioides
Chaenactis carphoclina
Chamaesyce abramsiana
Chamaesyce setiloba
Gilia flavocincta
Linanthus demissus
Nama hispidum
Nemacladus glanduliferus
Oenothera deltoides
Oenothera primiveris
Penstemon subulatus
Proboscidea althaeifolia
Proboscidea parviflora
Rafinesquia californica
Salvia columbariae

Figure 5. Sides of wash. Photo credit: John Mainieri, October, 2008.

2. Sides of wash (Figure 5). This habitat is one of the most luxuriant in the Eagletail Mountain Region as a result of a combination of soil conditions and concentrated runoff from storms. The soils are predominantly a mix of clay, sand,

and organic debris or loam. The washes are dendritic in nature, flow through deep canyons, and drain south to the Gila River. The vegetation is continuous in nature, not intermittent, and also receives large amounts of sunlight. The combination of soils, heat, and extra water creates good conditions for plant growth. Most of the trees and perennial grasses collected in the Eagletail Mountain Region are found in this habitat. Typical species of this habitat are:

Acacia greggii
Acourtia wrightii
Aloysia wrightii
Ambrosia ambrosioides
Aristida purpurea
Atriplex polycarpa
Baccharis sarothroides
Brandegea bigelovii
Chilopsis linearis
Clematis drummondii
Colubrina californica
Condalia globosa
Heteropogon contortus
Hyptis emoryi
Justicia californica
Kallstroemia grandiflora
Lycium andersonii
Olneya tesota
Parkinsonia florida
Pectis papposa
Pleuraphis rigida
Prosopis velutina
Psorothamnus spinosus
Salazaria mexicana
Salix gooddingii
Sporobolus airoides
Ziziphus obtusifolia

Figure 6. Bajada slopes-volcanic soils-lower slope. Photo credit: John Mainieri, February, 2009.

3. Bajada slopes – volcanic soils – lower elevations (Figure 6). This habitat is found on the north-facing and south-facing slopes of the Eagletail Mountains. The soils usually have a deep layer of fine clay intermixed with various sized rocks that are underlain with calcium carbonate (caliche), so that rainfall infiltrates only the shallow uppermost layer of soil and much of it runs off rapidly into the drainages. Fine-grained material is the main form of soil as the volcanic base rock that is eroding is fine-grained in nature. Shreve (1951) reports that the drainages for these types of soils are large and deep and assume a definite course. Plants common to this habitat are:

Ambrosia dumosa
Argythamnia lanceolata
Bowlesia incana
Carnegiea gigantea
Cryptantha angustifolia
Lotus rigidus
Lupinus sparsiflorus
Mammillaria grahamii
Microseris lindleyi
Opuntia chlorotica

Dalea mollis
Encelia farinosa
Ephedra aspera
Erigeron lobatus
Fouquieria splendens
Larrea tridentata
Parkinsonia microphylla
Peniocereus greggii
Plantago ovata
Psathyrotes ramosissima
Sphaeralcea ambigua
Tetracoccus hallii

Figure 7. Bajada slopes – volcanic soils – upper elevations. Photo credit: John Mainieri, February, 2009.

4. Bajada slopes – volcanic soils – upper elevations. On north-facing slopes of the Eagletail Mountains below the rock outcrops at approximately the 610 m (2,000 ft) elevation a different vegetation pattern develops. The soils found in this area are the same as those of the lower slopes except that they are rockier. At this higher elevation the climate is cooler and additional moisture results from runoff that hits the rock outcrops and main mountain ridges and drain onto the bajada slope. At this elevation, perennial grasses become much

more common and in some parts of the range, the non-native species *Bromus rubens* is becoming common. Shrubs and small trees that at lower elevations are only found along the washes are found in this habitat, and *Olneya tesota* which is sensitive to frost disappears. Some species within this habitat:

Abutilon incanum
Acacia greggii
Argythamnia lanceolata
Bromus rubens
Delphinium parishii
Enneapogon desvauxii
Gutierrezia sarothrae
Janusia gracilis
Lotus rigidus
Muhlenbergia porteri
Panicum hirticaule
Simmondsia chinensis
Tetracoccus hallii
Tridens muticus

Figure 8. Bajada slopes – granitic sandy soils. Photo credit: John Mainieri, February, 2008.

5. Bajada slopes – granitic sandy soils (Figure 8). This habitat is found within and on the west side of the Granite Mountains located to the northeast of the Eagletail Mountains and separated from them by a valley. The highest elevation in the Granite Mountains is 683 m (2,241 ft). The drainages in this range are wide and shallow. Vegetation not only grows along and in these drainages as it does in the volcanic soils but is also more widely dispersed across the landscape. The main difference between this habitat and the bajada slopes – volcanic soils is the soil particle size. This habitat consists of a deep layer of sandy soils as granite erodes in to sandy particles and volcanic rock erodes into fine-grained clay particles. A comparison of the common shrubs and trees in this habitat with that of the volcanic soils reveals that species such as *Olneya tesota* and *Larrea tridentata* are much larger than plants of these species growing in volcanic desert soils. Shreve (1951) compared vegetation of granitic soils with that of volcanic soils. He found that granitic soils allow for water infiltration rather than runoff and that water is retained at lower levels of the soil. He also found that the same species growing on granitic soils were larger and in greater number than those of volcanic soils. McAuliffe (1994) found the same conditions when he compared soils on the granitic Tortolita Mountains with the volcanic Tucson Mountains. The sandy soils around the Tortolita Mountains had much less calcium carbonate mixed in with the soils allowing more water infiltration rather than runoff. Listed below are species found in much greater concentration or only in these granitic soils:

Allionia incarnata
Bowlesia incana
Linanthus bigelovii
Lotus salsuginosus

Calycoseris parryi
Chamaesyce micromera
Eriogonum thomasii
Erodium texanum
Eschscholzia californica
Eucrypta micrantha
Hesperocallis undulata
Lesquerella tenella
Lotus strigosus
Lycium macrodon
Malacothrix glabrata
Nama demissum
Plantago ovata
Schismus arabicus
Sisymbrium irio
Sphaeralcea coulteri

Figure 9. Slot canyon/rock outcrops. Photo credit: John Mainieri, February, 2009.

6. Slot canyons/rock outcrops (Figure 9). Both of these habitats are found on the north-facing side of the Eagletail Mountains. The slot canyons are narrow, steep, and rocky drainages that carry water when it rains. Because they are shaded for several hours a day they are also much cooler with lower evaporation rates than less sheltered habitats. The extra water from runoff provides increased

moisture to species found growing in these habitats. Rock outcrops are found at the intersection of the bajada slopes and the bedrock forming the mountain mass. It is in these habitats that many of the relictual plants that were common during the Holocene and are typical of the Interior Chaparral biotic community are found. All of the ferns collected in this region were found in these habitats. Species collected in these habitats include:

Abutilon malacum
Achnatherum speciosum
Arabis perennans
Astrolepis cochisensis
Ayenia filiformis
Berberis haematocarpa
Bernardia myricifolia
Bouteloua curtipendula
Canotia holacantha
Celtis pallida
Cheilanthes covillei
Cheilanthes parryi
Dudleya arizonica
Eriogonum wrightii
Forestiera shrevei
Galium proliferum
Gilia transmontana
Juniperus coahuilensis
Keckiella antirrhinoides
Logfia californica
Mammillaria tetrancistra
Matelea parviflora
Nolina bigelovii
Notholaena standleyi
Pellaea mucronata
Parietaria hespera
Peucephyllum schottii
Portulaca oleracea
Pterostegia drymarioides
Quercus turbinella
Rhus aromatica

Figure 10**.** Desert pavement. Photo credit: John Mainieri, January, 2009.

7. Desert pavement (Figure 10). This habitat consists of a layer of small stones that form a tightly packed surface with the exposed surface of the stones frequently covered by a dark patina called rock varnish. The soils beneath this layer of stones are usually a mixture of fine-grained particles. This area is usually devoid of most vegetation and receives much exposure to direct sunlight. Most rain runs off in the form of sheet flooding with very little moisture penetrating the soil below the layer of stones. In the Eagletail Mountain Region this habitat covers large areas of stony alluvial fan deposits on lower bajada slopes with a volcanic soil base located between the large washes that drain the area (Phillips & Comus, 2000). This habitat can also be found on the granitic sandy soil surfaces but is not as pervasive. A few shrubs of *Ambrosia dumosa* and *Larrea tridentata* grow on its edges but usually not in the habitat itself. There are plants

that seem to prefer this habitat and usually grow after rain has fallen during the cool season. A species that one would not expect to find here is *Hesperocallis undulata*, a perennial bulb. This species is commonly found in the granitic sandy soils around the Granite Mountains but a few plants can also be found in the desert pavement habitat. It is thought that the species grows in pockets of sandy soil that underlie the stone surface (Felger 2000). Species that grow here are :

Chorizanthe rigida
Echinocereus engelmannii
Eriastrum diffusum
Eriogonum inflatum var*. inflatum*
Eriogonum trichopes
Fagonia laevis
Geraea canescens
Hesperocallis undulata
Mentzelia affinis

Figure 11. Open valley, Harquahala Valley. Photo credit: John Mainieri, February, 2008.

8. Open valley (Figure 11). This habitat includes the open valleys to the north and east of the Eagletail Mountains including the Harquahala Valley It is also found in the Lower Colorado River subdivision of the Sonoran Desert, the driest and hottest subdivision. It has deep, stratified, coarse to fine textured soils that are level to gently sloping on flood plains (Hendricks 1985). This area is used for farming and little of the native vegetation remains. The dominant native vegetation found in this habitat includes *Ambrosia, Larrea, Olneya, Parkinsonia,* and *Prosopis.* Other species collected in this habitat are:

Amaranthus palmeri	*Koeberlinia spinosa*
Ambrosia deltoidea	*Plantago patagonica*
Baileya multiradiata	*Trianthema portulacastrum*
Castela emoryi	*Tribulus terrestris*

Non-native species in the region. Twelve species, 4 % of the total collected in the region, are not native. The low percentage of non-native species is probably due to the remoteness of the region. At this time none of these species are considered invasive. The species most likely to become troublesome at some future time is *Brassica tournefortii*. It is located on the fringes of the region where most of the human-caused disturbance; grazing, mining, camping and off-road driving has occurred. Such activity allows non-native species to invade the region. There has been some mining activity, mostly confined to the Cemetery Ridge area, that has not covered large areas. Listed below are the non-native species collected, locations found, and their level of abundance.

Brassica tournefortii-Eagletail Mountains; Courthouse Rock Trailhead, Indian Springs Wash, mine shaft east of Courthouse Rock, Natural Bridge Canyon east of Eagletail Peak. Occasional after wet winters.

Bromus rubens-Eagletail Mountains; north of Triple Eye Arches, east of Indian Springs Canyon, west of Eagle Peak, northwest base of Double Eagle Peak. Occasional.

Cynodon dactylon-Eagletail Mountains; Indian Springs Wash, Indian Springs Canyon. Rare.

Erodium cicutarium-Granite Mountains; Eagletail Mountains; Indian Springs Wash. Infrequent during wet winters.

Eragrostis cilianensis-Eagletail Mountains; Indian Springs Canyon, Indian Springs Wash. Rare.

Phalaris minor-Eagletail Mountains; canyon east of Indian Springs Canyon, narrow canyon in section 32. Rare.

Schismus arabicus-Granite Mountains. Infrequent.

Schismus barbatus-Granite Mountains; Eagletail Mountains; Indian Springs Wash. Infrequent.

Sisymbrium irio-Granite Mountains; road to Frenchman Mine, Eagletail Mountains; east of Eagle Peak, west boundary of wilderness at stock tank. Infrequent.

Sonchus oleraceus-Eagletail Mountains; Indian Springs Canyon, Courthouse Rock, Triple Eye Catchment, west of Eagle Peak. Occasional.

Tamarix aphylla-Eagletail Mountains; stock tank at west boundary of wilderness. Rare.

Tribulus terrestris-Harquahala Valley along Courthouse Road. Occasional.

Riparian species in the region. The word “riparian” means pertaining to a river bank (Allaby 1994). Although there are no rivers in the Eagletail Mountain Region, the area does have some species that are characteristic of riparian habitats found elsewhere in Arizona such as:

Mimulus guttatus-Wet soils on side of a tinaja. Eagletail Mountains; Indian Springs Canyon. Rare, only one location. Observed in bloom twice during wet winters since 1989.

Pluchea sericea-Bottom of sandy wash at base of dry waterfall. Eagletail Mountains; deep canyon east of Indian Springs Canyon. Rare, twelve stems in one location were in bloom.

Salix gooddingii-Side of sandy wash in deep canyon. Eagletail Mountains; Indian Springs Canyon. Rare. Found in the place previously known as Willow Spring, now called Indian Spring. Earliest report of the plant was in 1917 (Ross 1923) and this tree has been observed since 1989. A flood in the summer of 2004 knocked over the main trunk and now the tree sends up shoots off its trunk. This tree also survived 15 months without rain in the 2001/2002 drought.

Tamarix aphylla-Bottom of dry sandy wash. Eagletail Mountains; stock tank west boundary of wilderness. Rare, five mature trees found. Non-native. After Hurricane Nora's exit in September, 1997, two seedlings of *Tamarix* sp. were found growing on side of a fiberglass wildlife tank and were at least 31 cm (12 inches) tall but did not survive.

The Gila River is located 80 km (50 mi) south of the Eagletail Mountain Region, and prior to its damming, all of these species were probably common along its banks. Currently *Pluchea sericea*, *Tamarix aphylla* and *Tamarix chinensis* are common. It would be expected that seeds of these species would be transported long distances in the winds created by decaying hurricanes, such as Hurricane Nora, local thunderstorms, or by birds, attached to their feet or within their feces. The seeds would become a part of the seed bank in the region and would grow in favorable locations under suitable climatic conditions. However, the possibility exists that some of these species were introduced into the region by humans. Some of these same species, *Mimulus* and *Salix,* are observed growing in the wet soils at Dripping Springs, a desert spring located north of the Kofa Game Refuge and even further away from the Gila River than the Eagletail Mountain Region.

Comparison of flora with Sierra Estrella Mountains and Kofa Mountains. Differences in the trees, shrubs, and perennials (not including annuals) in the described mountain ranges are listed below.

Table 1. Species occurring in the Eagletail Mountain Region but not in the Sierra Estrella Mountains.

Asclepiadaceae	*Asclepias nyctaginifolia*
Berberidaceae	*Berberis haematocarpa*
Bignoniaceae	*Chilopsis linearis*
Cactaceae	*Cylindropuntia echinocarpa*
	Grusonia kunzei

	Mammillaria tetrancistra
	Opuntia basilaris
Euphorbiaceae	*Tetracoccus hallii*
Fabaceae	*Psorothamnus spinosus*
Koeberliniaceae	*Koeberlinia spinosa*
Lamiaceae	*Salazaria mexicana*
Nolinaceae	*Nolina bigelovii*
Poaceae	*Sporobolus airoides*
Rhamnaceae	*Colubrina californica*
	Condalia globosa
Verbenaceae	*Tetraclea coulteri*

Table 2. Species occurring in the Sierra Estrella Mountains but not in the Eagletail Mountain Region.

Agavaceae	*Agave deserti*
Asteraceae	*Brickellia atractyloides*
	Ericameria laricifolia
	Erigeron oxyphyllus
	Psilostrophe cooperi
Burseraceae	*Bursera microphylla*
Caprifoliaceae	*Sambucus mexicana*
Chenopodiaceae	*Atriplex lentiformis*
	Suaeda moquinii
Ephedraceae	*Ephedra fasciculata*
Euphorbiaceae	*Sapium biloculare*
Grossulariacea	*Ribes quercetorium*
Krameriaceae	*Krameria erecta*
Lamiaceae	*Salvia mohavensis*
	Salvia pinguifolia
Malvaceae	*Eremalche exilis*
Poaceae	*Digitaria californica*
	Setaria leucopila

	Sporobolus cryptandrus
	Stipa arida
Salicaceae	*Populus fremontii*
Selaginellaceae	*Selaginella arizonica*
Solanaceae	*Lycium torreyi*
	Solanum americanum
Typhaceae	*Typha domingensis*

The main differences between the Sierra Estrella Mountains and the Eagletail Mountain Region are that 1) the Sierra Estrellas at 1,310 m (4,298 ft) are higher than the Eagletails at 1,005 m (3,297 ft), and receive more rainfall; 2) the Sierra Estrellas are further east and receive more monsoon moisture than the Eagletail Mountains; 3) the Sierra Estrellas are predominantly granitic while the Eagletails are volcanic; 4) the Sierra Estrellas are close to the Gila River flood plain so riparian species are found there. Both places are mainly in the Arizona Upland subdivision of the Sonoran Desert.

Table 3. Species occurring in the Eagletail Mountains Region but not in the Kofa Mountains.

Asteraceae	*Ambrosia deltoidea*
	Gymnosperma glutinosum
	Isocoma acradenia
Crassulaceae	*Dudleya arizonica*
Cupressaceae	*Juniperus coahuilensis*
Solanaceae	*Lycium macrodon*
Ulmaceae	*Celtis pallida*
Verbenaceae	*Tetraclea coulteri*

Table 4. Species occurring in the Kofa Mountain area but not in the Eagletail Mountain Region:

Acanthaceae	*Anisacanthus thurberi*
Agavaceae	*Agave deserti*
Amaryllidaceae	*Allium parishii*
Arecaceae	*Washingtonia filifera*
Aristolochiaceae	*Aristolochia watsonii*
Asteraceae	*Artemisia ludoviciana*
	Brickellia atractyloides
	Ericameria cuneata
	Ericameria laricifolia
	Ericameria linearifolia
	Psilostrophe cooperi
	Xylorhiza tortifolia
Berberidaceae	*Berberis harrisoniana*
Cactaceae	*Neoloydia johnsonii*
Euphorbiaceae	*Tragia nepetaefolia*
Fabaceae	*Acacia angustissima*
	Calliandra eriophylla
Garryaceae	*Garrya flavescens*
Krameriaceae	*Krameria erecta*
Lamiaceae	*Hedeoma nana*
	Monardella arizonica
Liliaceae	*Calochortus flexuosus*
Malvaceae	*Horsfordia alata*
Poaceae	*Digitaria californica*
	Pennisetum setaceum
	Setaria macrostachya
	Sporobolus contractus
	Sporobolus cryptandrus
Rosaceae	*Prunus fasciculata*
Rutaceae	*Thamnosma montana*
Scrophulariaceae	*Mohavea confertiflora*

Solanaceae	*Lycium torreyi*
	Solanum douglasii
Verbenaceae	*Verbena gooddingii*

The main differences between the Eagletail Mountain Region and the Kofa Mountains are 1) the Kofa Mountains are higher, reaching an elevation of 1,460 m (4,790 ft), and so receive more rainfall while the Eagletail Mountain Region only reach an elevation of 1,005 m (3,297 ft); 2) the Kofas are further west with greater exposure to winter storms than the Eagletails. The geology of both places is predominantly volcanic, and both are in the Arizona Upland subdivision of the Sonoran Desert.

A comparison of the three floras from the perspective of the Eagletail Mountain Region reveals some interesting plant distributions. There are no species endemic to the Eagletail Mountain Region but there are species that reach the edge of their range in this region. For example, the large shrub, *Celtis pallida,* whose range is shown in (Figure 12) and requires warm season moisture, is found in the Sierra Estrella Mountains. The plant has been observed in Saddle Mountain, the next range east of the Eagletail Mountain Region and west of the Sierra Estrellas. This shrub reaches its westernmost distribution in the eastern edge of the Eagletail Mountains and is not found west of Eagletail Peak. It is also not found in the Kofa Mountains.

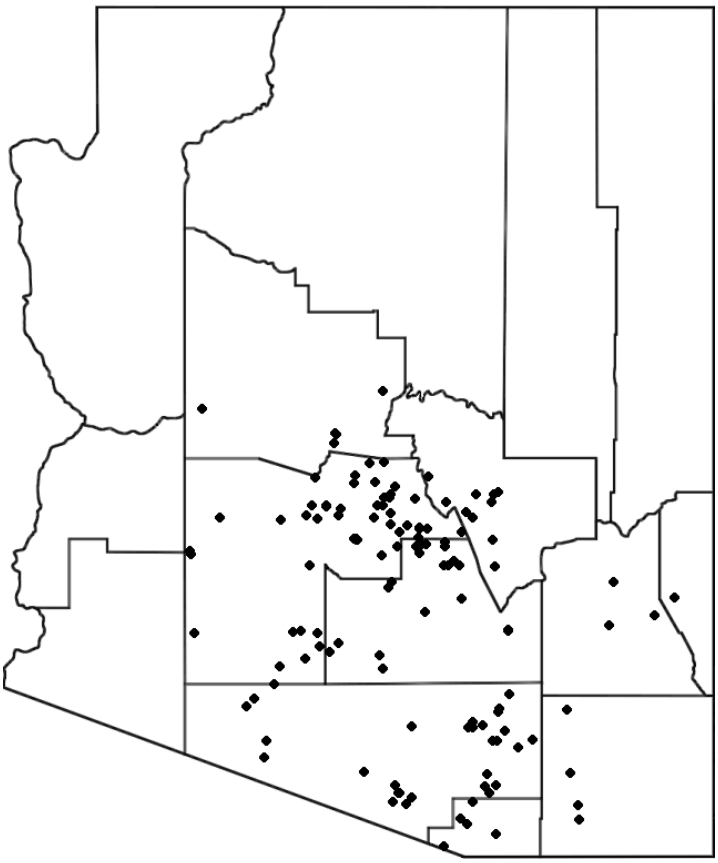

Figure 12. Range of *Celtis pallida* (SEINet, 2012).

The species *Opuntia basilaris* is common in the Mohave Desert of California and is found in the western half of the Eagletail Mountains but not the eastern half and does not occur in the Sierra Estrella Mountains. Another common Mohave Desert plant that does not grow south and east of the Eagletail Mountain Region is *Tetracoccus hallii,* see (Figure 13) for its range). Another species that occurs in the Eagletail Mountain Region but not in the Sierra Estrellas is *Nolina bigelovii*; its most southeastern distribution is Woolsey Peak (SEINet 2011).

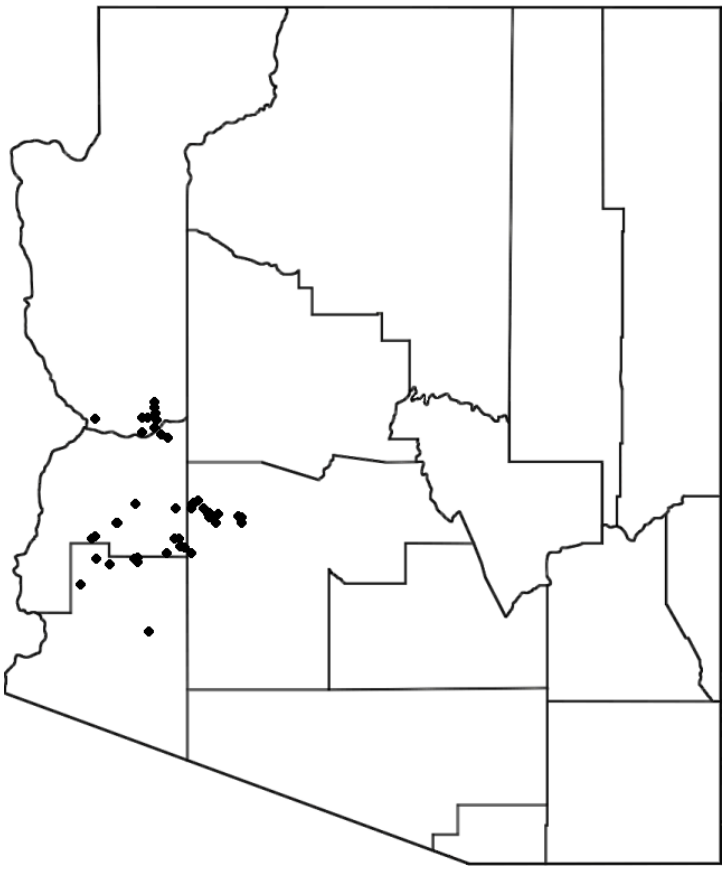

Figure 13. Range of *Tetracoccus hallii.* (SEINet, 2012).

The species *Ambrosia deltoidea* is at the western edge of its range in the Eagletail region. This species is dominant in the central portion of Arizona in the Sonoran Desert but does not grow west of Maricopa County and is not found in the Kofa Mountains. Its distribution in the Eagletail Mountain Region seems to be the reverse of its normal distribution as discussed in Biotic Communities in this paper and by Brown (1994). The species *Dudleya arizonica, Gymnosperma glutinosum,* and *Isocoma acradenia* do not occur west of the Eagletail Mountain Region and are not found in the Kofa Mountains.

Two species whose distribution is widely scattered but localized in Arizona and grow in the Eagletail Mountain Region are *Tetraclea coulteri* and *Matelea parvifolia*. The species *T. coulteri* does not occur in either the Sierra

Estrella or Kofa Mountains and *M. parvifolia* is found in the Sierra Estrella Mountains only.

Agave deserti is widespread in southwestern Arizona and is found in mountain ranges that are both drier and wetter than the Eagletail Mountain Region. *Agave deserti* occurs in both the Sierra Estrella Mountains and the Kofa Mountains but not in the Eagletail Mountain Region even though the geologic and climatic conditions of the Eagletail region are very similar to those of the Kofa Mountains. There are geologic differences, as discussed above, between the Eagletail region and the Sierra Estrella area and the climate is wetter in the Sierra Estrella area.

A search of SEINet reveals that a majority of Sonoran Desert mountain ranges in western Arizona include *Agave deserti* in their flora:

Ajo Mountains
Cabeza Prieta Mountains
Castle Dome Mountains
Gila Mountains (northest end)
Harcuvar Mountains
Harquahala Mountains
Hualapai Mountains
Kofa Mountains
McDowell Mountains
North Maricopa Mountains
Sand Tank Mountains
Sauceda Mountains
Sheep Tank Mountains
Sierra Estrella Mountains
Silver Bell Mountains
Table Top Mountains
Tinajas Atlas Mountains
White Tank Mountains
Woolsey Peak

Mountain ranges located in southwest Arizona that do not include *Agave deserti* in their flora:

Big Horn Mountains
Eagle eye Mountain
Eagletail Mountains
Little Horn Mountains
Saddle Mountain
South Mountain

Of the 19 ranges in which *Agave deserti* occurs, 12 have their highest elevation at or above 1,300 meters (4,000 ft.). The remaining seven fall below 1,300 m and are also in areas that are drier and hotter than are the Eagletail Mountains. It does not appear that climate is the only factor determining where this species is found.

It may be that soils play some part in determining where *Agave deserti* grows. Felger (2000) reports that *A. deserti* was found on granitic soils. Turner (1995) reports that in the Ivanpah Mountains in California, *A. deserti* is found on granite. Many of the low, hot, dry, mountain ranges where it occurs in Arizona, such as the Cabeza Prieta, Tinajas Altas, Gila, and Sheep Tank Mountains, are granitic. However, the Kofa, Castle Dome, and Ajo Mountains, and Woolsey Peak are volcanic and have populations of this species.

Felger & Van Devender (In press) in their flora of the Tinajas Altas Mountains, report that the population of this species expanded during the wetter rainfall climates of the early Holocene but its population became fragmented during the later Holocene. This species is still found in the Tinajas Altas Mountains today but is only widely scattered on the upper slopes and east-facing bajada slopes. McAuliffe (1998) also reports that *Agave deserti* occurred in the early Holocene at 10,440 YBP on mainly volcanic Eagle Eye Mountain. It is not found there today.

It appears that *Agave deserti* prefers granitic based soils over volcanic based soils, but it will survive on volcanic soils at elevations high enough to create a cooler climate that receives more rainfall. It may be that the Eagletail Mountain Region, being volcanic, and not being high enough to create a cooler,

wetter climate, does not include this species currently but it may have grown there in the past.

The location of the Eagletail Mountain Region is in a transition zone which is far enough west for some Mohave Desert species, which require cool season rainfall, and far enough east for some species requiring warm season rainfall. It is also far enough south that some frost sensitive species commonly found in the lower Sonoran Desert occur there such as *Olneya tesota* but not *Jatropha* sp.

CLIMATE OF EAGLETAIL MOUNTAIN REGION

The climate of the Eagletail Mountain Region is typical of the Sonoran Desert with two unpredictable rainy seasons, summer and winter, and with high temperatures in the summer. Rainfall records have been maintained for the Eagletail Mountains since 1992 using a tubular rain gauge located at a wildlife tank at an elevation of 548 m (1,797 ft). The gauge is located approximately 3.2 km (2 mi) southwest of the Courthouse Rock trailhead. The gauge was usually checked on a monthly basis but if some months were missed the rain that fell was protected from evaporation by maintaining mineral oil in the gauge.

Table 5 reveals average climatic conditions at various stations in the southwestern portion of Arizona with the stations in the Kofa Mountains, Salome, and the Eagletail Mountains located in the Arizona Upland Subdivision and the remaining stations located in the Lower Colorado River Valley Subdivision. The Upland stations record higher rainfall levels and lower temperatures than do the Valley stations. The temperature conditions at the Eagletail site are probably closest to those of the Kofa Mine.

Table 5. Climatic data for selected stations in southwestern Arizona (Sellers and Hill 1974; NOAA National Weather Service, 2011)

NAME	ELEV(FT)	TEMP				RAIN (IN)		
		JAN (F)		JUL(F)				
		MIN	MAX	MIN	MAX	WINTER	SUMMER	ANN
Kofa Mine	1,775	46.0	65.8	79.7	103.5	2.91*	2.72*	6.99
Harquahala	1,260	30.6	65.4	72.5	106.4	2.45	2.48	6.15
Tacna	324	36.3	68.3	78.1	106.0	1.87	1.61	4.35
Gila Bend	735	40.6	69.4	79.2	109.0	3.05	2.53	7.01
Salome	1,700	33.3	63.7	72.0	104.1	3.45	3.21	7.87
Tonopah	1,090	38.2	65.9	77.1	106.8	3.37	1.56	5.91
Eagletail Mts.	1,800					2.69	2.74	7.07

*Winter, December-March Summer, July-September

Generally speaking, locations in southwestern Arizona that are in the valleys, especially the Gila River Valley, receive less rainfall and experience higher temperatures than do upland sites at higher elevation. Most upland regions, at least those in excess of 1,300 m (4,000 ft), are capable of generating their own weather if conditions are right, which is sufficient for chaparral and woodland flora to grow (Brown 1978). Based on personal observations, the Eagletail Mountains are sufficiently high to generate their own weather. Depending on air flow patterns, during the summer thunderstorm season local showers can develop in close proximity to the range.

There are microclimates in the Eagletail Mountains that provide weather conditions quite different from typical Sonoran Desert regions. The locations where these conditions occur are narrow rocky canyons on the north side of the range. Some of these canyons may see direct sunlight for only a few hours of the day in the summer and no sunlight in the winter. These canyons also collect large amounts of rain that falls on the sides and drains into the canyon. It is in

these areas that species such as*, Berberis haematocarpa, Bernardia myricifolia, Forestiera shrevei, Juniperus coahuilensis, Nolina bigelovii, Quercus turbinella,* and *Rhus aromatica* can be found.

These rainfall records reveal that in desert regions average rainfall can be misleading and do not reflect true weather conditions. The rainfall records that were accumulated over twenty years show that it is common for the region to receive little or no rainfall for months at a time with three month periods being common, only to be followed by rainfall events that could result in flooding and extended surface flow over several months. The year 2008 could be considered typical as total rainfall of 193.0 mm (7.6 in) was recorded. This is close to the average of 179 mm (7.07 in). However for 6 months of the year no rain fell and most of the rain that did fall occurred in storms in July, 63.5 mm (2.50 in), and August, 50.8 mm (2.00 in) with smaller amounts in February and October. Some significant weather events that have occurred since 1992 illustrating these extreme weather conditions and their effect on the geology and flora of the region are summarized below.

January, 1993 – 152.4 mm (6.00 in)-Strong winter storms moved through southwestern Arizona. Annuals were not yet in bloom due to a very dry fall and only woody shrubs and trees had responded to the wet conditions.

September, 1996 – 62.2 mm (2.45 in)-Indian Springs Wash showed signs of heavy flooding. *Senna covesii* and *Bebbia juncea* were in full bloom*,* and seedlings of *Parkinsonia* spp. and *Prosopis velutina* were found emerging in desert washes. In Indian Springs Canyon large pools of

water collected at the base of the rock face near the *Salix gooddingii.* The water level had reached 60.9 cm (24 in) in the wash.

September, 1997 – 101.6 mm (4.00 in)-On September 25, 1997 remnants of Hurricane Nora , a tropical storm, entered the state in the vicinity of Yuma, moved northeast and exited the state near Page. This storm dumped heavy rain in southwestern and north central Arizona. The Harquahala Mountains received 304.8 mm (12 in), within a 24 hour period, a new record for the state. In the Eagletail Mountains heavy rain also fell. The water table rose to the point that the main washes were running for weeks after the storm passed. At the wildlife tank, which has a fiberglass holding tank, two small tree like plants at least 15.2 cm (6 in) tall had glued themselves to the side of the tank and were growing,. They were *Tamarix* sp. and eventually died. Shrubs or perennials in bloom included *Bebbia juncea, Colubrina californica, Hyptis emoryi, Janusia gracilis, Krameria grayi*, and *Senna covesii.*

March, 1998 – 91.4 mm (3.60 in)-Heavy rain during winter months continued to fall after the rains from Nora. Seedlings of *Plantago ovata* emerged in late September, 1997 shortly after Nora left the state, and continued to grow, though they did not produce seed heads until February, 1998. Approximately 80% of annual plant growth consisted of this species which covered the hill sides. The other annuals *Amsinckia, Castilleja, Cryptantha, Gilia, Lupinus,* and *Phacelia did* not begin to germinate until December or January, 1998.

November, 2000 – 83.8 mm (3.30 in)-A wet fall followed a wet summer for this region. A number of species that normally bloom in the summer continued to bloom into the fall including *Allionia incarnata, Janusia gracilis, Muhlenbergia porteri, Senna covesii,* and *Sporobolus airoides.* Seedlings of *Plantago ovata* were beginning to emerge. Other shrubs in bloom included *Abutilon incanum, Aloysia wrightii,* and *Lycium fremontii.*

June, 2001 to August, 2002- Except for a shower in September, 2001 of 5 mm (0.4 in) no rain fell for 15 months. This dry period affected six consecutive seasons: spring, 2001; summer, 2001; fall, 2001; winter, 01/2002; spring, 2002; and summer, 2002. By the end of this period the effect on the vegetation was significant. *Prosopis velutina* had dropped its leaves, *Salix gooddingii* had dropped its leaves and the ends of its branches were dying, *Larrea tridentata* leaves were retained but were dry and had turned brown, and *Ambrosia dumosa* were dying. *Simmondsia chinensis* retained its leaves, which were observed to be a major source of food for mule deer. *Erioneuron pulchellum* became locally extinct. The first major rainfall occurred in September, 2002 of 25 mm (1 in).

September, 2003 – 50.8 mm (2.00 in)-This event followed a wet August in which 38 mm (1.5 in) fell. Summer annuals were common and in bloom including *Amaranthus palmeri, Boerhavia wrightii, Bouteloua aristidoides, Bouteloua barbata, Euphorbia eriantha, Leptochloa dubia, Kallstroemia californica, K. grandiflora, Panicum hirticaule, Pectis papposa,* and

Tidestromia lanuginosa. These plants have certain features in common in that they photosynthesize using the C4 method (Mulroy & Rundel 1977) and are usually found growing on the sides of the major washes.

August, 2004 – 97.8 mm (3.85 in)-This storm resulted in large changes in Indian Springs Canyon. The tree, *Salix gooddingii,* was knocked over and lying on its side. It continued to survive, sending up branches from the main trunk. Large pools of water collected at the base of the cliff face on the south side of the canyon, and 30 cm (11.8 in) of cliff face was newly exposed by the flood event.

October, 2004 – 94.0 mm (3.70 in)-With this rainfall and that which fell in August, many plants were in flower that do not normally bloom at this time including *Adenophyllum porophylloides, Encelia farinosa,* and *Perityle emoryi.* The species *Colubrina californica* and *Condalia globosa* bloom and set fruit in the fall of wet years, and did so this year. The water table had risen to the surface; water had been running in Indian Springs Wash since August. The portion of the cliff face that was exposed in the August storm was now covered by a new deposit of sand.

January, 2005 – 146.0 mm (5.75 in)-Rain fell in storms in December and January. Indian Springs Wash continued to run with a small flow of surface water for about 0 .6 km (0.37 mi) in the canyon. The species *Prosopis velutina* and *Acacia greggii* as well as other shrubs and trees had dropped their leaves due to freezing temperatures. Leaves of

Fouquieria splendens and *Tetracoccus hallii* had turned red in response to freezing temperatures. *Condalia globosa* and *Lycium andersonii* were in bloom.

February, 2005 – 95.2 mm (3.75 in)-Additional heavy rain fell in the region.

August, 2005 – 104.1 mm (4.10 in)-After heavy thunder storms the gas pipeline road washed out due to runoff in the washes. Plants in bloom at this time included *Cassia covesii, Colubrina californica,* and *Nicotiana obtusifolia*. In June, 2005, a normally dry time of the year, in Indian Springs Canyon plants in bloom included *Erigeron lobatus, Perityle emoryi,* and *Senecio lemmonii.* Normal summer blooming annuals were not yet in bloom.

August, 2008 – 50.8 mm (2.00 in)-Thunderstorms occurred in the region which followed heavy rain that fell in July of (72.4 mm). There were signs of significant runoff and erosion in Indian Springs Canyon. Shrubs and trees began to leaf out in July. These species as well as some annuals began to bloom in August including *Colubrina californica, Kallstroemia grandiflora, Krameria grayi, Lycium berlandieri, Proboscidea althaeifolia, Trixis californica,* and *Viguiera parishii*. Annuals continued to bloom until October.

August, 2009 – 95.2 mm (3.75 in)-After six months of little or no rainfall the region was hit by thunderstorms with heavy rain accompanied by very

strong winds. In the following months the results of this storm were seen as numerous large shrubs, cacti, and trees were uprooted along Indian Springs Wash. Plants of the species *Carnegiea gigantea, Cylindropuntia acanthocarpa, Fouquieria splendens*, and *Parkinsonia microphylla* were blown over by the strong winds during the storm.The plants fell in a southwest to northeast direction. From the level of flood debris in the wash it was determined that the water level had reached 91 cm (35.8 in).

January, 2010 – 152.4 mm (6.00 in)-Very heavy rain hit the region and the rain gauge had overflowed. Three days of rain occurred accompanied by strong winds on the third day. At least 26 mature *Carnegiea gigantea* had blown down falling in a southeast to northwest direction and hundreds more of this species were leaning towards the northwest making them susceptible to damage in future storms. Unlike the August storm, the other three species of cacti, trees, and shrubs were not affected with the exception of some broken branches. One tree, *Parkinsonia microphylla,* which was a nurse plant to ten *C. gigantea,* had several branches break that damaged or knocked over at least five of the cacti. The Weather Bureau reported that the low barometric pressure in this storm, 29.20 inches, was the lowest ever recorded in Arizona. In comparison, a category 1 hurricane has a barometric pressure of 28.80 inches.

These storm events demonstrate that averages are very misleading when trying to determine the effect of the climate on the growth patterns of the plants

found in the region. Desert plants seem to respond more to significant rainfall events rather than to seasonal changes or average rainfall. Additionally, plants that normally grow in the winter/spring can extend their growth into the late spring or early summer or can begin to grow in the early fall if favorable moisture conditions exist. The same can be said for plants that normally grow in the summer period, which can continue their activities into the late fall or early winter.

GEOLOGY OF THE EAGLETAIL MOUNTAINS REGION

The geological setting for this region falls within the Basin and Range physiographic and tectonic province. The Eagletail Mountain range runs in a northwest/southeast direction, typical of most ranges in this part of Arizona. The south side of the range slopes gradually to the southwest and is cut by deep canyons. The north side of the range slopes very steeply and is cut by canyons that are short, steep, and quite narrow.

The bedrock in this range consists of pre-Tertiary granitoid rock of Jurassic age (144 to 206 million years ago, MYA) that is intruded by numerous Tertiary dikes and overlain by a sequence of Miocene silicic volcanic rock (5 to 24 MYA) (Spencer et al. 1992).

The backbone of the range is made up of volcanic ash and tuff that formed during the early Miocene and of numerous northwest trending dikes that formed during the Tertiary. Courthouse Rock is the result of an intrusion that trended to the northeast (Spencer et al. 1992).

The mountains and hills on the northeast edge of the Eagletail Mountains are the Granite Mountains, and consist of granitoid rocks from the early Tertiary

to the late Cretaceous (55 to 85 MYA). The hills west of the Granite Mountains and north of the main range are also granitoid rocks from the mid- Proterozoic (1,400 MYA). The main mountain mass of the Eagletails is made up of volcanic rocks from the mid- Miocene to the Oligocene (15 to 38 MYA), and the eastern tip of the main range consists of basaltic rock from the late to mid -Miocene (8 to 16 MYA) (Spencer et al. 1993). The valley deposits north of the main range are recent surficial deposits from the Holocene to the mid- Pleistocene (0 to 1.5 MYA) and the valley deposits south of the main range are older surficial deposits from the mid -Pleistocene to the late Pliocene (1.5 to 5 MYA). Cemetery Ridge, found south of the main range is sedimentary and volcanic rock from the Jurassic (144 to 206 MYA) (Reynolds 1988; Gilbert et al. 1992).

The volcanic rock that makes up the main mountain mass of the range is formed by rapid cooling of molten rock or magma on the surface as lava. Examples of this type of rock that makes up the main mass include rhyolite and andesite. Because of this rapid cooling, the crystals that make up these rocks are very small and this rock erodes into soils that are fine-grained such as clay soils.

The granitoid rock which forms the Granite Mountains on the northeast edge of the Eagletail Mountains formed as a plutonic rock. This rock cools deep within the earth very slowly, which allows crystals that form within the rock to become quite large. This rock erodes into a coarse, sandy, large grained soil.

Desert pavement surfaces are quite common on the volcanic rock soils. This surface is made up of flat cobbles and pebbles that cover the surface of the soil. This pavement structure protects the fine-grained soils found underneath from water and wind erosion, and is created by the wetting and drying of the rocks on the surface. When certain clay minerals such as smectite become wet

they expand. This expansion gradually moves the pebbles and cobbles found within the soil to the surface. Over time, the results of the expansion of soils and contraction when the soils dry out produce a tightly fitting mosaic of stones on the surface (Bezy et al. 2000).

On its north-facing side, the Eagletail Mountains have a very steep gradient with the elevation dropping rapidly from the peaks that make up the main volcanic dike of the range to the valley floor of Centennial Wash. Drainages that erupt from the range on this side cut through the pediment, which is an erosional bedrock surface of low relief that makes up a part of the mountain mass, and slopes gently away from it (Monroe & Wicander 1995). They enter the bajada, which is downslope of the pediment and represents a deep layer of erosional debris that has washed down from the mountain range during flood events (Bezy et al. 2000). Where the drainages erupt from the mountains, they create erosional features that are deep, narrow, and full of boulders and debris. These drainages result in microclimates that are much cooler and wetter than the surrounding desert due to shading from being on the north-facing slope and from the accumulation of water into the drainage.

On its south-facing side the gradient is much more gradual with drainages forming deep canyons that run towards the southwest as they cross the pediment and open up into shallow drainages as they enter the large valleys to the south of the mountain mass that lies between the Eagletail Mountains and Cemetery Ridge.

The soils of this region include three types. Soils in the Torrifluvents Association are located on the north and east side of the range in the Harquahala Valley and are deep, stratified, coarse to fine textured nearly level to gently

sloping on flood plains and lower alluvial fans. These soils are commonly used for irrigated croplands. The second type is the Gunsight-Rillito-Pinal Association which is located on the bajada slopes found at the base of the mountain range and in the valley to the south of the range. These soils are both deep and shallow, gravelly, medium and moderately coarse textured that are located on nearly level to strongly sloping alluvial surfaces and valley plains. These soils are used as open range for grazing and wildlife habitat. The third type ranges from the Lithic-Camborthides-Rock Outcrop to the Lithic-Haplargids Association. These soils are found in the main range of the Eagletail Mountains and are shallow, very gravelly and cobbled, and have a moderately coarse to fine texture. They are located on gently sloping to very steep rock outcrops on hill sides and mountain tops. These soils occur in habitats used by wildlife, especially bighorn sheep (Hendricks 1985).

These soil types represent a broad spectrum of soil surface textures, mainly gravelly loams. Other textures include loamy sands, silt loam, loam, clay, and silt clay loam. Soil depth is determined by location in the landscape. Soils located in the wash bottoms, alluvial fans, and terraces are moderate to deep with good infiltration rates. Soils found on hillsides and mountain tops are very shallow with low infiltration rates. Large areas of the soils are covered with desert pavement and therefore are devoid of vegetation. The soils with most nutrients are the loamy sand and silt loam soils usually found on the sides of major drainages (Hendricks 1985).

PREHISTORY AND HISTORY OF EAGLETAIL MOUNTAIN REGION

Introduction to the prehistory of the region. The prehistoric time frame in North America begins with the Paleo-Indian period beginning approximately 13,000 years before present (YBP) and ending approximately 10,000 YBP. Within this period, the San Dieguito culture occupied western Arizona during the late Pleistocene and hunted large game animals. Ancient occupations possibly existed on the margins of the Harquahala Valley, but these findings are based on surface artifacts and are difficult to assign to a specific time period (Stone 1986). Paleo-Indians lived in southwestern Arizona during the time when the Pinyon-Juniper woodland and the Juniper – Oak woodland were found at elevations down to 550 m (1,804 ft) (Van Devender et al. 1979).

The Archaic period began 10,000 YBP and ended approximately 2,000 YBP. During this time two cultures occupied southwestern Arizona, the Amargosan, originated in the deserts of southern California and extended east, and the Cochise, originated in southeastern Arizona and extended west. Their way of life during this period involved hunting small game such as rabbits and gathering of seeds and plant foods. Metates and bedrock mortars came into use to process plant food but ceramics were not produced (Stone 1986). It was during this period that Pinyon Pine disappeared from the southwestern Arizona region and the Juniper-Oak woodland was rapidly replaced by the desert vegetation seen in the area today. By 4,000 YBP the modern climate was fully established (Van Devender et al. 1979).

The Ceramic period began 2,000 YBP and ended approximately 500 YBP. Three cultures dominated southwestern Arizona. The Patayan were

centered along the lower Colorado River and extended east to the great bend of the Gila River. The Hohokam were centered in south central Arizona along the Salt and Gila Rivers and their territory extended west. Both of these cultures grew corn, beans, and squash but these foods were supplemented with seeds and plant material from native vegetation and game such as rabbits and deer. The Hohokam and Patayan cultures occupied semi-permanent villages. The third culture to occupy the deserts and mountains of western Arizona was the Yavapai, who are considered to have been derived from the Upland Yuman. Their life style was that of hunting and gathering of native plants and animals. They did not occupy permanent villages and moved within their territory as resources became available. They did produce ceramics for cooking and storage (Stone 1986). The climate and vegetation during this time period was the same as it is currently.

Archeological findings of the region. The Eagletail Mountain Region was occupied during the Archaic and the Ceramic periods. There is no evidence of earlier occupation. There have been limited archeological surveys and excavations of sites in the Eagletail Mountain Region. One notable archaeological feature is the petroglyphs, which are designs pecked or scratched on rock surfaces by prehistoric cultures. The large petroglyph site at Indian Springs was surveyed by Connie Stone (1986) and included in the National Registry of Historic Places. A site on the northwestern edge of the Eagletail Mountains was identified by Malcome Rogers as a rhyolite quarry and a site was excavated along Centennial Wash by Todd Bostwick (1988). Beginning in 1992,

this author has located and described approximately 26 additional archaeological sites in the Eagletail Mountains.

The excavated site on Centennial Wash was in a bosque, a grove, of *Prosopis* sp. trees located about 13 km (8 mi) northeast of the Eagletail Mountains. It was considered a camp site for the processing, cooking, and consumption of mesquite flour, made from pounding the pods as well as a site for processing other plant seeds and small animals. At least 71% of the chipped flakes and tools found at the site were made of rhyolite from the Eagletail Mountains. The earliest date of occupation was 3,290 YBP, which would have placed the site within the late Archaic period. Based on the artifacts found, the site had been used over time by Archaic, Patayan, and Yavapai cultures. Tools found at the site included manos and slab metates made of rhyolite from the Eagletail Mountains, and vesicular and fine-grained basalt from other locations. Also, pestles of rhyolite were found that would have been used with wooden mortars (Bostwick 1988).

The petroglyph and living site at Indian Springs in the Eagletail Mountains, officially recorded as AZ S: 11:1 (Arizona State Museum, ASM) is located in a deep canyon running east and west with cliffs on both sides. The attraction of this place is water from three sources. The first source, Indian Spring (historically called Willow Spring), is located on a side drainage to the canyon and is more like a tinaja, which is a naturally formed rock tank, eroded into the bottom of the drainage, that holds water for a significant period of time after large storms. It has an upper and a lower tank that have been known to be dry for up to six months at a time; there is no permanent source of water at this location. The second source of water is a sand tank, which is a tinaja filled with sand,

located on the side of the main canyon. It holds water at a shallow level that can be reached by digging and is probably the most permanent source. It is very seldom that water is seen on the surface, but large pools of water have been observed after heavy rainstorms, and a willow tree has been growing at this location since at least 1917 (Ross 1923). The third source includes numerous temporary tinajas that hold water for short periods of time found in the bedrock that forms the bottom of the wash.

Also found in this location are 18 bed-rock mortars, some up to 38 cm (15 in) deep, and 22 grinding slicks. The mortars were used to pound pods or seeds of *Acacia greggii, Olneya tesota, Prosopis* sp., *Parkinsonia* spp., and *Simmondsia chinensis* into flour or for other processing. The grinding slicks were used to grind small seeds of annuals such as *Amaranthus* spp., *Muhlenbergia* spp., *Salvia columbaria,* and *Sporobolus* spp. for food processing.

The petroglyphs on this site are of the Archaic, Gila River or Hohokam, and Patayan styles indicating that the site had a long history of use by many cultures. Additionally, the site was used by the Yavapai because it was in the territory of two Yavapai bands (Stone 1986).

In addition to the petroglyphs on the canyon walls, there is a large campsite with cleared areas, rock alignments, and artifacts, but very little pottery, located on the hilltops. The site is large with cleared areas, rock alignments, and pathways where it appears that ceremonial events may have been conducted (Boma Johnson, personal communications). Stone (1986) thought this site was a public place where more than one group of people would come together periodically to trade goods, arrange marriages, settle disputes, and hold various ceremonial events.

The importance of the site becomes apparent as five trails converge on the area coming from the southwest, southeast, west, northwest, and northeast. Malcome Rogers reported that a major trail, running east and west, with Hohokam and Patayan pottery, passes just to the south of the Eagletail Mountains and links the Gila and the Colorado Rivers. He also observed another trail leaving the Gila River at Agua Caliente and running north to the Clanton Wells area, which is south of the site near Cemetery Ridge (Rogers 1966). This would connect with the trail that runs southwest from the Indian Springs campsite. This trail also continues north from the campsite passing to the west of Courthouse Rock and on to Centennial Wash.

The majority of the 26 sites, described by this author and reported to the BLM, were found on the south side of the Eagletail Mountains. On the north side of the range few sites were found near Courthouse Rock and along trails leading to Centennial Wash but none were found elsewhere. The majority of sites were located along large washes, mainly in places where water accumulated, or on saddles between hills or valleys as well as along trails on the desert pavement.

The majority of these sites could be considered temporary camp sites with one or two rock rings situated on desert pavement usually without pottery. Features at these sites generally include trail fragments, lithic material in the form of flakes, and usually at least one grinding slick/metate.

At places where water was available for longer periods of time, more features were found including a few bedrock mortars, metates, numerous lithic materials usually of rhyolite in the form of flakes or scrapers, and scattered plain red ware or brown ware pottery. One of these more permanent sites, found on a

bluff overlooking a wash had two large cleared areas that were circular, 6 m (20 ft) in diameter. This site may have been used for ceremonial purposes.

A number of large rock piles, possibly representing trail shrines, were found. They were located in saddles between valleys or at high points along trails. The largest shrine was 6 m (20 ft) long and 1.5 m (5 ft) high and hollow in the center. It was accompanied by a long north to south rock alignment that divided the saddle in two. The alignment may have represented a boundary between territories (Boma Johnson, personal communication).

The valleys to the north, west, and southwest of the Indian Springs site appear to have been heavily used. Many sites with rock alignments, grinding slicks, lithics, and scattered pottery are found in association with trail fragments. Scattered at various locations on hill sides or along washes are metates and manos that were not associated with other artifacts. This would indicate that a high level of seed and plant processing occurred in this area.

Five rock shelters and one cave were found to contain artifacts. These locations were not high up in the hills in inaccessible places but were located at the base of hills and cliffs in the valleys. These sites were accompanied by petroglyphs, pottery, lithics, grinding slicks or metates, and manos indicating differing levels of use. One rock shelter had nine metates, one mano, and one pestle. Another rock shelter included a tool of wood that appeared to be a portion of a plant grubbing stick burned on one end.

Panels of petroglyphs, which are surfaces of a boulder or rock face covered with various designs, were found in four locations other than Indian Springs Canyon. These sites were usually associated with places where water

was available for long periods of time. Two locations were found where outcrops of high quality rhyolite were being mined for flakes and other tools.

Intaglio features, ground figures made of rocks or areas cleared of rocks, are not common in the Eagletail Mountain Region. Two features were identified, one on the west side of the range, located in a small valley, consisted of parallel lines of rocks aligned in a northeast/southwest direction. The other intaglio features were much more extensive and located near the campsite and ceremonial site in the Indian Springs area. These consisted of pathways cleared down to the bedrock. Each feature was aligned at approximately 54 degrees east of true north, and averaged 16.8 m (55 ft) long. The body of the feature formed the pathway and on the southwest side ended with a cleared circle. Thirteen of these features were aligned in the same direction, always with the heads pointing southwest. Boma Johnson, regional archeologist, for the Yuma region, interpreted these features as the possible representation of a serpent. The complete group of features resembled an intermittent trail as each feature was succeeded by an area of undisturbed desert and followed by another feature lined up in the same direction. Boma Johnson (personal communication) had seen features like these on bluffs overlooking the Colorado River near Yuma with the same direction of alignment. He thought that the alignment followed the direction of the Milky Way at certain times of the year.

A hunting blind was found in one location near a deep tinaja. The blind, located along a wash, opened to the southwest and consisted of a rock wall built up around a small rock shelter. Any animal walking south in the wash could have been struck at close range with an arrow.

Living off the land. This region was occupied for thousands of years by groups whose main occupation was hunting of animals and gathering of plants. Hunter/gatherer bands traveled in small groups that consisted of approximately ten nuclear families (Bostwick 1988). These bands would periodically come together or split into smaller groups based on resource availability. They would have kept moving from one living site to the next because resources, food and water, were in short supply and would have been depleted quickly at any one site. Native Americans have been observed to travel up to 4 hours daily to obtain water so it was not absolutely necessary to camp near water (Stone 1990). The Yavapai, who lived in this style, obtained approximately 60% of their total food intake from gathering and processing of plant material and 40% from hunting (Bostwick 1988). The typical Yavapai band would eat two meals a day, cooking their food by boiling water in baskets or pots using hot rocks, or roasting it on coals. Agave or cholla buds were cooked in earth ovens, and seeds were parched in flat baskets with hot coals. They did not eat any form of aquatic life such as fish, ducks, and turtles nor did they eat snakes (Gifford 1936).

The most intense use of the Eagletail Mountain Region occurred between 3,500 YBP and 2,000 YBP (Stone 1990), placing their occupation within the late Holocene. This was a time when the modern climate and flora would have been in place (Van Devender et al. 1979).

The region was also well known to other river-based groups. The Patayan people from the Colorado River and the Hohokam from the Gila and Salt Rivers visited this region to obtain specific resources. During the ceramic period and after, the region was well known to the Mohave people from the Colorado River as a place to collect quartz crystals. The Maricopa/Pima people were aware of

this region as a place to hunt bighorn sheep. The region was also known to all these groups as a source of fine-grained rhyolite, jasper, and chert for making tools. The Yavapai people were the more permanent residents of this region and would have lived on the wild plant and animal resources that were available. The Wiltaikapaya band of the Yavapai lived from the Eagletail Mountains north and the Haka-whatapa band lived from the Eagletail Mountains south (Stone 1990).

Sources of water. Without water people could not visit or live in this region. Because there are no permanent springs, the main source of surface water would have come from tinajas, which are naturally formed rock tanks. Water-filled tinajas are numerous after winter or summer rainstorms. These temporary sources of water are found in the deep canyons and washes on the south side of the range.

In various locations the people deepened or expanded the size of these tinajas. In one location, a shallow tinaja had a rock ring built around it that would expand its size but would only hold water if animal skins were placed inside the tank and held down with rocks. In another place a water fall existed and the water ran down the rock wall to a rock surface at its base. Large boulders were arranged in a circle around the base of the waterfall to form a dam. This rock alignment would have held water if soil were placed on the outside or if animal skins were placed inside the dam and held down with rocks.

More permanent tinajas have been found in deep washes. These can be up to 1.5 m (5 ft) deep and can hold water for longer periods of time, up to six months. In addition to Indian Springs, previously described, three of these deeper tinajas have been found in canyons on the south side of the range. These sites

are usually accompanied by bed-rock mortars, grinding slicks, rock circle alignments, flakes, and pottery These sites seem to have been occupied for longer periods of time and appeared to be reused periodically.

The last source of water would have come from sand tanks, which could have been converted to walk-in wells. These have no surface water but the water level would have been shallow and with a little digging water would be available. Since the water was not on the surface and subject to evaporation it would represent a more permanent source for individuals aware of its location. evidence of the permanence of this water source can be seen in a willow tree that has roots growing into a sand tank in the wash at Indian Spring canyon. The willow survived in an area without measurable rainfall for a period of fifteen months.

Use of plants. From Table 6 we see that 87 plants of the 292 species collected in the Eagletail Mountain Region were used mainly as food or for other purposes by the people living in this region. This represents about 30% of the total plant species collected. The table shows how these species were used and their local abundance in the region (Ebeling 1986; Felger & Broyles 2007; Hodgson 2001).

Table 6. Plants of Eagletail Mountain Region Used by Native Americans.

Name	Abundance	Ethnobotanical Usage
Acacia greggii CAT-CLAW ACACIA	Common	Pods ground in mortars to make flour. Seeds not used. Pods sometimes tasted bitter.
Aloysia wrightii OREGONILLO	Occasional	Leaves dried and crushed to be used as a flavoring. Also, dried leaves used in tea.
Amaranthus fimbriatus FRINGED AMARANTH	Occasional during wet summers only	Seeds gathered, ground, and eaten in late summer.
Amaranthus palmeri CARELESS WEED	Occasional during wet summers only	Leaves were very important as greens. Seeds were baked and eaten.
Ambrosia confertiflora SLIMLEAF RAGWEED	Occasional	Young leaves eaten as greens. Roots collected in fall to be eaten.
Antheropeas lanosum WOOLLY DAISY	Occasional	Seeds parched and ground into flour.
Atriplex polycarpa DESERT SALT-BUSH	Occasional	Fruits gathered in November and beaten in mortar to release seeds, which were baked.
Berberis haematocarpa RED BARBERRY	Infrequent	Fruits eaten.
Boerhavia erecta ERECT SPIDERLING	Occasional	Larvae of white lined Sphinx moth eat this plant and were in turn eaten by native people. Large outbreak of this insect larva seen eating this plant species in South Mountain Park in Phoenix after a wet summer in 2008.
Bouteloua barbata SIX-WEEKS GRAMA	Occasional in wet summers	Seeds collected, and ground into flour on a metate.
Brassica tournefortii SAHARA MUSTARD	Occasional	Leaves eaten as greens. Seeds provided flavoring to other foods. Non-native, only used since 1950s.
Bromus carinatus CALIFORNIA BROME	Infrequent	A cool season grass, in which the seeds were gathered, ground on a metate, and cooked into a bread or mush.
Camissonia californica SUN CUP	Occasional	Young leaves eaten as greens or steamed.
Carnegiea gigantea SAGUARO	Common	Yavapai collected ripe fruits, ate the fruit and saved the seeds for parching and grinding into flour.

Castela emoryi CRUCIFIXION THORN	Occasional	Fruits gathered and eaten.
Castilleja exserta PURPLE OWL'S CLOVER	Common in wet winters	Seeds gathered, dried, and stored for winter use after being parched and ground.
Celtis pallida DESERT HACKBERRY	Rare, only seen at points east of Eagletail Peak	Fruits of this species eaten fresh or cooked and then dried and ground on a metate. Fruits of *Celtis reticulata* a tree of this family had better flavor than this species.
Chaenactis stevioides DESERT PINCUSHION	Occasional	Seeds parched and ground into flour.
Cylindropuntia acanthocarpa BUCKHORN CHOLLA	Common	The most important species of this family. Flower buds were picked and baked in underground baking pits for 24 hours.
Cylindropuntia echinocarpa SILVER CHOLLA	Rare	Yavapai baked and ate flower buds of this species.
Cylindropuntia leptocaulis CHRISTMAS CACTUS	Infrequent	Fruits were eaten.
Daucus pusillus AMERICAN CARROT	Occasional	Roots cooked and eaten.
Delphinium parishii DESERT LARKSPUR	Infrequent	Flowers and leaves were boiled and eaten.
Descurainia pinnata TANSY MUSTARD	Occasional	Leaves eaten as greens. Seeds parched and ground into flour.
Dichelostemma capitatum ssp. *pauciflorum* BLUEDICKS	Occasional	Corms dug up in spring and eaten raw or cooked.
Dicoria canescens BUGSEED	Common seasonally	Seeds collected and dried to be eaten in winter.
Dudleya arizonica CHALK DUDLEYA	Rare, only 15 plants seen in one location	Leaves and stems eaten as greens.
Echinocereus engelmannii STRAWBERRY HEDGEHOG CACTUS	Occasional	Fruits are sweet and were eaten as soon as they became ripe. Thorns fall off when fruit is ripe.
Encelia farinosa BRITTLEBUSH	Abundant	Sap used as an adhesive or sealant.
Ephedra aspera BOUNDARY EPHEDRA	Occasional	Fresh and dried twigs boiled in water as a tea.
Eriogonum inflatum var. *inflatum* DESERT TRUMPET	Occasional	Young stems and leaves collected in spring and eaten raw or cooked. Seeds collected and ground on

		metates then were eaten as mush or baked.
Erodium texanum DESERT STORKBILL	Rare	Eaten as a green or cooked when young.
Eschscholzia minutiflora LITTLE GOLD POPPY	Occasional	Some groups gathered and cooked the leaves of this family before the plant would bloom.
Ferocactus cylindraceus BARREL CACTUS	Occasional	Flesh considered source of emergency water. Fruits were boiled and eaten. Seeds eaten.
Fouquieria splendens OCOTILLO	Common	Flowers and seeds eaten. Seeds were ground on metate.
Hesperocallis undulata DESERT LILLY	Occasional	Bulbs dug up and eaten raw, cooked, or boiled.
Justicia californica CHUPAROSA	Occasional	Nectar from flowers used as food, but not a main source of food for humans.
Larrea tridentata CREOSOTE BUSH	Abundant	This species has many uses but mainly as a medicine using dried leaves or ground roots as a poultice. Lac, produced by the lac scale, was used as an adhesive.
Lepidium lasiocarpum SAND PEPPERGRASS	Occasional	Provided greens and seeds for flour.
Leptochloa panicea ssp. *brachiata* RED SPRANGLETOP	Infrequent	Seeds gathered, ground, and made into flour.
Lotus salsuginosus COASTAL BIRDS-FOOT TREFOIL	Infrequent	Leaves employed as food.
Lupinus sparsiflorus MOHAVE LUPINE	Occasional	Plants of this family were used as greens as the leaves and flowers were steamed and baked.
Lycium andersonii DESERT WOLFBERRY	Common	Fruits eaten raw, cooked and mixed with flour for a sauce, or dried and then rehydrated at a later time. Formed a main part of diet as a fruit. Fruits normally ripened in spring.
Lycium berlandieri BERLANDIER'S WOLFBERRY	Occasional	Important as fruits ripened during summer.
Lycium exsertum ARIZONA DESERT-THORN	Occasional	Fruits also eaten though not as important as others in family.
Lycium fremontii FREMONT WOLFBERRY	Rare	Produces larger fruits than *L. andersonii* or *L. berlandieri.*

Mammillaria grahamii FISHHOOK CACTUS	Infrequent	Dried fruits eaten.
Matelea parviflora SPEARLEAF	Rare, only found in one location	Pods boiled and eaten.
Mentzelia involucrata SILVER BLAZING STAR	Occasional	Seeds collected, ground, and eaten. Storage jars with 3 pounds of these seeds found in a cave in New Mexico.
Mimulus guttatus MONKEYFLOWER	Rare, only seen during wet winters in one location	Leaves boiled and used as greens.
Muhlenbergia microsperma LITTLE-SEED MUHLY	Occasional	Seeds collected, ground on metates, toasted, and cooked as gruel.
Muhlenbergia porteri BUSH MUHLY	Occasional	Seeds collected, ground on a metate, toasted, and cooked as gruel.
Nama demissum PURPLE MATSEED	Occasional	Seeds collected, pounded in mortar, and boiled as a mush.
Nicotiana obtusifolia DESERT TOBACCO	Occasional	Leaves of this plant were dried and smoked. Many groups planted this species in fields close to their homes. Leaves either smoked as a cigarette or in a pipe.
Nolina bigelovii BEAR GRASS	Rare	Young stalks, flowers, and seeds cooked and eaten.
Oenothera deltoides WHITE DESERT PRIMROSE	Infrequent	Seeds used as food.
Oligomeris linifolia DESERT CAMBESS	Infrequent	Seeds are small, black, and shiny, and are collected, ground, and toasted. Seeds are numerous and in wet winters this species becomes a major source of food.
Olneya tesota IRONWOOD	Common along washes	Seeds were eaten, however they tasted bitter so were leached before they become food. Seeds were ground on a metate into a flour and boiled or baked.
Opuntia basilaris BEAVERTAIL PRICKLY- PEAR	Occasional, found only in western half of range	Young pads collected and dried to be boiled after glochids removed. Fruits also collected and steamed or boiled.
Orobanche cooperi DESERT BROOMRAPE	Rare	Young stems baked and eaten. Mature stems very bitter.
Panicum hirticaule PANIC GRASS	Rare	Seeds gathered and ground into flour on a metate then were mixed with water to form cakes.

Parkinsonia florida BLUE PALO VERDE	Occasional	When seeds were young they were pounded in mortar and eaten. When pods dried they were collected and pounded in mortars. Mature seeds not eaten as they were hard and bitter tasting.
Parkinsonia microphylla FOOTHILL PALO VERDE	Abundant	Young seeds and pods were eaten. Dried seeds and pods were ground in a mortar into flour. Seeds and pods of this species tasted better than did those of *Parkinsonia florida*.
Pectis papposa DESERT CINCHWEED	Common during wet summers	Stems and flowers eaten fresh and dried to be ground into flour.
Peniocereus greggii NIGHT-BLOOMING CEREUS	Rare, only 6 plants found in range	Fruits collected and eaten. Roots dug up and baked or boiled to be eaten.
Phalaris minor LITTLE-SEED CANARY GRASS	Rare	A cool season grass whose seeds were collected, ground on a metate, and eaten at end of spring season.
Phaseolus filiformis DESERT BEAN	Rare	Flowers, mature seeds, and immature pods were eaten.
Phoradendron californicum DESERT MISTLETOE	Common on trees of *Fabaceae*	Fruits of this species are edible and not bitter. Some people ate fruits of this species that were growing on *Prosopis*, *Olneya*, or *Acacia* but not *Parkinsonia* or *Condalia* as fruits on these species were considered to be bitter.
Physalis crassifolia DESERT GROUND CHERRY	Occasional	Fruits were eaten fresh or dried and cooked or stored for future use. Possibility exists that Hohokam domesticated this plant and grew it in their fields.
Plantago ovata DESERT INDIAN WHEAT	Abundant during wet winters	Seeds of this species were gathered and either ground and cooked or soaked and eaten as the seeds are mucilaginous when wet.
Pluchea sericea ARROWWEED	Rare, plants in one location	Stems used as arrow shafts. Roots gathered, roasted, and eaten.
Poa bigelovii BLUE GRASS	Infrequent	A cool season grass, in which seeds were collected and eaten before summer fruits were available.
Portulaca oleracea LITTLE HOGWEED	Rare	Fleshy stems and leaves eaten as fresh greens. Seeds also ground on metates and eaten.

Proboscidea althaeifolia DESERT UNICORN-PLANT	Infrequent	Seeds and immature fruits eaten. Fibers from dried fruits used in making baskets.
Proboscidea parviflora DEVIL'S CLAW	Occasional	Seeds and immature fruits eaten. Fibers from dried fruits used in making baskets.
Prosopis velutina VELVET MESQUITE	Common	Young pods and seeds chewed and eaten. Usually, the dried pods were collected in late summer. Pods pounded in mortars in to flour to be made into cakes. This is a most important food source as pod production was usually dependable.
Quercus turbinella SHRUB LIVE OAK	Occasional	Acorns of this species eaten by many groups. Seeds broken up into a meal in mortars. Meal was leached to remove tannins. Species fairly common but seldom produces acorns.
Rhus aromatica SKUNKBUSH	Rare, have seen four plants	Fruits and seeds cooked and eaten. Straight stems used in making baskets.
Salix gooddingii GOODINGS WILLOW	Rare	Young shoots and flowers eaten. Flowers made into a tea. Leaves and bark made into a tea as a medicine. Stems used in making baskets and large granaries for storage of seeds. Yavapai used branches to make their bows.
Salvia columbariae CHIA	Infrequent	Seeds collected and soaked in water. Became mucilaginous to make a beverage. Seeds also were ground and parched into flour.
Sarcostemma cynanchoides ssp. *hartwegii* CLIMBING MILKWEED	Occasional	Sap boiled as a chewing gum. Flowers also eaten.
Senna covesii COUES' CASSIA	Common during summer	Various groups ate seeds of this species.
Simmondsia chinensis JOJOBA	Common	Seeds eaten but not in large amount. Plant not considered main food plant of native people. Seeds oily and some considered taste to be bitter.
Sonchus oleraceus SOW THISTLE	Occasional	Leaves gathered and eaten when fresh. Non-native.
Sporobolus airoides ALKLI SACATON	Infrequent	Seeds of this species gathered and ground into flour on a metate to make a bread or mush.

Trianthema portulacastrum HORSE PURSLANE	Infrequent	Leaves eaten as greens.
Vulpia octoflora SIXWEEKS FESCUE	Infrequent	A cool season grass in which the seeds were gathered in the spring and ground into flour to be eaten at end of spring season.
Ziziphus obtusifolia GRAYTHORN	Occasional	Fruits considered very sweet when ripe, gathered and eaten raw.

Seeds, fruits, and leaves were the main parts of the plant that were used (Table 7). Some plants provided more than one usable part. If rainfall was insufficient, these plant parts would not be produced and thus would be

Table 7. Plant parts used.

Name of Plant Part	# of Plant Parts	% of Total
Buds	2	2.2
Bulbs	2	2.2
Flowers	3	3.3
Fruits	19	20.9
Leaves	18	19.8
Pods	4	4.4
Roots	4	4.4
Seeds	35	38.5
Twigs/Stems	4	4.4

unavailable to the people living in this region. The population levels of the 87 species indicate that 55 are abundant, common, or occasional in the region and 32 are infrequent or rare. Thus only the 55 species would have been regularly available to the people living in the region.

Table 8. Description of plants used as food.

Plant Description	# of Plants	% of Total
Cool Season Annual	26	30.0
Warm Season Annual	12	13.8
Shrub	22	25.3
Tree	5	5.8
Succulent	9	10.3
Perennial Herb	11	12.6
Perennial Bulb	2	2.3

Cool season annuals made up the majority of plants eaten (Table 8). These plants would be in bloom and produce seeds at the end of the cool season. Most of these species would be used either for leaves as a green or seeds that would be ground on a metate and made into a mush or cake to be baked. Warm season annuals would be used in the same way as the cool season annuals.

Shrubs would mainly produce fruits or large seeds that would be eaten and would be available at various times of the year depending on rainfall. The edible portion of plants of the family *Fabaceae* (legumes), which are the pods and seeds, are mainly available during the warm season of the year, were very dependable, and would be available even if dry conditions existed. The seeds of perennial herbs and grasses would be considered non-seasonal and could be available during the year depending on rainfall. Succulents (mainly cacti) provided fruits and seeds and were also very dependable. Perennial bulbs were only present after cool season rains and with sufficient winter rainfall.

One wonders how often the residents would have been able to secure sufficient plant food from this region. Long term studies conducted in the Mojave Desert reveal that in order for winter annuals to germinate and provide fruits and

seeds, an initial rainfall of 25 mm (1 in) must occur between October and December followed by subsequent smaller rainfall events. These same rainfall requirements also occur during the warm season (Rundel & Gibson 1996). Because the region has a dual rainy season sufficient plant material could have been available for use during either the cool season or warm season or both. Rainfall records in the Eagletail Mountains over a 19 year period revealed that favorable climatic conditions existed 8 times or 42% of the time in the cool season and 14 times or 74% during the warm season. In six of the 19 years sufficient rain fell in both the winter and the summer seasons. In three years insufficient rain fell in both the winter and the summer season. Reviewing the rainfall on an annual basis shows that there was sufficient rainfall for plants to germinate or provide fruit and nuts for small bands of people living in this region in 16 of the 19 years, or 84% of the time.

It must be remembered that the residents that lived here occupied a large territory and moved from site to site searching for areas that had received rainfall. The Yavapai band, Haka-whatapa, occupied a large territory that stretched from the Eagletail Mountains on the north and east to the Gila River on the south to the Colorado River on the west (Stone 1990).

The most useful species based on its abundance and reliability in the Eagletail Mountain Region is *Prosopis velutina.* Because it depends on ground water rather than rainfall it provides pods and seeds four out of five years. The other tree legumes, *Olneya tesota* and *Parkinsonia* spp., are much less dependable as they are more reliant on rainfall (Stone 1990).

The other useful species, based on its abundance in the Eagletail Mountain Region, is *Carnegiea gigantea*. This species is even more reliable than

is *Prosopis velutina* because it is a succulent and is drought resistant (Stone 1990). Other species of Cactaceae found in this region that were fairly abundant and would have been used extensively include *Cylindropuntia acanthocarpa* and *Opuntia basilaris.*

The abundant annuals found in the Eagletail Mountain Region that would have provided food included *Amaranthus* spp.*, Bouteloua barbata*, *Castilleja exserta*, *Daucus pusillus*, *Descurainia pinnata*, *Dicoria canescens, Mentzelia* spp.*, Muhlenbergia microsperma, Pectis papposa,* and *Plantago ovata*. Other species that would have been used if they were more common include *Erodium texanum*, *Oligomeris linifolia, Phaseolus filiformis, Panicum hirticaule, Poa bigelovii, Portulaca oleracea,* and *Salvia columbariae.*

Perennials that are common in the Eagletail Mountain Region included *Ambrosia confertiflora, Dichelostemma capitatum, Hesperocallis undulata, Muhlenbergia porteri, Nicotiana obtusifolia, Phoradendron californicum, Physalis crassifolia,* and *Sarcostemma cynanchoides.* Other perennials that would have been used if they had been more abundant include *Delphinium parishii*, *Dudleya arizonica*, *Matelea parvifolia*, and *Sporobolus airoides*. *Sporobolus* spp. was the main perennial grass used by people of the deserts of central Arizona.

Common shrubs of the Eagletail Mountain Region that would have been used include *Acacia greggii, Aloysia wrightii, Atriplex polycarpa, Castela emoryi, Encelia farinosa, Ephedra aspera, Fouquieria splendens, Larrea tridentata, Lycium* spp.*, Simmondsia chinensis*, and *Ziziphus obtusifolia.* Other shrubs of lesser abundance include *Berberis haematocarpa, Celtis pallida, Nolina bigelovii, Pluchea sericea, Quercus turbinella,* and *Rhus aromatica.* Under present climatic conditions these shrubs seldom produce fruits. *Quercus* sp. was used

extensively for its acorns in other habitats and is fairly common in the Eagletail Mountains but it seldom produces acorns so would be of little use as a food plant. The other species are rare in the region.

The one species that is missing from this region that would have been heavily used is *Agave deserti,* which is a drought resistant leaf succulent and is very reliable, which produces its highest nutrient value in late winter and spring (Stone 1990). The Yavapai depended on this species as a primary food item in the winter/early spring season when other plants were dormant but *Agave* was also eaten year around (Gifford 1936).

Another species of interest found in the Eagletail Mountains is *Salix gooddingii*, which is represented by one tree in Indian Spring Canyon. The Yavapai used this species in many ways as reported in Table 6. This species was formerly abundant along the Gila River located to the south of this region. The question is how the willow came to this location in the Eagletail Mountains. Perhaps it might have arrived as a seed caught up in a summer storm or dissipating tropical storm or it might have been transplanted by the people who lived in this region. A branch cut from a living tree can easily be established in a location that has a shallow water table. Native Americans have a long history of manipulating the landscape to better their environment including the cultivating of seeds of useful plants. Walnut trees grow in central California near archeological sites and the Cahuilla were known to spread seeds of *Washingtonia filifera* (fan palm) to other locations (Anderson 2006). An analysis of the range distribution of *Salix gooddingii* from (SEINet 2011) reveals that in southwestern Arizona, north of the Gila River, it is found in six locations in various mountain ranges:

Table 9. *Salix gooddingii* localities in southwestern Arizona.

Locality	Mountain range
Brown Canyon	Harquahala Mountains
Dead Horse Tank	Big Horn Mountains
Dripping Springs	New Water Mountains
Dushey Canyon	Harquahala Mountains
Horse Tank	Castle Dome Mountains
Indian Springs Canyon	Eagletail Mountains

Two other locations in which this species have been observed but not collected are Alamo Springs in the Kofa Mountains and Tres Alamos Spring north of Date Creek.

What these locations have in common is that they are isolated springs/seeps not connected to any riverine systems, were occupied by Yavapai bands, and *Populus fremontii* (cottonwood) is not found. In other parts of Arizona it appears that *P. fremontii* is the common species at isolated springs/seeps.

Use of animals. The use of animals as food in this region is based on an ethnographic analysis of the Yavapai people (Gifford 1936) and would probably apply to the Archaic people who preceded them. Bostwick's (1988) excavation of the site along Centennial Wash revealed that the main animal species consumed as food included cottontail rabbits, ground squirrels, jackrabbits, and woodrats as well as desert mule deer and bighorn sheep. The Yavapai also consumed desert tortoises but would not eat antelope found in Harquahala Valley as it was believed that the antelope ate toads (Gifford 1936).

Deer were usually hunted in the late fall and winter and again in the late summer and early fall. Bighorn sheep were hunted in the spring and again in the

late summer and early fall (Stone 1990). The Yavapai often hunted large game animals with poison arrows. The poison was made from various ingredients including rattlesnake, spider, and centipede venom which was pulverized, dried, and baked. The poison usually took about 24 hours to take effect (Gifford 1936). This may have been the main method of hunting large animals in the Eagletail Mountain Region as few stone arrowheads have been found.

The Eagletail Mountain Region supports large numbers of game animals. When the author first began to visit the region in 1990, it was common to see groups of mule deer, 4-6 animals in a group, traveling during the day in the winter/spring. Occasionally, in the spring herds of 12-15 mule deer were seen. However, with the drought that began in June, 2001 and ended in August, 2002 the population of mule deer in the region collapsed. Since that time mule deer travel singlely or in pairs and are rarely seen. This region was well known to other groups as a good place to hunt mule deer and bighorn sheep. The Pima and Maricopa people may have traveled to this region from the Salt and Gila River area to hunt large game animals (Stone 1990).

Small animals such as lizards, mammals, birds, and insects were usually collected by either men or women. Large game animals were usually hunted by men. Deer were hunted by various methods including the driving of deer into a net or other enclosure, running down the deer until it became exhausted, or shooting the deer with arrows from a hunting blind (Gifford 1936).

Animals were cooked using various methods. Tortoises were baked in their shell in small earthen ovens as were rabbits and bighorn sheep. Rabbits were also cooked in ashes or were boiled (Bostwick 1988).

Agriculture in the region. Agricultural practices (defined as flood water irrigation of corn, beans, and squash), appears not to have been practiced given the absence of cleared areas, check dams, or long rock alignments for diverting water. This lack of agriculture was not due to insufficient precipitation as the rainfall in this region is equal to or exceeds rainfall that occurs in other locations in southwestern Arizona in which fields have been found. Evidence of corn pollen was found in valleys south and west of Gila Bend, which has a climate more xeric than that of the Eagletail region (Altschul & Rankin 2008) and agricultural field sites were located along the Winters Wash drainage that is east of the Palo Verde Hills (Stone 1990).

Conclusion. Stone (1990) feels that the most extensive use of the Eagletail Mountain Region occurred between 3,500 YBP and 2,000 YBP by Archaic cultures with less extensive use of the area by later groups. This is based on the excavation of one site along Centennial Wash (Bostwick 1988) and the survey of the petroglyph site at Indian Springs (Stone 1986). Land use patterns in this region include 1) temporary or seasonal use of natural resources by river based groups, probably farmers such as Hohokam or Patayan, 2) occupation by mobile groups relying primarily or fully on wild resources such as the Archaic or Yavapai, and 3) travel and associated transient resource use by other groups such as the Mohave, Pima or Maricopa (Stone 1986). The Patayan predominately were found along the Colorado River but extended their range into the deserts east of the river to obtain resources. The origin of the Yavapai is not clear. The most accepted theory is that they were a Patayan culture that spoke an upland Yuman dialect that moved into western Arizona between 700 YBP and

1,300 YBP (Braatz 2003; Stone 1986). The other groups of people that came to the region, which included the Hohokam, Mohave, Pima, and Maricopa, would be considered visitors who came to hunt large game or for special resources such as collecting rhyolite for making tools, and mining quartz crystals.

Based on the number and distribution of plant processing tools, metates, manos, and flakes found in the region, especially in the valleys north of Indian Springs Canyon, it would appear that plant processing was common. However, from an evaluation of the flora used by the native inhabitants, it appears that many of the species used for food are not found growing in those locations currently or are found in small populations. Remember that the current flora and climatic condition extends back into the late Holocene. What then were the people gathering and eating? Archaic people may have been using this region earlier than the late Holocene, 3,500 YBP, (Stone 1990), which could indicate that they were here during the early to middle Holocene when the climate and flora were different, and they would have had access to different species. For example, *Quercus turbinella*, may have been more numerous and able to produce acorns that could have been used as food. Also, plants such as *Rhus aromatica* and *Berberis haematocarpa,* which are rare, and *Agave deserti,* which was not found, might have been available at that time.

Another piece of evidence that may support the view that people occupied this region in the early to middle Holocene is that the majority of sites are located on the south side of the range along the major canyons and washes. A few temporary camp sites along trails that crossed through the range near Courthouse Rock are the only sites found on the north side of the range. This would indicate that the rich plant life found in the slot canyons and north-facing

bajada slopes on the north side of the range were not being heavily used possibly because sufficient plant foods were available in the more accessible south side of the range. Under current climatic conditions with the existing flora we do not see the population or diversity of species that the early Archaic residents may have been able to exploit.

Historic use of this region by non-native people. Historically this region was very isolated. There is no record of any visits made by Spanish explorers, and the first historic petroglyphs at Indian Springs are dated to 1908. In contrast, historic petroglyphs in the Gila River basin date to the 1840's, those at Saddle Mountain date to the 1870's, and those at Dripping Springs in the New Water Mountains date to the 1860's. It is possible that the first persons of European decent that traveled in the Eagletail Mountain Region were Olive Oatman and her sister after their family was attacked in 1851. McGinty (2005) provides evidence that points to the Yavapai as being the attackers of Olive's family and that the village that they were taken to was near the town of Salome, Arizona on Centennial Wash. Stratton (1994) quotes Olive that after the attack, which took place on the bluffs overlooking the Gila River on its south side, the Yavapai immediately, crossed the river, followed established trails, stayed in established campsites, and traveled at night. The most logical pathway for them to follow would be to go west to Agua Caliente, north to Clanton Well, continue north to the Indian Springs area in the Eagletail Mountains, travel through that range to Centennial Wash, and follow that wash to their village near Salome.

Clyde Ross, a geologist with the U.S.G.S., conducted the first historic survey of water sources in the area of Arizona, north of the Gila River and west

of Buckeye, and south of the Harquahala Mountains in 1917. In the Eagletail Mountains he visited Willow Springs, now Indian Springs (Ross 1923).

Mining and grazing are the only activities that have affected the Eagletail Mountain Region. Most of the mining activity occurred along Cemetery Ridge starting in the 1870s and ending in the early 1900s. A small community named Palomas located near Nottbusch Butte supported that activity. The town was sold in 1940 (Barnes 1960). Only a few mining claims were filed in the Eagletail Mountains,and none of them are currently active.

There are three grazing allotments in the Eagletail Mountain Region. All of them are classified as perennial/ephemeral and are currently being grazed (Bureau of Land Management, BLM 1994). All of the grazing occurs on the periphery of the region especially on its eastern, southern and northern boundaries. No grazing occurs in the Eagletail Mountains presently due to a lack of water, so the effect of grazing on the vegetation and wildlife has been minimal. Additionally, the BLM reports that there is no history of wildfire suppression in the region (BLM 1994).

In conclusion, the Eagletail Mountain Region may have been occupied by Native Americans for at least 3.500 year, prehistorically, and by people of European decent for 140 years, historically.

REFERENCES

Allaby, M. 1994. *The Concise Oxford Dictionary of Ecology.* Oxford University Press, WaltonStreet, Oxford. 415 pp.

Altschul, J. H. and Rankin, A. G., editors. 2008. *Fragile Patterns: The Archeology of the Western Papagueria.* SRI Press, Tucson, Arizona.731 pp.

Anderson, K. M. 2006. *Tending the Wild.* University of California Press, Berkeley California.526 pp.

Barnes, W. C. 1960. *Arizona Place Names.* University of Arizona Press, Tucson Arizona. 519 pp.

Betancourt, J. L., Van Devender, T. R., Martin, P. S., editors. 1990. *Packrat Middens: The last 40,000 Years of Biotic Change.* The University of Arizona Press, Tucson, Arizona. 467 pp.

Bezy, J. V., Gutmann, J. T., and Haxel, G. B. 2000. *A Guide to the Geology of Organ Pipe Cactus National Monument and the Pinacate Biosphere Reserve.* Tucson: Arizona Geological Survey.

Bostwick, T., editor. 1988. *An Investigation of Archaic Subsistence and Settlement in the Harquahala Valley, Maricopa County, Arizona.* U.S. Department of Interior, Bureau of reclamation, Arizona Projects Office, Contract 3-PA-30-00740, task 12. Northland Research Inc., Flagstaff, Az. 422 pp.

Braatz, T. 2003. *Surviving Conquest: A History of the Yavapai Peoples.* Board of Regents of the University of Nebraska. 299 pp.

Brown, D. E. 1978. The Vegetation and Occurrence of the Chaparral and Woodland Flora on Isolated Mountains within the Sonoran and Mojave deserts in Arizona. *Journal of the Arizona-Nevada Academy of Science*. 13: 207-212.

Brown, D. E., editor. 1994. *Biotic Communities; Southwestern United States and Northwestern Mexico.* University of Utah Press, Salt Lake City, Utah. 342 pp.

Ebeling, W. 1986. *Handbook of Indian Foods and Fibers of Arid America*, University of California Press, Berkeley, California. 971 pp.

Felger, R. S. 2000. *Flora of the Gran Desierto and Rio Colorado of northwestern Mexico.* University of Arizona Press, Tucson, Arizona. 673 pp.

Felger, R. S. and Broyles, B., editors, 2007. *Dry Borders: Great Natural Preserves of the Sonoran Desert.* University of Utah Press, Salt Lake City, Utah. 799 pp.

Felger, R. S. and Van Devender, T. R. In Press. Flora of Tinajas Altas, Arizona – A Century of Botanical Forays and Forty Thousand Years of Neotoma Chronicles. *San Diego Natural History Museum.*

Giffords, E.W. 1936. Northeastern and Western Yavapai. *University of California Publications in American Archeology and Ethnology*. 34, No. 4. University of California Press Berkeley, Ca. 247-354.

Gilbert, W. G., Laux, D. P., Spencer, J. E., and Richard, S. M. 1992. *Geologic Map of the Western Gila Bend and Southern Eagletail Mountains, Maricopa and Yuma Counties.* Arizona. Tucson: Arizona Geological Survey Open- File Report 92-5.

Harris, J. G. and Harris, M. W. 1994. *Plant Identification Terminology.* Spring Lake Publishing, Payson, Utah. 197 pp.

Hendricks, D. M. 1985. *Arizona Soils.* University of Arizona, Tucson, Arizona 244 pp.

Hodgson, W. C. 2001. *Food Plants of the Sonoran Desert.* University of Arizona Press.Tucson, Arizona. 313 pp.

Johnson, B. 1992-1996. U.S. Department of Interior, Bureau of Land Management, Yuma Resource Area, Regional Archaeologist. Personal Communications.

Kearney, T. H., and Peebles, R. H. 1960. *Arizona Flora.* University of California Press, Berkeley, California. 1,085 pp.

McAuliffe, J. R. 1994. Landscape Evolution, Soil Formation, and Ecological Patterns and Processes in Sonoran Desert Bajadas. *Ecological Monographs*, 64:111-148.

McAuliffe, J. R. and Van Devender. T. R. 1998. A 22,000-year Record of Vegetation Change in the North-Central Sonoran Desert. *Paleogeography, Paleoclimatology, Paleoecology*, 141(1998): 253-275.

McGinty, B. 2005. *The Oatman Massacre: A tale of Desert Captivity and Survival.* University of Oklahoma Press, Norman Oklahoma. 258 pp.

McLaughlin, S. P. 2008, Vascular Flora, In: P. F. Ffolliott and O. K. Davis., editors, *Natural Environments of Arizona*. University of Arizona Press, Tucson, Az. 196 pp.

McLaughlin, S. P.2007, Tundra to Tropics: The Floristic Plant Geography of North America, BRIT PRESS, No. 30, 20 April, 2007, *Botanical Research Institute of Texas*, Fort worth, Texas.

Monroe, J. S., and Wicander, R. 1995. *Physical Geology, Second edition.* St Paul, Minnesota. West Publishing Company. 627 pp.

Mulroy, T.W. and Rundel, P.W. 1977. Annual Plants: Adaptations to Desert Environments. *Bioscience:* 27: 109-114.

Neilson, R.P., and Wullstein, L.H. 1983. Biogeography of Two Southwest American Oaks in Relation to Atmospheric Dynamics. *Journal of Biogeography*, 10: 275-297.

Palmer, M.W., Wade, G.L., and Neal, P. 1995. Standards for the Writing of Floras*. Bioscience* 45: 339-345.

Reynolds, S. J. 1988. *Geologic Map of Arizona, Map 26.* Arizona Geological Survey.

Rogers, Malcome J. 1966. *Ancient Hunters of the Far West*. Ed Richard F. Pourade. Union-Tribune Publishing Company, San Diego. 208 pp.

Ross, C. P. 1923. *Department of Interior, U.S.G.S., Water Supply Paper 498.* Government Printing Office, Washington, D.C.

Rundel, P. W. and Gibson, A. C. 1996. *Ecological Communities and Processes in a Mojave Desert Ecosystem: Rock Valley, Nevada*. Cambridge University Press, New York. 369 pp.

Sellers, W. D. and Hill, R. H. 1974. *Arizona Climate 1931-1972.* The University of Arizona Press, Tucson, Arizona. 616 pp.

Shreve, F. 1951. *Vegetation of the Sonoran Desert.* Carnegie Institution of Washington Publication 591. Washington D.C. 186 pp.

Southwest Environments Information Network (SEINet). March, 2012. <http//swbiodiversity.org/seinet.index. *Arizona State University, Southwestern Natural History Database, Life Sciences Collections.*

Spencer, J. E., Gilbert, W. G. and Richard, S. M. 1992. *Geologic Map of the Eastern Eagletail Mountains, Maricopa, La Paz, and Yuma Counties, Arizona,* Open-File Report 92-3.Tucson: Arizona Geological Survey.

Spencer, J. E., Richard, S.M., and Ort, M. H. 1993 (Updated 1997). *Geologic Map of the Western Eagletail Mountains La Paz, County, Arizona*. Open – File Report 93-12. Tucson: Arizona Geological Survey.

Stone, C. L. 1986. *Deceptive Desolation: Prehistory of the Sonoran Desert in West-Central Arizona*. Cultural resource Series, Monograph # 1. Arizona State Office of the Bureau of Land Management. 172 pp.

Stone, C. L. 1986. *Report on the Eagletail Rock Art Site, AZ S: 11:1 (ASM).* U.S. Bureau of Land Management, Phoenix District Office.

Stone, C. L. 1990. *Living in no Man's Land: Prehistoric Economic Strategies and Land Use Patterns in Western Arizona Outback*. PhD thesis. Arizona State University, Tempe, Az. 362 pp.

Stratton, R. B. 1994. *The Captivity of the Oatman Girls among the Apache and Mohave Indians.* Dover Publications, Inc., Mineola, N.Y. 209 pp.

Turner, R. M., Bowers, J. E., and Burgess, T. L. 1995. *Sonoran Desert Plants: an Ecological Atlas*. University of Arizona Press, Tucson, Arizona. 504 pp.

U.S. Department of Agriculture – Natural Resources Conservation Service. 2012. The Plants Database, (http://plants.usda.gov, 19, March, 2012). National plant Data Team, Greensboro, North Carolina 27401 – 4901.

U.S. Department of Commerce. <www.wrcc.dri.edu/summary/climsmaz.html. October, 2010. National Oceanic and Space Administration. National Weather Service. Silver Springs, Maryland, 20910.

U.S. Department of Interior, Bureau of Land Management, Arizona State Office, Yuma Resource Area. September. 1994. *Eagletail Mountains Wilderness Management Plan and Environmental Assessment*. E.A. Number: EA – AZ-055-94-80.

U.S. Department of Interior, Bureau of Land Management, U.S. Fish and Wildlife Service; Yuma Field Office, Kofa National Wildlife Refuge. October, 1996. *Kofa National Wildlife Refuge & Wilderness and New Water Mountains Wilderness Interagency Management Plan and Environmental Assessment.* EA Number: EA-AZ-055-95-105.

Van Devender, T. R. and Spaulding, W. G. 1979. Development of Vegetation and Climate in the Southwestern United States. *Science*, 204: 701-710.

Van Devender, T. R., Thompson, R.S., and Betancourt, J. L. 1987. Vegetation History of the Deserts of Southwestern North America; The Nature and Timing of the Late Wisconsin-Holocene Transition. *The Geology of North America, Vol. K-3, North America and Adjacent Oceans during the last Deglaciation.* The Geological Society of America: 323 – 350.

Wetherwax, M., managing editor. 2002. *The Jepson Desert Manual.* University of California Press, Berkeley, California. 624 pp.

APPENDIX A

FLORA OF EAGLETAIL MOUNTAIN REGION

Taxa are arranged alphabetically by family, genus, and species. Nomenclature, author name, and abbreviations follow the USDA PLANTS database (2012), with exception for those species that are based on the new treatment for Arizona published in the “Journal of Arizona-Nevada Academy of Science” and “Canotia”. A description of information included in this flora follows:

A. Definitions of the growth forms used to describe the plants:
Annual – One year life cycle. Plants active within the cool season (November – March), warm season (summer monsoon period), or non-seasonal (active within either cool or warm season).

Perennial – Life cycle more than two years and non-woody at base. Can grow from underground bulb, tuber or be vining.

Shrub – Multiple woody stems, usually shorter than trees. Plants can be deciduous, without leaves during dry season, evergreen, holding leaves year around, or fleshy.

Sub-shrub – Lower stems are woody, and upper stems are herbaceous. Can be either deciduous or evergreen.

Tree – Large woody plant with one or a few woody stems can be deciduous, evergreen, or fleshy.

B. Plants that are considered non-native in North America are identified by an asterisk (*) at the end of the species name. Plants are considered native if they were present before the entry of Columbus.

C. Common names based on the USDA PLANTS database and local floras including Felger (2000).

D. Elevation based on the elevation range of the species collected or observed.

E. Flowering time is specific to species collected in the region.

F. Eight habitat types were identified: bottom of sandy washes, side of sandy washes, bajada slope-volcanic soil- lower elevation, bajada slope-volcanic soil-upper elevations, bajada slope-granitic sandy soil, slot canyons/ rock outcrops, desert pavement, open valleys. Habitat types are based on observation as well as vouchers, or interpreted from locality data of other collectors.

G. Locality represents locations in Eagletail Mountain Region where plants were collected.

H. Abundance adopted from Palmer (1995) and includes:

1. Abundant – Dominant or codominant in one or more common habitats.
2. Frequent – Easily seen or found in one or more common habitats but not dominant in any common habitat.
3. Occasional – widely scattered but not difficult to find.
4. Infrequent – Difficult to find with few individuals or colonies but found in several locations.
5. Rare- Very difficult to find and limited to one or very few locations or uncommon habitats.

I. Collector and number of voucher specimens. Collections deposited at ASU herbarium have been verified.

Acanthaceae *Carlowrightia arizonica* Gray. ARIZONA CARLOWRIGHTIA. Deciduous subshrub. 490 – 610 m. March-April, October. Side of sandy washes. Eagletail Mountains; canyon E of Indian Springs Canyon, canyon SW of end of cherry stem road. Infrequent. DN 111, 329, 555, 646; Lehto 21239.

Acanthaceae *Justicia californica* (Benth.) D. Gibson. CHUPAROSA. Deciduous shrub. 490 – 600 m. March, December. Side of sandy washes; rock outcrops. Eagletail Mountains; Indian Springs Wash, Courthouse Rock. Occasional. DN 39, 91; Lehto 21195, 21241.

Aizoaceae *Trianthema portulacastrum* L. HORSE PURSLANE. Warm season annual. 360 m. August. Open valley. Harquahala Valley. Infrequent. DN 169.

Amaranthaceae *Amaranthus fimbriatus* (Torr.) Benth. ex S. Wats. FRINGED AMARANTH. Warm season annual. 540 – 640 m. August-September. North-facing bajada slopes on volcanic soil base. Eagletail Mountains; Indian Springs Wash, 2 km. W of Eagletail Peak. Occasional during wet summers only. DN 20, 35, 301, 398, 412.

Amaranthaceae *Amaranthus palmeri* S. Wats. CARELESS WEED. Warm season annual. 360 m. August. Open valley. Harquahala Valley. Occasional during wet summers only. DN 167.

Amaranthaceae *Tidestromia lanuginosa* (Nutt.) Standl. HONEYSWEET. Warm season annual. 520 – 560 m. July-September. North-facing bajada slopes on volcanic soil base. Eagletail Mountains; Indian Springs Wash. Common during wet summers only. DN 22, 307, 339.

Anacardiaceae *Rhus aromatica* Ait. SKUNKBUSH. Deciduous shrub. 570 – 656 m. February – March, Slot canyons; north-facing rock outcrops. Eagletail Mountains; Triple Eye tank Canyon, Arches Canyon E of Eagletail Peak. Rare, have seen four plants. DN 2, 60, 504; Butterwick 8005; Anderson 2003-5-a.

Apiaceae *Bowlesia incana* Ruiz & Pavón. HOARY BOWLESIA. Cool season annual. 516 m. February. Bajada slope, south-facing, granitic sandy soils. Granite Mountains. Infrequent. DN 263.

Apiaceae *Daucus pusillus* Michx. AMERICAN CARROT. Cool season annual. 510 – 640 m. March-April. Sides of sandy washes; north-facing rock outcrops. Eagletail Mountains; Dead Deer Tank Canyon, Indian Springs Canyon. Occasional. DN 481, 572.

Asclepiadaceae *Asclepias albicans* S. Wats. WHITE-STEM MILKWEED. Perennial herb. 450 – 540 m. March. Top of and north-facing side of rocky outcrops. Eagletail Mountains; SW of end of cherry stem road. Rare, only three plants seen. DN 530, 676, 698; Reina 96-94.

Asclepiadaceae *Asclepias nyctaginifolia* Gray. MOJAVE MILKWEED. Perennial herb. 488 – 560 m. April – September. Bottom of sandy washes. Eagletail Mountains; Indian Springs Canyon. Infrequent. DN 56, 456; Butterwick 7363.

Asclepiadaceae *Matelea parviflora* (Torr.) Woods. SPEARLEAF. Perennial herb.492 m. March. Rock outcrop, north-facing. Eagletail Mountains; SW of cherry stem road. Rare, only found in one location. DN 650.

Asclepiadaceae *Sarcostemma cynanchoides* ssp*. hartwegii* (Vail) R. Holm. CLIMBING MILKWEED. Perennial herb, twining. 509 – 560 m. April. Sides of large sandy washes. Eagletail Mountains; Indian Springs Wash. Occasional. DN 145, 452; Lehto 21245.

Asteraceae *Acourtia wrightii* (Gray) Reveal & King. BROWNFOOT. Perennial herb. 540 – 575 m. September – October. Sides of sandy washes. Eagletail Mountains; Indian Springs Canyon, Dead Deer Tank Canyon. Occasional. DN 16, 122.

Asteraceae *Adenophyllum porophylloides* (Gray) Strother. SAN FELIPE DOGWEED. Deciduous subshrub. 487 – 579 m. March – May, September – October. Sandy washes; bajada slopes, volcanic soils. Eagletail Mountains; Indian Springs Wash. Occasional. DN 78, 289, 411, 684.

Asteraceae *Ambrosia acanthicarpa* Hook. ANNUAL BURSAGE. Warm season annual. 520 m. October. Side of sandy washes. Eagletail Mountains; Indian Springs Canyon. Rare. DN 26.

Asteraceae *Ambrosia ambrosioides* (Cav.) Payne. CANYON RAGWEED. Perennial herb. 482 m. March – May. Side of sandy washes. Eagletail Mountains; Indian Springs Wash. Common. DN 75; Lehto 21232.

Asteraceae *Ambrosia confertiflora* Dc. SLIMLEAF RAGWEED. Perennial herb. 440 – 520 m. May – June and October – November. Side of sandy washes. Eagletail Mountains; Indian Springs Canyon; EPNG pipe line road. Occasional. DN 48, 547, 600.

Asteraceae *Ambrosia deltoidea* (Torr.) Payne. TRIANGLELEAF BURSAGE. Deciduous shrub. 394-400 m. March. Open valley. Clanton Well Road S of Eagletail Mountains. Occasional. Not found in the mountain range, but only in the open valleys south of the range. DN 110, 537, 630.

Asteraceae *Ambrosia dumosa* (Gray) Payne. WHITE BURSAGE. Deciduous shrub. 425 – 546 m. May, October. Bajada slopes, volcanic soils; sides of sandy washes; open valleys. Eagletail Mountains; Indian Springs Wash, EPNG Pipeline Road. Abundant. The only shrubby bursage found in the mountain range. DN 55, 89.

Asteraceae *Antheropeas lanosum* (Gray) Rydb. WOOLLY DAISY. Cool season annual. 490 – 540 m. February-April. Bajada slopes, granitic sandy soils, volcanic soils. Granite Mountains; Eagletail Mountains; Courthouse Rock, Triple Eye Catchment. Occasional. DN 279, 427, 597, 661.

Asteraceae *Baccharis brachyphylla* Gray. SHORTLEAF BACCHARIS. Deciduous shrub. 520 m. November. Side of sandy washes. Eagletail Mountains; Indian Springs Wash. Infrequent. DN 49.

Asteraceae *Baccharis sarothroides* Gray. DESERT BROOM. Deciduous shrub. 362 – 380 m. August. Side of sandy washes. Harquahala Valley, Apache Box. Occasional along major washes. DN 168, 579.

Asteraceae *Baileya multiradiata* Harvey & Gray ex Gray. MANY- FLOWERED DESERT MARIGOLD. Perennial herb. 432-490 m. March, July, October. Bottom of sandy wash along road; open valleys. Eagletail Mountains; along road to Indian Springs Canyon; Harquahala Valley. Infrequent. DN 79, 624.

Asteraceae *Bebbia juncea* (Benth.) Greene. SWEETBUSH. Deciduous subshrub. 500 – 615 m. February-May, November. Slot canyons; side of sandy washes. Eagletail Mountains; Indian Springs Canyon, canyon NW of Eagletail Peak, canyon E of Eagletail Peak. Common. DN 62, 128, 152, 296, 565.

Asteraceae *Brickellia coulteri* Gray. BRICKELLBUSH. Deciduous shrub. 500 – 640 m. March-April, September-December. Rock outcrops; bajada slopes, volcanic soils; sides of sandy washes; slot canyons. Usually on north-facing sides. Eagletail Mountains; Courthouse Rock, Indian Springs Canyon, Dead Deer Tank Wash; canyon north of Triple Eye Arches, Double Eagle Peak. Occasional. DN 25, 99, 121, 137, 323, 388, 399, 498, 544, 567, 574, 640; Lehto 21237; Reina 96-100.

Asteraceae *Calycoseris parryi* Gray. YELLOW TACKSTEM. Cool season annual. 510 m. February. Bajada slopes, granitic sandy soils. Granite Mountains, west side. Occasional. DN 374.

Asteraceae *Calycoseris wrightii* Gray. WHITE TACKSTEM. Cool season annual. 520 m. March. Side of sandy washes on volcanic tuff. Eagletail Mountains, north of Triple Eye Arches. Infrequent. DN 65.

Asteraceae *Chaenactis carphoclina* Gray. PEBBLE PINCUSHION. Cool season annual. 488 m. April. Bottom of sandy washes. Eagletail Mountains; Indian Springs Wash. Infrequent. DN 227; Lehto 21227.

Asteraceae *Chaenactis stevioides* Hook. & Arn. DESERT PINCUSHION. Cool season annual. 520 m. April. Bottom of sandy washes; bajada slopes, granitic

sandy soils. Granite Mountains; Eagletail Mountains; Indian Springs Wash. Occasional. DN 226; Unruh 3.

Asteraceae *Conyza canadensis* (L.) Cronq. HORSEWEED. Warm season annual. 545 m. November. Side of sandy washes. Eagletail Mountains; Indian Springs Canyon. Infrequent. DN 52.

Asteraceae *Dicoria canescens* Gray. BUGSEED. Non-seasonal annual. 362 m. Spring, summer. Open valley, sandy soils along pipeline road. Harquahala Valley. Common seasonally. DN 336.

Asteraceae *Encelia farinosa* Gray ex Torr. BRITTLEBUSH. Deciduous shrub. 438 – 527 m. May, October. Bajada slopes, volcanic soil; rock outcrops; side of sandy washes. Eagletail Mountains; SW of Courthouse Rock, EPNG pipeline road. Abundant. DN 52a, 127.

Asteraceae *Erigeron divergens* Torr. & Gray. DESERT FLEABANE. Perennial herb. 380 – 450 m. March. Side of sandy washes. Apache Box, stock tank at western edge of wilderness. Infrequent. DN 510, 535.

Asteraceae *Erigeron lobatus* A. Nels. DESERT FLEABANE. Perennial herb. 450 – 645 m. March-April, September-November. Bajada slopes, north-facing, volcanic soils; Slot canyon. Eagletail Mountains; canyon north of Triple Eye Arches, Dead Deer Tank Canyon, Indian Springs Canyon. Occasional. DN 19, 41, 46, 57, 457, 509, 532, 557; Butterwick 7372.

Asteraceae. *Geraea canescens* Torr. & Gray. DESERT SUNFLOWER. Cool season annual. 420 – 500 m. March. Desert pavement; granitic sandy soils and volcanic soils. Granite Mountains, Clanton Well Road. Occasional. DN 443, 528.

Asteraceae *Gutierrezia sarothrae* (Pursh) Britt. & Rusby. BROOM SNAKEWEED. Deciduous subshrub. 501 – 548 m. August – December. Rock outcrop; bajada

slope, north-facing, volcanic soils. Eagletail Mountains; Eagle Peak, Indian Springs Wash. Occasional. DN 31, 92; Butterwick 7364, 8004.

Asteraceae *Gymnosperma glutinosum* (Spreng.) Less. GUMHEAD. Deciduous subshrub. 492 – 736 m. March, September. Bajada slopes, north and south-facing; rock outcrop; slot canyon. Eagletail Mountains; Indian Springs Canyon, slot canyon E of Eagletail Peak, N facing bajada slope W of Eagletail peak. Occasional. DN 24, 28, 192, 314, 396, 648, 671; Butterwick 7375, 7988; Reina 96-92.

Asteraceae *Hymenoclea salsola* Torr. & Gray ex Gray. WHITE BURROBUSH. Deciduous shrub. 370 – 421 m. March. Bottom and side of large sandy washes not in mountain range. Harquahala Valley; Granite Mountains along EPNG road. Common. DN 165, 436, 524.

Asteraceae *Isocoma acradenia* (Greene) Greene. ALKALI GOLDENBUSH. Deciduous subshrub. 362 m. August. Open valley. Harquahala Valley. Occasional. DN 161.

Asteraceae *Logfia californica* (Nutt.) Holub. CALIFORNIA FLUFFWEED. Cool season annual. 656 m. March. Slot canyon, north-facing side. Eagletail Mountains; east of Eagletail Peak, Natural Bridge. Infrequent. Butterwick 7987.

Asteraceae *Machaeranthera pinnatifida* (Hook.) Shinners. LACY TANSYASTER. Perennial herb. 490-623 m. February-May, August-October. Side of sandy washes; bajada slope, volcanic soils, north-facing. Eagletail Mountains; Indian Springs Canyon, 2 km W of Eagletail Peak, canyon E of Indian Springs Canyon. Occasional. DN 29, 43, 60, 154, 286, 311, 331, 414, 577, 683, 699.

Asteraceae *Malacothrix glabrata* (Gray ex D.C. Eat.) Gray. DESERT DANDELION. Cool season annual. 420-510 m. February-April. Bajada slopes, granitic sandy soils. Granite Mountains. Occasional. DN 352, 378.

Asteraceae *Malacothrix sonorae* W.S. Davis & Raven. SONORAN DESERT DANDELION. Cool season annual. 520 m. February-April. Side of sandy washes. Eagletail Mountains; wash/road to Indian Springs. Infrequent. DN 228.

Asteraceae *Microseris lindleyi* (DC.) Nutt. SILVER PUFFS. Cool season annual. 510-580 m. February-April. Bajada slope, north-facing, volcanic soils; side of sandy washes. Eagletail Mountains; W of Eagle Peak, S of Triple Eye Catchment. Occasional. DN 71, 467, 489, 596.

Asteraceae *Monoptilon bellioides* (Gray) Hall. DESERT STAR. Cool season annual. 520 m. February-April. Bajada slope, granitic sandy soils. Granite Mountains. Occasional. DN 281.

Asteraceae *Pectis papposa* Harvey & Gray. DESERT CINCHWEED. Warm season annual. 426-560 m. July-October. Sides of sandy washes. Granite Mountains; Eagletail Mountains; Double Eagle Peak, Indian Springs Wash. Common during wet summers. DN 8, 86, 415, 451, 554; Baker 15606.

Asteraceae *Perityle emoryi* Torr. DESERT ROCK DAISY. Non-seasonal. 480 – 551 m. March – June, September – December. Rock outcrop; bajada slope, volcanic soil; bajada slope, granitic sandy soil; side of sandy washes. Granite Mountains; Eagletail Mountains; Courthouse Rock, Indian Springs Canyon, Eagletail Peak. Common. DN 30, 35, 94, 389, 429, 436, 556.

Asteraceae *Peucephyllum schottii* Gray. PYGMY CEDAR. Evergreen shrub. 502-694 m. January-May. Rock outcrops at top of range. Eagletail Mountains; S of Grey Tank. Occasional. DN 90, 616.

Asteraceae *Pleurocoronis pluriseta* (Gray) King & H.E. Robins. ARROWLEAF. Deciduous subshrub. 513-680 m. Year around. North-facing bajada slope, volcanic soils. Eagletail Mountains; Indian Springs Canyon. Occasional. DN 37, 140, 160; Reina 96-9.

Asteraceae *Pluchea sericea* (Nutt.) Coville. ARROWWEED. Deciduous shrub. 530 m. March-June. Bottom of sandy washes at base of dry waterfall. Eagletail Mountains; deep canyon E of Indian Springs Canyon. Rare, 12 stems in one location, in bloom. This species common in Gila River flood plain 80 km (50 mi) south of Eagletail Mountains. DN 570.

Asteraceae *Psathyrotes ramosissima* (Torr.) Gray. DESERT VELVET. Deciduous subshrub. 441 m. March-June. Bajada slope, volcanic soils. Eagletail Mountains; along EPNG road west of turn to Courthouse Rock. Infrequent, a number of plants seen in only one location. DN 598.

Asteraceae *Rafinesquia californica* Nutt. CALIFORNIA CHICORY. Cool season annual. 570 m. March-May Bottom of sandy washes. Eagletail Mountains; canyon south of Triple Eye Catchment. Rare. DN 486.

Asteraceae *Rafinesquia neomexicana* Gray. DESERT CHICORY. Cool season annual. 510-520 m. February-May. Bajada slopes, granitic sandy soils; bajada slopes, volcanic soils. Granite Mountains; Eagletail Mountains; W of end of cherry stem road. Common in wet winters. DN 375, 672.

Asteraceae *Senecio lemmonii* Gray. LEMON GROUNDSEL. Perennial herb. 450-640 m. February-May. Bottom of sandy washes; bajada slope, volcanic soil, north-facing. Eagletail Mountains; Indian Springs Canyon, W of Eagle Peak, SE of Eagletail Peak. Occasional. DN 40, 533, 562, 610, 639, 643.

Asteraceae *Sonchus oleraceus** L. SOW THISTLE. Cool season annual. 440-580 m. Spring. Side of sandy washes; north-facing rock outcrop. Eagletail Mountains; Indian Springs Canyon, Courthouse Rock, Triple Eye Catchment, W of Eagle Peak. Occasional. DN 224, 434, 464, 487, 527.

Asteraceae *Stephanomeria pauciflora* (Torr.) A. Nels. DESERT STRAW. Deciduous subshrub. 362-523 m. Year around. Side of sandy washes; Open

valley. Harquahala Valley; Eagletail Mountains; Indian Springs Wash, EPNG pipeline road. Occasional. DN 2, 171, 287.

Asteraceae *Stylocline micropoides* Gray. NEST STRAW. Cool season annual. 565 m. February-May, Side of sandy washes. Eagletail Mountains: Indian Springs Wash. Occasional. DN 214.

Asteraceae *Trichoptilium incisum* (Gray) Gray. YELLOW HEAD. Cool season annual. 440-640 m. January-April. Bajada slope, granitic sandy soils; bajada slope, volcanic soil, north-facing. Granite Mountains; Eagletail Mountains; NNW of Double Eagle Peak, W of Eagle Peak, SE of Eagletail Peak. Infrequent. DN 155, 285, 447, 608, 685; Baker 15608.

Asteraceae *Trixis californica* Kellogg. TRIXIS. Deciduous shrub. 451 – 519 m. Year around. Side of sandy washes. Eagletail Mountains, Courthouse Rock, NW base of Double Eagle Peak; Clanton Well Road. Occasional. DN 47,178,184; Reina 96-91.

Asteraceae *Verbesina encelioides* (Cav.) Benth. & Hook. f. ex Gr. GOLDEN CROWNBEARD. Warm season annual. 362 m. August. Open valley, along road. Harquahala Valley. Occasional in disturbed habitats. DN 173.

Asteraceae *Viguiera parishii* Greene. PARISH GOLDENEYE. Deciduous shrub. 483-623 m. March-April, September-December. Side of sandy washes; North-facing bajada slope, volcanic soil. Eagletail Mountains; Courthouse Rock, E of Indian Springs Canyon, Grey Tank, Indian Springs Wash. Occasional. DN 12, 64, 76, 107, 384, 402, 563; Lehto 21233.

Berberidaceae *Berberis haematocarpa* Woot. RED BARBERRY. Evergreen shrub. 500-762 m. March. Rock outcrop, north-facing; slot canyon. Eagletail Mountains; W of Eagle Peak, SE of Eagletail Peak, N side of Eagletail Peak, canyon S of Triple Eye Catchment. Infrequent. Species only found in areas on

north-facing canyons near areas where water collects. Blooms infrequently. DN 3, 73, 471, 638; Butterwick 7789.

Bignoniaceae *Chilopsis linearis* (Cav.) Sweet. DESERT WILLOW. Deciduous tree. 374 m. May-September. Side of sandy wash. Apache Box. Rare. Species not found in Eagletail Mountains. Species rare in SW Arizona. DN 180.

Boraginaceae *Amsinckia menziesii* (Lehm.) A. Nelson & J.F. Macbr. FIDDLENECK. Cool season annual. 480 m. February-May. Side of sandy wash. Eagletail Mountains; Courthouse Rock. Occasional. Unruh 22.

Boraginaceae *Amsinckia tessellata* Gray. CHECKER FIDDLENECK. Cool season annual. 500-536 m. February-May. Bajada slope, granitic sandy soils; bajada slopes, volcanic soils. Granite Mountains; Eagletail Mountains; Courthouse Rock. Occasional. DN 241, 252.

Boraginaceae *Cryptantha angustifloia* (Torrey) Greene. NARROW-LEAF CRYPTANTHA. Cool season annual. 470 m. February-May. Bajada slopes, volcanic soil. Eagletail Mountains; Courthouse Rock. Infrequent. Lehto 21238; Unruh 19.

Boraginaceae *Cryptantha barbigera* Gray) Greene. BEARDED CRYPTANTHA. Cool season annual. 475-550 m. February-May. Bajada slopes, volcanic soils. Eagletail Mountains; Double Eagle Peak, Courthouse Rock. Infrequent. Reina 96-84; Unruh 17.

Boraginaceae *Cryptantha maritima* (Greene) Greene. WHITE-HAIRED CRYPTANTHA. Cool season annual. 534-560 m. February-May. Bottom of sandy wash; bajada slope, south-facing, volcanic soil. Granite Mountains; Eagletail Mountains; Indian Springs Wash, SE of Eagletail Peak, Courthouse Rock. Occasional. DN 201, 261, 272, 635; Lehto 21239.

Boraginaceae *Cryptantha pterocarya* (Torr.) Greene. WINGED-NUT CRYPTANTHA. Cool season annual. 490-560 m. February-May. Bottom of sandy wash; bajada slope, south-facing, volcanic soils. Eagletail Mountains; Indian Springs Wash, Triple Eye Catchment, E of Eagletail Peak. Occasional. DN 211, 432, 592, 634; Reina 96-105.

Boraginaceae *Pectocarya heterocarpa* (I.M.Johnson) I.M. Johnson. MIXED-NUT COMB-BUR. Cool season annual. 457 m. April. Side of sandy wash. Eagletail Mountains; wash NW of Courthouse Rock. Infrequent. Lehto 21229.

Boraginaceae *Pectocarya platycarpa* (Munz & Johnston) Munz & Johnston. COMB-BUR. Cool season annual. 370 – 573 m. February – May. Side and bottom of sandy washes. Eagletail Mountains; Courthouse Rock Trailhead, Indian Springs Wash; Apache Box. Infrequent. DN 230, 250, 424, 525; Unruh 15.

Boraginaceae *Pectocarya recurvata* I.M. Johnston. ARCHED COMB-BUR. Cool season annual. 540 m. February-May. Bajada slope, granitic sandy soils; bajada slope, volcanic soils. Granite Mountains; Eagletail Mountains; Triple Eye Catchment. Infrequent. DN 245, 593.

Boraginaceae *Plagiobothrys jonesii* Gray. POPCORN FLOWER. Cool season annual. 457 m. April. Side of sandy wash. Eagletail Mountains; wash NW of Courthouse Rock. Infrequent. Lehto 21242.

Boraginaceae *Tiquilia canescens* (DC.) A. Richards. CRINKLEMAT. Deciduous subshrub. 525 m. August. Side of sandy wash on volcanic tuff. Eagletail Mountains; Indian Springs Canyon. Rare in region, 6 plants seen. DN 290, 317.

Brassicaceae *Arabis perennans* S. Watson. ROCK CRESS. Perennial herb. 610 m. February-May. Rock outcrop, north-facing side. Eagletail Mountains; Natural Bridge canyon E of Eagletail Peak. Infrequent. Only seen in one location. Butterwick 7989.

Brassicaceae *Brassica tournefortii* * Gouan. SAHARA MUSTARD. Cool season annual. 490-530 m. February-May. Side of sandy wash; bajada slope, south-facing, volcanic soils. Eagletail Mountains; Courthouse Rock Trailhead, Indian Springs Wash, mine shaft E of Courthouse Rock, Natural Bridge Canyon E of Eagletail Peak. Occasional. Concentration of plants found near Courthouse Rock trail head and road to Indian Spring Canyon. DN 208, 244, 430; Butterwick 7999.

Brassicaceae *Descurainia pinnata* (Cockerell) Detling. TANSY MUSTARD. Cool season annual. 520 m. February-May. Side of sandy wash. Eagletail Mountains; NW of Courthouse Rock, Natural Bridge Canyon E of Eagletail Peak, Indian Springs Wash. Occasional. Leaves eaten as greens. DN 205; Butterwick 7998; Lehto 21226.

Brassicaceae *Draba cuneifolia* Nutt. ex Torr. & Gray. WEDGELEAF DRABA. Cool season annual. 520 m. March-May. Bajada slopes, granitic sandy soils; Rock outcrop, north-facing. Granite Mountains; Eagletail Mountains, E of Eagletail Peak near Natural Bridge. Occasional. DN 284, 545; Butterwick 7986.

Brassicaceae *Guillenia lasiophyllus* (Hook. & Arn.) Greene. CALIFORNIA MUSTARD. Cool season annual. 460-540 m. February-April. Bajada slopes, granitic sandy soil; bajada slopes, volcanic soil. Granite Mountains; Eagletail Mountains; stock tank W edge wilderness area, SW of end of cherry stem road, NW base of Double Eagle Peak. Occasional. DN 249, 266, 582, 682; Lehto 21225; Unruh 16; Reina 96-101.

Brassicaceae *Lepidium lasiocarpum* Nutt. SAND PEPPERGRASS. Cool season annual. 410-589 m. February-April. Bajada slopes, granitic sandy soils; bajada slopes, volcanic soil; side of sandy washes. Granite Mountains; Eagletail Mountains; Indian Springs Wash, road to Triple Eye Catchment, NW of Courthouse Rock. Occasional. DN 1, 267, 356, 595, 627; Lehto 21225.

Brassicaceae *Lesquerella tenella* A. Nels. BLADDERPOD. Cool season annual. 369-511 m. February-April. Bajada slopes, granitic sandy soil; bottom of sandy wash. Granite Mountains; Apache Box. Occasional. DN 363, 423, 519.

Brassicaceae *Sisymbrium irio** L. LONDON ROCKET. Cool season annual. 463-583 m. January-April. Bajada slopes, granitic sandy soils; side of sandy wash; rock outcrop. Granite Mountains; road to Frenchman Mine; Eagletail Mountains; E of Eagle Peak, W boundary of wilderness at stock tank. Infrequent. Not wide spread in region. DN 257, 259, 465, 512.

Brassicaceae *Thysanocarpus curvipes* Hook. LACEPOD. Cool season annual. 487 – 583 m. February – April. Bajada slopes, granitic sandy soils; side of sandy wash; bajada slopes, volcanic soils. Granite Mountains; Eagletail Mountains; 1 km E of Courthouse Rock, W of Eagle Peak, SE of Eagletail Peak. Occasional. DN 254, 425, 441, 474, 590, 647.

Cactaceae *Carnegiea gigantea* (Engelm.) Britton & Rose. SAGUARO. Columnar tree, fleshy. 450-850 m. May-June. Bajada slopes, granitic sandy soil; bajada slopes, volcanic soil. Granite Mountains; Eagletail Mountains; Harquahala Valley; Apache Box. Common. DN 689.

Cactaceae *Cylindropuntia acanthocarpa* (Engelm. & Bigelow) F.M. Knuth. BUCKHORN CHOLLA. Fleshy shrub. 549 m. April-May. Bajada slopes, granitic sandy soils; bajada slopes, volcanic soils. Eagletail Mountains; Indian Springs Canyon. Common. DN 694.

Cactaceae *Cylindropuntia bigelovii* (Engelm.) Knuth. TEDDYBEAR CHOLLA. Fleshy shrub. 549 m. March-April. Bajada slopes, volcanic soils; desert pavement. Eagletail Mountains; SW of Courthouse Rock Trailhead. Abundant. DN 691.

Cactaceae *Cylindropuntia echinocarpa* (Engelm. & Bigelow) F.M. Knuth. SILVER CHOLLA. Fleshy shrub. 525 m. March-April. Bajada slopes, granitic sandy soils;

bajada slopes, volcanic soils. Granite Mountains; Eagletail Mountains, canyon N of Triple Eye Catchment. Rare. DN 692.

Cactaceae *Cylindropuntia leptocaulis* (DC.) Knuth. CHRISTMAS CACTUS. Fleshy shrub. 397-548 m. April-May. Bajada slopes, volcanic soils. Eagletail Mountains; Indian Springs Wash, Cemetery Ridge. Infrequent. DN 319, 696.

Cactaceae *Cylindropuntia ramosissima* (Engelm.) Knuth. DIAMOND CHOLLA. Fleshy shrub. 545 m. April-May. Bajada slopes, volcanic soil. Eagletail Mountains; Indian Springs Wash. Occasional. DN 688; Butterwick 7377.

Cactaceae *Echinocereus engelmannii* (Parry ex Engelm.) Lem. STRAWBERRY HEDGEHOG CACTUS. Fleshy shrub with branches forming clumps. 552 m. April-June. Desert pavement; Bajada slopes, volcanic soil. Eagletail Mountains; Indian Springs Wash. Occasional. DN 693; Lehto 21219-a.

Cactaceae *Ferocactus cylindraceus* (Engelm.) Routt. BARREL CACTUS. Fleshy shrub, one stem, columnar, unbranched. 536 m. April-June. Bajada slopes, volcanic soils. Eagletail Mountains; Indian Springs Canyon. Occasional. DN 318.

Cactaceae *Grusonia kunzei* (Rose) Pinkava. DESERT CLUB CHOLLA. Fleshy shrub, mat forming. 524 m. April-June. Side of sandy wash on volcanic tuff rock base. Eagletail Mountains; Indian Springs Canyon. Rare. DN 695.

Cactaceae *Mammillaria grahamii* Engelm. FISHHOOK CACTUS. Fleshy shrub, one too many stems, cylindrical. 583 m. March. Bajada slopes, volcanic soils. Eagletail Mountains; W of Eagle Peak. Infrequent. DN 686.

Cactaceae *Mammillaria tetrancistra* Engelm. CORKSEED FISHHOOK CACTUS. Fleshy shrub, one too many stems, cylindrical. 580 m. April. Slot canyon. Eagletail Mountains; SE of Dead Deer Tank. Rare, only seen in one canyon. Butterwick 7376.

Cactaceae *Opuntia basilaris* Engelm. & Bigelow. BEAVERTAIL PRICKLYPEAR. Fleshy shrub with pads. 587 m. April – June. Side of sandy washes; bajada slopes, volcanic soil. Eagletail Mountains; S of Triple Eye Catchment, SE of Dead Deer Tank. Occasional, found only in western half of Eagletail Mountains. DN 687; Butterwick 7386.

Cactaceae *Opuntia chlorotica* Engelm. & Bigelow. DOLLAR JOINT PRICKLY-PEAR. Fleshy shrub with pads. 549 m. April-May. Bajada slopes, volcanic soils. Eagletail Mountains; E of Indian Springs Canyon. Rare. Only three plants seen in eastern half of range. DN 690.

Cactaceae *Peniocereus greggii* (Engelm.) Britt. & Rose. NIGHT-BLOOMING CEREUS. Fleshy shrub. 550 m. May-July. Bajada slopes, volcanic soils. Eagletail Mountains; Courthouse Rock. Rare. Only 6 plants found in range. Stems that extend above ground often damaged by rabbits, big-horn sheep, mule deer, cattle but usually survive as underground tuber. DN 422.

Campanulaceae *Nemacladus glanduliferus* Jepson. THREADSTEM. Cool season annual. 520 m. March-May. Bottom of sandy wash. Eagletail Mountains; Indian Springs Wash. Occasional. DN 202.

Caryophyllaceae *Silene antirrhina* L. SLEEPY CATCHFLY. Cool season annual. 525 m. April. Bottom of sandy wash. Eagletail Mountains; Indian Springs Canyon. Infrequent. DN 216.

Celastraceae *Canotia holacantha* Torr. CRUCIFIXION THORN. Deciduous shrub. 615-684 m. May-August. Slot canyon, north-facing slope. Eagletail Mountains; NW of Eagletail Peak. Rare. Only seen in two locations on east side of range. Plants appeared to be quite old. DN 39, 41, 153.

Chenopodiaceae *Atriplex canescens* (Pursh) Nutt. FOUR WING SALTBUSH. Deciduous shrub. 518 m. June-August. Side of sandy wash. Eagletail Mountains; Indian Springs Wash. Infrequent. Only one location. DN 61.

Chenopodiaceae *Atriplex polycarpa* (Torr.) S. Wats. DESERT SALTBUSH. Deciduous shrub. 476-540 m. July-October. Side of sandy wash; slot canyon, south-facing side. Eagletail Mountains; Indian Springs Wash, E of Eagletail Peak. Occasional. DN 103, 614.

Crassulaceae *Dudleya arizonica* Rose. CHALK DUDLEYA. Perennial Herb. 497 m. March-May. Rocky outcrops, north-facing, in cracks of volcanic rock. Eagletail Mountains; SW of end of cherry stem road. Rare. Only 15 plants seen. DN 649.

Crossosomataceae *Crossosoma bigelovii* S. Wats. RAGGED ROCKFLOWER. Deciduous shrub. 502-753 m. January-March. Slot canyons; rock outcrops, north-facing side. Eagletail Mountains; mountain top E of Anvil Top, NW part of Eagletail range, NW base of Double Eagle Peak. Occasional. DN 4, 38, 93, 368, 658; Lehto 21214; Reina 96-93.

Cucurbitaceae *Brandegea bigelovii* (S. Wats.) Cogn. DESERT STAR VINE. Perennial herb. 337-537 m. May-October. Sides of sandy washes. Clanton Well; Eagletail Mountains; Indian Springs Wash. Occasional. DN 53, 176, 306.

Cupressaceae *Juniperus coahuilensis* (Martiñez) Gaussen ex R.P. Adams. REDBERRY JUNIPER. Evergreen tree. 610 m. Spring. Slot canyon. Eagletail Mountains; N of Eagletail Peak. Rare. BLM reports that 2 plants of Junipers remain on north-facing slope of Eagletail Peak. “Plants appear to be quite old with several main branches arising from the base". Butterwick 7791.

Cuscutaceae *Cuscuta umbellata* Kunth. DESERT DODDER. Warm season annual. 425 m. Summer. Bajada slope, granitic sandy soils. Granite Mountains. Rare, only seen in one location. DN 435.

Ephedraceae *Ephedra aspera* Engelm. ex S. Wats. BOUNDARY EPHEDRA. Deciduous shrub. 492-584 m. March. Bajada slopes, north-facing, volcanic soils; rock outcrops. Eagletail Mountains; SW of end of cherry stem road, E of

Courthouse Rock. Occasional. DN 66, 67, 433, 645; Butterwick 7995; Lehto 21183.

Euphorbiaceae *Argythamnia lanceolata* (Benth.) Mull. Arg. NARROW-LEAF DITAXIS. Deciduous subshrub. 492-579 m. March, September-October. Bajada slope, north-facing, volcanic soil; rock outcrop, north-facing. Eagletail Mountains; Indian Springs Canyon, Courthouse Rock, 2km W of Eagletail Peak, SW of end of cherry stem road. NW base of Double Eagle Peak. Occasional. DN 17, 55, 381, 413, 655; Unruh 20; Reina 96-97; Van Devender 95-1027.

Euphorbiaceae *Argythamnia neomexicana* Mull. Arg. NEW MEXICO DITAXIS. Warm season annual. 457-518 m. August-October. Side of sandy wash. Eagletail Mountains; Indian Springs Wash and Canyon; Clanton Well. Infrequent. DN 186, 303, 545; Reina 96-81.

Euphorbiaceae *Bernardia myricifolia* (Scheele) S. Watson. MOUSE'S EYE. Deciduous shrub. 492-611 m. March-April, August-October. Slot canyon; bajada slope, north-facing, volcanic soil; Rock outcrop, north-facing. Eagletail Mountains; Courthouse Rock, 2 km W of Eagletail Peak, W of Eagle Peak, N of Triple Eye Arches, SE of Eagletail Peak. Common. Usually found growing with *Quercus turbinella*, and *Forestiera shrevei*. DN 56, 295, 385, 394, 466, 505, 568, 652.

Euphorbiaceae *Chamaesyce abramsiana* (L.C. Wheeler) Koutnik. PROSTRATE SPURGE. Warm season annual. 523-549 m. July-August. Bottom of sandy washes. Eagletail Mountains; Indian Springs Wash. Common during wet summers. DN 300, 343, 345, 450.

Euphorbiaceae *Chamaesyce micromera* (Boiss. ex Engelm.) Woot. & Standl. SONORAN SAND MAT. Warm season annual. 467 m. September. Bajada slope, north-facing, granitic sandy soils. Granite Mountains. Infrequent. DN 419.

Euphorbiaceae *Chamaesyce polycarpa* (Benth.) Millsp. ex Parish. SMALLSEED SANDMAT. Perennial herb. 467-640 m. May-October. Bajada slope, north-facing, granitic sandy soils; bajada slope, north-facing, volcanic soil; bottom of sandy washes. Granite Mountains; Eagletail Mountains; Indian Springs Canyon, Courthouse Rock, W of Eagle Peak, SW of Courthouse Rock. Common. DN 21, 49, 83, 341, 421, 607; Reina 96-80.

Euphorbiaceae *Chamaesyce serpyllifolia* (Pers.) Small. THYME-LEAVED SPURGE. Warm season annual. 490 m. September. Bajada slope, volcanic soils. Eagletail Mountains; N of Double Eagle Peak. Infrequent. Baker 15605.

Euphorbiaceae *Chamaesyce setiloba* (Engelm. ex Torr.) Millsp. ex Parish. FRINGED SPURGE. Warm season annual. 523-611 m. August-October. Bottom of sandy washes. Eagletail Mountains; SW of Courthouse Rock, NE of wildlife tank 726, Indian Springs Wash. Occasional. DN 82, 327, 344, 454.

Euphorbiaceae *Euphorbia eriantha* Benth. BEETLE SPURGE. Warm season annual. 457-579 m. July-October. Bajada slope, north-facing, volcanic soils; side of sandy wash. Eagletail Mountains; Dead Deer Tank, 2km W of Eagletail Peak, wildlife tank E of Clanton Well. Occasional. DN 5, 27, 182, 391; Unruh 12.

Euphorbiaceae *Tetracoccus hallii* Brandegee. RED BUSH. Deciduous shrub. 480-579 m. September. Bajada slopes, north-facing, volcanic soils. Eagletail Mountains; Indian Springs Wash, E of Eagletail Peak, W of Eagletail Peak. Infrequent. DN 11, 96, 408; Butterwick 7788; Lehto 21200.

Fabaceae *Acacia constricta* Benth. WHITETHORN ACACIA. Deciduous shrub. 457 – 677 m. February – March, September – October. Rock outcrop; side of sandy wash; bajada slope- volcanic soil. Eagletail Mountains; pass to Anvil Top Mesa, Grey Tank, NE of Eagletail Peak. Common. DN 108, 156, 179, 357, 666; Baker 11515.

Fabaceae *Acacia greggii* Gray. CAT-CLAW ACACIA. Deciduous shrub. 457-579 m. April-June. Side of sandy washes; bajada slopes, north-facing, volcanic soils. Eagletail Mountains; Courthouse Rock Trailhead, 2 km W of Eagletail Peak. Common. DN 144, 404, 644.

Fabaceae *Astragalus nuttallianus* var. *cedrosensis* DC. SMALL-FLOWERED MILKVETCH. Cool season annual. Leaf tips notched. 520 m. March-April. Bottom of sandy wash. Eagletail Mountains; Indian Springs Canyon. Infrequent. DN 223.

Fabaceae *Astragalus nuttallianus* var*. imperfectus* (Rydb.) Barneby. SMALL-FLOWERED MILKVETCH. Cool season annual. Leaf tips acute. 520 m. March-April. Bottom of sandy wash. Eagletail Mountains; Indian Springs Wash. Infrequent. DN 204.

Fabaceae *Dalea mollis* Benth. SILKY DALEA. Non-seasonal annual. 428-561 m. February, October. Bajada slopes, volcanic soil. Eagletail Mountains; E of wildlife tank 726, E of Eagletail Peak. Rare. DN 54, 328, 664.

Fabaceae *Lotus rigidus* (Benth.) Greene. DESERT ROCK-PEA. Perennial herb. 579-645 m. March. Bajada slopes, north-facing, volcanic soils. Eagletail Mountains; 2 km W of Eagletail Peak, W of Eagle Peak, N of Dead Deer Tank. Occasional. DN 42, 405, 469.

Fabaceae *Lotus salsuginosus* Greene. COASTAL BIRDS-FOOT TREFOIL. Cool season annual. 520-611 m. February-April. Bajada slopes, granitic sandy soils; bottom of sandy washes. Granite Mountains, road to Frenchman Mine; Eagletail Mountains; Indian Springs Wash, N of Triple Eye Arches. Occasional. DN 203 265, 492.

Fabaceae *Lotus strigosus* (Nutt.) Greene. DESERT LOTUS. Cool season annual. 537 m. February. bajada slopes, granitic sandy soils. Granite Mountains, road to Frenchman Mine. Infrequent. DN 264.

Fabaceae *Lupinus arizonicus* (S. Wats.) S. Wats. ARIZONA LUPINE. Cool season annual. 497-678 m. February-March. Rock outcrop, bottom of sandy wash. Eagletail Mountains; pass to Anvil Top, Indian Springs Canyon, SW of end of cherry stem road. Infrequent. .DN 364, 622, 637; Lehto 21193.

Fabaceae *Lupinus sparsiflorus* Benth. MOHAVE LUPINE. Cool season annual. 369-537 m. February-April. Bajada slopes, south-facing, granitic sandy soil; bottom of sandy wash. Granite Mountains; Apache Box; Eagletail Mountains; Indian Springs Wash. Occasional. Much more common than *L. arizonica*. DN 232, 247, 262, 282, 518; Unruh 4.

Fabaceae *Marina parryi* (Torr. & Gray) Barneb. MARINA. Perennial herb. 518-611 m. March-May, July-October. Bottom of sandy wash; bajada slopes, north-facing, volcanic soil. Eagletail Mountains; Indian Springs Wash, N of Triple Eye Arches, E of Indian Springs Wash. Occasional. DN 58, 315, 334, 392, 494.

Fabaceae *Olneya tesota* Gray. IRONWOOD. Deep-rooted tree. 457 m. May. Sides of sandy washes; bajada slopes, granitic sandy soils. Not usually seen above 610 m. on north-facing slopes. Granite Mountains; Eagletail Mountains; Courthouse Rock; Apache Box, Harquahala Valley. Common along washes in Eagletail mountains. DN 141.

Fabaceae *Parkinsonia florida* (Benth. Ex Gray) S. Wats. BLUE PALO VERDE. Deep rooted tree. 509 m. April. Sides of sandy wash. Eagletail Mountains; Indian Springs Wash; Apache Box. Occasional. DN 146, 158.

Fabaceae *Parkinsonia microphylla* Torr. FOOTHILL PALO VERDE. Deep-rooted tree. 518 m. May. Sides of sandy washes; bajada slopes, volcanic soil; bajada slopes, granitic sandy soils. Granite Mountains; Eagletail Mountains; Indian Springs Canyon. Abundant. DN 143; Lehto 21186.

Fabaceae *Phaseolus filiformis* Benth. DESERT BEAN. Non-seasonal annual, vining. 611-684 m. October. Side of sandy washes. Eagletail Mountains; Canyon

E of Indian Springs Canyon, canyon running E/W is SW of Eagletail Peak. Rare. DN 42, 330.

Fabaceae *Prosopis velutina* Woot. VELVET MESQUITE. Deep-rooted tree. 452-513 m. April-May. Slot canyons, side of sandy washes; open valley. Eagletail Mountains; Indian Springs Canyon, SW of end of cherry stem road; Apache Box; Harquahala Valley. Common. DN 159, 629.

Fabaceae *Psorothamnus spinosus* (Gray) Barneby. SMOKE TREE. Deep-rooted tree. 376 m. June-July. Bottom and side of large sandy washes at low elevations. Not in Eagletail Mountain range. Apache Box; Clanton Well; Nottbusch Valley W of Clanton Well. Rare. DN 177, 188; Butterwick 7519; Anderson 2002-5.

Fabaceae *Senna covesii* (Gray) Irwin & Barneby. COUES' CASSIA. Deciduous subshrub. 521-546 m. April-October. Side of sandy wash. Eagletail Mountains; Indian Springs Wash and Canyon. Common. DN 54, 309, 563.

Fagaceae *Quercus turbinella* Greene. SHRUB LIVE OAK. Evergreen shrub-small tree. 476-736 m. April. Slot canyons; rock outcrops, north-facing side. Eagletail Mountains; S of Grey Tank, slot canyon E of Eagletail Peak, SW of end of cherry stem road, ridgeline E of Eagle peak, Natural bridge E of Eagletail Peak, canyon W of Dead Deer Tank. Occasional. DN 69, 102, 194, 618, 663, 675; Lehto. 21182; Butterwick 7371, 7997.

Fouquieriaceae *Fouquieria splendens* Engelm. OCOTILLO. Deciduous shrub. 500 m. February-May, September-October. Bajada slopes, volcanic soils; sides of sandy washes; rock outcrops. Eagletail Mountains; EPNG Pipeline Road. Common. DN 88; Lehto 21218.

Geraniaceae *Erodium cicutarium** (L.) L'Hér. ex Ait. FILAREE. Cool season annual. 501-525 m. February-May. Bajada slopes, granitic sandy soils; side of sandy wash. Granite Mountains; Eagletail Mountains; Indian Springs Wash. Infrequent during wet winters. Not considered invasive. DN 142, 248.

Geraniaceae *Erodium texanum* Gray. DESERT STORKBILL. Cool season annual. 511 m. February. Bajada slopes, granitic sandy soil. Granite Mountains. Rare. DN 360.

Hydrophyllaceae *Eucrypta chrysanthemifolia* (Bentham) Greene. SPOTTED HIDESEED. Cool season annual. 547 m. February. Bajada slopes, north-facing, volcanic soil. Eagletail Mountains. Infrequent. Unruh 14.

Hydrophyllaceae *Eucrypta micrantha* (Torr.) Heller. DAINTY DESERT HIDESEED. Cool season annual. 501-511 m. February. Bajada slopes, granitic sandy soils. Granite Mountains. Infrequent. DN 246, 380.

Hydrophyllaceae *Nama demissum* Gray. PURPLE MATSEED. Cool season annual. 422 – 449 m. February – April. Bajada slopes, granitic sandy soils. Granite Mountains. Occasional. DN 350, 44.

Hydrophyllaceae *Nama hispidum* Gray. BRISTLY NAMA. Cool season annual. 369-530 m. March-April. Bottom of sandy wash. Apache Box; Eagletail Mountains; canyon E of Indian Springs Canyon. Infrequent. DN 521, 560.

Hydrophyllaceae *Phacelia affinis* Gray. LIMESTONE PHACELIA. Cool season annual. 418-520 m. March-April. Side of sandy wash. Granite Mountains; Eagletail Mountains; Indian Springs Wash. Occasional. DN 222, 440.

Hydrophyllaceae *Phacelia crenulata var. ambigua* (M.E. Jones) J.F. Macbr. PURPLE STEM PHACELIA. Cool season annual. 530-543 m. February-April. Bajada slopes, granitic sandy soils; bajada slopes, volcanic soils. Granite Mountains, road to Frenchmen's Mine; Eagletail Mountains; Triple Eye Catchment, Indian Springs Canyon. Occasional. DN 217, 260, 270, 587.

Hydrophyllaceae *Phacelia crenulata* var. *minutiflora* (J. Voss) Jepson. CLEFTLEAF WILD HELIOTROPE. Cool season annual. 400-452 m. February-April. Bottom sandy wash; bajada slopes, granitic sandy soils. Granite

Mountains; Eagletail Mountains; SW of end of cherry stem road, Indian Springs Wash. Occasional. DN 198, 371, 437, 526.

Hydrophyllaceae *Phacelia distans* Benth. CATERPILLAR PHACELIA. Cool season annual. 510-520 m. February-April. Bajada slope, granitic sandy soil; bottom of sandy wash; slot canyon. Granite Mountains; Eagletail Mountains; Indian Springs Wash, canyon E of Eagletail Peak near Natural Bridge. Occasional. DN 199, 271; Butterwick 8006.

Hydrophyllaceae *Phacelia rotundifolia* S. Wats. ROUND-LEAF PHACELIA. Warm season annual. 562 m. September. Bajada slope, volcanic soil. Eagletail Mountains; Indian Springs Wash. Rare. Observed/not collected.

Hydrophyllaceae *Pholistoma auritum* var*. arizonicum* (M.E. Jones) Constance. ARIZONA PHOLISTOMA. Cool season annual. 484-583 m. February-March. Bajada slope, granitic sandy soil; bajada slopes, volcanic soil; Rock outcrops. Granite Mountains; Eagletail Mountains; W of Eagle Peak, SW of end of cherry stem road, E of Courthouse Rock. Occasional. DN 251, 276, 376, 428, 476, 642.

Koeberliniaceae *Koeberlinia spinosa* Zuccarini. CRUCIFIXION THORN. Deciduous shrub. 411 m. Late spring. Open valley. Harquahala valley. Infrequent. Butterwick 8068.

Krameriaceae *Krameria grayi* Rose & Painter. WHITE RATANY. Deciduous shrub. 502-540 m. April-May, July-October. Slot canyon; bajada slopes, volcanic soil; side of sandy wash. Eagletail Mountains; Grey tank, SW of Courthouse Rock, Indian Spring Canyon, W of Eagle Peak. NW base of Double Eagle Peak. Common. DN 48, 105, 113, 138; Van Devender 95-1028; Lehto 21230.

Lamiaceae *Hyptis emoryi* Torr. DESERT LAVENDER. Deciduous shrub. 476-543 m. March-May, September-November. Side of sandy wash; rock outcrop; bajada slopes, volcanic soils, north-facing. Eagletail Mountains; Indian Springs Canyon. Occasional. DN 15, 32, 74, 130; Reina 96-103.

Lamiaceae *Salazaria mexicana* Torr. BLADDER SAGE. Deciduous shrub. 376-540 m. March-May, July-September. Side of sandy wash; rock outcrop. Eagletail Mountains; Indian Springs Wash and Canyon, SW of end of cherry stem road; Apache Box. Occasional. DN 13, 57, 534, 669.

Lamiaceae *Salvia columbariae* Benth. CHIA. Cool season annual. 525 m. February-April. Bottom of sandy wash. Eagletail Mountains; Indian Springs Wash. Infrequent. DN 213.

Liliaceae *Dichelostemma capitatum* ssp*. pauciflorum* (Torr.) G. Keator. BLUEDICKS. Perennial bulb. 526 – 637 m. March. Rock outcrops. Eagletail Mountains; Indian Springs Canyon, N of Dead Deer Tank. Occasional. DN 485, 625.

Liliaceae *Hesperocallis undulata* Gray. DESERT LILY. Perennial bulb. 405-543 m. March-April. Desert pavement; bajada slopes, granitic sandy soil. Eagletail Mountains; along road to Courthouse Rock Trailhead, along road to Triple Eye Catchment; Harquahala valley; Granite Mountains. Occasional. DN 442, 506, 588, 603.

Loasaceae *Mentzelia affinis* Greene. TRIANGLE SEED BLAZING STAR. Cool season annual. 530 m. April. Desert Pavement. Eagletail Mountains; road to Indian Springs. Infrequent. DN 209.

Loasaceae *Mentzelia albicaulis* (Dougl. ex Hook.) Dougl. ex Torr. & Gray. WHITE-STEM BLAZING STAR. Cool season annual. 530-645 m. February-April. Bajada slopes, volcanic soils. Eagletail Mountains; Indian springs Canyon. Infrequent. DN 220, 369.

Loasaceae *Mentzelia involucrata* S. Wats. SILVER BLAZING STAR. Cool season annual. 537-552 m. February-April. Bajada slopes, granitic sandy soils; bajada slopes, volcanic soils; bottom of sandy wash. Granite Mountains;

Eagletail Mountains; canyon N of Triple Eye Arches, NW of Courthouse Rock. Occasional. DN 258, 495, 583; Lehto 21244.

Malpighiaceae *Janusia gracilis* Gray. SLENDER JANUSIA. Subshrub, vining. 535-580 m. July-September. Bajada slope, north-facing, volcanic soils. Eagletail Mountains; W of Eagletail Peak, Indian Springs Canyon. Occasional. DN 18, 401.

Malvaceae *Abutilon incanum* (Link) Sweet. INDIAN MALLOW. Deciduous subshrub. 490-640 m. March, September. Bajada slope, north-facing, volcanic soil; rock outcrop, north-facing. Eagletail Mountains; W of Eagletail Peak, SW of end of cherry stem road, Indian Springs Canyon. Occasional. DN 21, 395, 631, 674.

Malvaceae *Abutilon malacum* S. Wats. INDIAN MALLOW. Deciduous subshrub. 475-518 m. March-April. Slot canyon; rock outcrop. Eagletail Mountains; NW of Double Eagle Peak, S of Eagletail Peak. Rare. DN 47; Lehto 21184; Reina 96-88.

Malvaceae *Hibiscus coulteri* Harvey ex Gray. DESERT ROSE-MALLOW. Shrub. 490 m. March. Bajada slopes, volcanic soils. Eagletail Mountains; SW of end of cherry stem road. Rare. DN 651.

Malvaceae *Hibiscus denudatus* Benth. ROCK HIBISCUS. Deciduous subshrub. 518-536 m. March, October. Bajada slopes, volcanic soil. Eagletail Mountains; W of Eagle Peak, S of Eagletail Peak. Infrequent. DN 126, 667.

Malvaceae *Horsfordia newberryi* (S. Wats.) Gray. ORANGE VELVET MALLOW. Deciduous shrub. 509-540 m. March-April. November-December. Bajada slopes, volcanic soils. Eagletail Mountains; Indian Springs Canyon, SW of end of cherry stem road, NW of Double Eagle Peak. Occasional. DN 95, 134, 147, 681; Van Devender 95-1026; Reina 96-89.

Malvaceae *Sphaeralcea ambigua* ssp*. ambigua* Gray. DESERT GLOBEMALLOW. Deciduous subshrub. 426-518 m. March, October. Side of sandy wash. Eagletail Mountains; EPNG pipeline road, stock tank W boundary of wilderness area. Infrequent. DN 84, 514, 546.

Malvaceae *Sphaeralcea ambigua* ssp. *rosaceae* (Munz & Johnston) Kearney. PARISH MALLOW. Deciduous subshrub. 526 – 576 m. March – May, October. Rock outcrops; bajada slopes, volcanic soils; side of sandy washes. Eagletail Mountains; wildlife tank 726, Triple Eye Catchment, Dead Deer Tank Wash, Indian Springs Canyon. Occasional. DN 72, 100, 288, 591, 621.

Malvaceae *Sphaeralcea coulteri* (S. Wats.) Gray. ANNUAL GLOBEMALLOW. Cool season annual. 369-463 m. February-March. Bajada slopes, granitic sandy soils; bottom of sandy washes. Eagletail Mountains; stock tank on W boundary of wilderness; Apache Box; Granite Mountains. Infrequent. DN 353, 502, 517.

Malvaceae *Sphaeralcea emoryi* Torr. Ex Gray. EMORY GLOBEMALLOW. Deciduous subshrub. 463 m. April. Side of sandy wash. Eagletail Mountains; wash NW of Courthouse Rock. Infrequent. Lehto 21246.

Martyniaceae *Proboscidea althaeifolia* (Benth.) Dcne. DESERT UNICORN-PLANT. Perennial herb. 350-396 m. September-October. Bottom of sandy washes. Clanton Well; EPNG Pipeline road. Infrequent. DN 1, 187.

Martyniaceae *Proboscidea parviflora* (Wooten) Wooten & Standley. DEVIL'S CLAW. Warm season annual. 348 m. July-October. Bottom of sandy washes. Road to Clanton well. Occasional. Observed but not collected.

Nolinaceae *Nolina bigelovii* (Torr.) S. Wats. BEAR GRASS. Evergreen shrub. 610 m. Late spring. Slot canyons. Eagletail Mountains; S of Grey tank. Rare. DN 104.

Nyctaginaceae *Allionia incarnata* L. TRAILING FOUR-O'CLOCK. Warm season annual. 470-556 m. September-October. Bajada slopes, granitic sandy soils; side of sandy wash. Granite Mountains; Eagletail Mountains; Indian Springs Wash, Courthouse Rock. Occasional. DN 7, 51, 416, 458, 549.

Nyctaginaceae *Boerhavia coccinea* P. Mill. SCARLET SPIDERLING. Perennial herb. 515 m. August-September. Bajada slopes, volcanic soils. Eagletail Mountains; Indian Springs Canyon. Occasional. DN 312, 459.

Nyctaginaceae *Boerhavia coulteri* (Hook.) S. Wats. COULTER'S SPIDERLING. Warm season annual. 510 m. September. Bajada slopes, volcanic soil. Eagletail Mountains; Courthouse Rock. Rare. DN 383.

Nyctaginaceae *Boerhavia erecta* L. ERECT SPIDERLING. Warm season annual. 490 m. September. Bajada slopes, volcanic soil. Eagletail Mountains; N of Double Eagle Peak. Occasional. Baker 15604.

Nyctaginaceae *Boerhavia intermedia* M.E. Jones. FIVEWING SPIDERLING. Warm season annual. 362-556 m. July-August. Side of sandy wash; bottom of sandy wash. Eagletail Mountains; Indian Springs Wash; Harquahala Valley. Occasional. DN 162, 313, 347; Baker 11515.

Nyctaginaceae *Boerhavia wrightii* Gray. MAKKUMI HA-JEWED. Warm season annual. 523 m. August-September. Bottom of sandy wash. Eagletail Mountains; Indian Springs Wash. Occasional. DN 4, 338.

Nyctaginaceae *Mirabilis laevis var. retrorsa* (Heller) Jepson. TRAILING FOUR-O'CLOCK. Perennial herb. 488 – 686 m. February – March, August. Bajada slopes, volcanic soil; side of sandy washes. Eagletail Mountains; Indian springs Wash, pass to Anvil Top Mesa, W of Eagle Peak. Occasional. DN 299, 337, 365, 463, 629, 673.

Nyctaginaceae *Mirabilis laevis* var. *villosa* (Kellogg) Spellenb. TRAILING FOUR-O'CLOCK. Perennial herb. 441-571 m. March-April, August-December. Side and bottom of sandy wash; bajada slopes, volcanic soil. Eagletail Mountains; Triple Eye Catchment, Indian Springs Wash, Courthouse Rock. Occasional. DN 80, 97, 346, 488, 611; Lehto 21234.

Oleaceae *Forestiera shrevei* Standl. DESERT OLIVE. Deciduous shrub to small tree. 488-736 m. February-March. Slot canyon; rock outcrop; bajada slopes; volcanic soil, north-facing. Eagletail Mountains; E of Eagle Peak, E of Eagletail Peak, Occasional. DN 34, 36, 40, 59, 190, 515, 653; Anderson 2003-5-b; Lehto 21211.

Oleaceae *Menodora scabra* Gray. ROUGH MENODORA. Deciduous subshrub. 515-560 m. April, July-October. Bajada slopes, north-facing, volcanic soils; side of sandy wash. Eagletail Mountains; Indian Springs Canyon, W of Eagletail Peak, wildlife tank 726. Infrequent. DN 151, 332, 342, 453, 550, 575.

Onagraceae *Camissonia boothii* ssp. *condensata* (Munz) Raven. WOODY BOTTLE-WASHER. Cool season annual. 530 m. April. Bottom of sandy wash. Eagletail Mountains; Indian Springs Wash. Rare. DN 229.

Onagraceae *Camissonia californica* (Nutt. ex Torr. & Gray) Raven. SUN CUP. Cool season annual. 400-543 m. February-April. Bajada slopes, granitic sandy soil; bajada slope, volcanic soil; Rock outcrop. Granite Mountains; Eagletail Mountains; Triple Eye Catchment, SW of end of cherry stem road, pass to Anvil Top. Occasional. DN 283, 366, 379, 511, 594, 659; Lehto 21226.

Onagraceae *Camissonia chamaenerioides* (Gray) Raven. WILLOW-HERB PRIMROSE. Cool season annual. 520 m. April. Bottom of sandy wash. Eagletail Mountains; Indian Springs Wash, canyon near Natural Bridge. Infrequent. DN 225; Butterwick 8000.

Onagraceae *Camissonia claviformis* (Torr. & Frém.) Raven. BROWN EYES. Cool season annual. 400-483 m. February. Bajada slope, granitic sandy soil; bajada slope, volcanic soil. Granite Mountains; Eagletail Mountains; Courthouse Rock Trailhead. Infrequent. DN 278, 362.

Onagraceae *Camissonia refracta* (S. Wats.) Raven. NARROWLEAF SUN CUP. Cool season annual. 463 m. April. Side of sandy wash. Eagletail Mountains; valley .5 mi W of Eagle Peak. Rare. Butterwick 7362.

Onagraceae *Oenothera deltoides* Torr. & Frém. WHITE DESERT PRIMROSE. Cool season annual. 400 m. February. Bottom of sandy wash. Sandy wash along EPNG pipeline road. Eagletail Mountains; W of Courthouse Rock trailhead. Infrequent. DN 372.

Onagraceae *Oenothera primiveris* Gray. EVENING PRIMROSE. Cool season annual. 369 m. March. Bottom of sandy wash. Apache Box. Infrequent. DN 520.

Orobanchaceae *Orobanche cooperi* (Gray) Heller. DESERT BROOMRAPE. Cool season annual. 540 m. March-April. Bajada slope, volcanic soil, south-facing. Eagletail Mountains; SW of end of cherry stem road, S of Eagletail Peak. Rare. DN 678; Lehto 21194.

Papaveraceae *Argemone gracilenta* Greene. PRICKLY POPPY. Perennial herb. 376 m. March. Bottom of sandy wash. Apache Box. Rare. DN 578.

Papaveraceae *Eschscholzia californica* Cham. CALIFORNIA POPPY. Cool season annual. 484-512 m. February. Bajada slope, granitic sandy soil; bajada slope, volcanic soil. Granite Mountains; Eagletail Mountains; north of wildlife tank 726. Rare. DN 275, 373; Unruh 13.

Papaveraceae *Eschscholzia minutiflora* S. Wats. LITTLE GOLD POPPY. Cool season annual. 526-568 m. February-March. Bajada slope, granitic sandy soil; rock outcrop, south-facing; bottom of sandy wash. Granite Mountains; Eagletail

Mountains; SW of end of cherry stem road, Indian Springs Wash. Occasional. DN 37, 280, 685.

Plantaginaceae *Plantago ovata* Forsk. DESERT INDIAN WHEAT. Cool season annual. 511-537 m. February. Bajada slopes, granitic sandy soil; bajada slopes, volcanic soil. Granite Mountains; Eagletail Mountains. Abundant during wet years. DN 273, 358.

Plantaginaceae *Plantago patagonica* Jacq. WOOLY PLANTAIN. Cool season annual. 405 m. April. Open valley. Harquahala valley. Occasional. DN 602.

Poaceae *Achnatherum speciosum* (Trin. & Rupr.) Barkworth. DESERT NEEDLEGRASS. Perennial grass. 610 m. Spring. Slot canyon. Eagletail Mountains; narrow canyon, section 32. Rare. Butterwick 7367.

Poaceae *Aristida adscensionis* L. SIX-WEEKS THREE AWN. Annual grass. 362-640 m. Spring, Summer, Fall. Side of sandy wash; rock outcrop; bajada slopes, granitic sandy soil; bajada slope; volcanic soil. Granite Mountains; Eagletail Mountains; N of Dead Deer Tank, Indian Springs Canyon, W of Eagle Peak. Common. Local populations in vicinity of Dead Deer Tank with awns not divergent. Other populations with central awn longer than side awns. Remaining populations have awns of equal length. DN 26, 59, 116, 163, 417, 491, 541, 606, 658, 677; Reina G 82-96.

Poaceae *Aristida purpurea* var*. nealleyi* (Vasey) Allred. NEALLEY THREE-AWN. Perennial grass. 538-580 m. Spring-Summer. Side of sandy wash; bajada slope, volcanic soil. Eagletail Mountains; Dead Deer Tank Wash, W of Eagletail Peak, Indian Springs Wash, NW base of Double Eagle Peak. Occasional. DN 34, 115, 325, 409; Reina G 96-83.

Poaceae *Aristida purpurea* var. *parishii* (A.S. Hitchc.) Allred. PARISH THREE-AWN. Perennial grass. 535 m. Spring-Summer. Side of sandy wash. Eagletail Mountains; canyon E of Indian Springs Wash. Infrequent. DN 335.

Poaceae *Aristida ternipes* Cav. HOOK THREE-AWN. Perennial grass. 540-556 m. Summer-Fall. Side of sandy wash. Eagletail Mountains; Indian Springs Wash. Rare. DN 460, 612.

Poaceae *Bothriochloa barbinodis* (Lag.) Herter. CANE BLUESTEM. Perennial grass. 518-636 m. Summer-Fall. Side of sandy wash. Eagletail Mountains; Dead Deer Tank Wash, canyon E of Indian Springs Canyon, side canyon to Indian Springs Canyon. Infrequent. DN 118, 324, 540.

Poaceae *Bouteloua aristidoides* (Kunth) Griseb. SIX-WEEKS NEEDLE GRAMA. Annual grass. 537 m. Summer-Fall. Side of sandy wash. Eagletail Mountains; Indian Springs Canyon. Common in wet summers. DN 310.

Poaceae *Bouteloua barbata* Lag. SIX-WEEKS GRAMA. Annual grass. 362 – 543 m. Summer-Fall. Side of sandy wash. Eagletail Mountains; Indian Springs Wash, Indian Springs Canyon, Harquahala Valley. Occasional in wet summers. Much less common in region than *B. Aristides*. DN 175, 316, 538.

Poaceae *Bouteloua curtipendula* (Michx.) Torr. SIDE-OATS GRAMA. Perennial grass. 636 m. Summer-Fall. Slot canyon. Eagletail Mountains; Dead Deer Tank Canyon, Indian Springs Canyon. Rare. DN 124.

Poaceae *Bouteloua trifida* Thurb. RED GRAMA. Perennial grass. 549 m. Non-seasonal. Side of sandy wash, cracks in rock surface of volcanic tuff. Eagletail Mountains; Wildlife tank 726. Infrequent. DN 33.

Poaceae *Bromus carinatus* Hook. & Arn. CALIFORNIA BROME. Annual grass 530-637 m. Spring. Side of sandy wash. Eagletail mountains; Indian Springs Canyon, N of Dead Deer Tank. Infrequent. DN 215, 477.

Poaceae *Bromus rubens** L. RED BROME. Annual grass. 475-640 m. Spring. Bajada slope, north-facing, volcanic soil; side of sandy wash; slot canyon.

Eagletail Mountains; N of Triple Eye Arches, E of Indian Springs Canyon, W of Eagle Peak, NW base of Double Eagle Peak. Occasional. Can be locally common in undisturbed habitats, but not abundant or widespread. DN 238, 496, 580, 609; Butterwick 7368; Reina 96-87.

Poaceae *Cynodon dactylon* *(L.) Pers. BERMUDA GRASS. Perennial grass. 515 m. Spring-Summer. Side of sandy wash. Eagletail Mountains; Indian Springs Wash, Indian Springs Canyon. Rare. DN 297, 340.

Poaceae *Dasyochloa pulchella* (Kunth) Willd. Ex Rydb. FLUFF GRASS. Perennial grass. 470-519 m. Spring-Summer-Fall. Bajada slope, granitic sandy soil; bajada slope, volcanic soil. Eagletail Mountains; along trail to Indian Springs, .25 mi W of Courthouse Rock; Granite Mountains. Occasional. Became locally extinct during the 15 month period without rain that ended September, 2002, but returned with normal rainfall. DN 50, 420, 449.

Poaceae *Enneapogon desvauxii* Desv. ex Beauv. SPIKE PAPPUS GRASS. Perennial grass. 580-640 m. Summer-Fall. Bajada slope, north-facing, volcanic soil. Eagletail Mountains; 2 km E of Eagletail Peak. Rare. DN 393, 406.

Poaceae *Eragrostis cilianensis** (All.) Vign. ex Janchen. STINK GRASS. Annual grass. 537-556 m. Summer-Fall. Side of sandy wash. Eagletail Mountains; Indian Springs Canyon, Indian Springs Wash. Rare. DN 322, 461.

Poaceae *Heteropogon contortus* (L.) Beauv. ex Roemer & J.A. S. TANGLEHEAD. Perennial grass. 405-514 m. Summer-Fall. Side of sandy wash. Eagletail Mountains; canyon E of Indian Springs Canyon, Indian Springs Canyon. Infrequent. DN 135, 326.

Poaceae *Leptochloa dubia* (Kunth) Nee. GREEN SPRANGLETOP. Perennial grass. 515 m. Summer-Fall. Side of sandy wash. Eagletail Mountains; Indian Springs Canyon. Rare. DN 320.

Poaceae *Leptochloa fusca* ssp. *fascicularis* (Lam.) N. Snow. MEXICAN SPRANGLETOP. Annual grass. 510 m. Summer-Fall. Side of sandy wash. Eagletail Mountains; Indian Springs Canyon. Rare. DN 10.

Poaceae *Leptochloa panicea* ssp. *brachiata* (Steudl.) N. Snow. RED SPRANGLETOP. Annual grass. 510 – 515 m. Summer, fall. Side of sandy wash. Eagletail Mountains; Indian Springs Canyon. Infrequent. DN 24, 321, 542.

Poaceae *Muhlenbergia microsperma* (DC.) Trin. LITTLE-SEED MUHLY. Annual grass. 475-543 m. Summer-Fall. Side of sandy wash; bajada slope, volcanic soil. Eagletail Mountains; Indian Springs Wash, NW base of Double Eagle Peak. Occasional. DN 36, 548, 615; Reina 96-96.

Poaceae *Muhlenbergia porteri* Scribn. ex Beal. BUSH MUHLY. Perennial grass. 475-580 m. Summer-Fall. Side of sandy wash; bajada slope, volcanic soils. Eagletail Mountains; Indian Springs Wash, 2 km. W of Eagletail Peak, NW base of Double Eagle Peak. Occasional. DN 9, 410; Van Devender 95-1029.

Poaceae *Panicum hirticaule* J. Presl. PANIC GRASS. Annual grass. 640 m. Summer-Fall. Bajada slope, north-facing, volcanic soil. Eagletail Mountains; 2 km W of Eagletail Peak. Rare. DN 397.

Poaceae *Phalaris minor** Retz. LITTLE-SEED CANARY GRASS. Annual grass. 529-610 m. Spring. Bottom of sandy wash. Eagletail Mountains; canyon E of Indian Springs Canyon, narrow canyon in section 32. Rare. DN 569; Butterwick 7373.

Poaceae *Pleuraphis rigida* Thurb. BIG GALLETA. Perennial grass. 518-543 m. Spring-Fall. Side of sandy wash; bajada slope, volcanic soils. Eagletail mountains; Indian Springs Wash, NW base of Double Eagle Peak. Occasional. DN 30, 539, 576, 613; Reina 96-99.

Poaceae *Poa bigelovii* Vasey & Scribn. BLUE GRASS. Annual grass. 530-552 m. Spring. Side of sandy wash. Eagletail Mountains; Indian Springs Canyon, N of Triple Eye Arches, canyon near Natural Bridge. Infrequent. DN 382, 500; Butterwick 7985.

Poaceae *Schismus arabicus* *Nees. MEDITERRANEAN GRASS. Annual grass. 516 m. Spring. Bajada slope, granitic sandy soil. Granite Mountains. Infrequent. DN 221.

Poaceae *Schismus barbatus* *(Loefl. ex L.) Thellung. MEDITERRANEAN GRASS. Annual grass. 422-520 m. Spring. Bajada slope, granitic sandy soil; side of sandy wash. Granite Mountains; Eagletail Mountains, Indian Springs Wash. Infrequent. DN 268, 351.

Poaceae *Sporobolus airoides* (Torr.) Torr. ALKALI SACATON. Perennial grass. 524 m. Summer-fall. Side of sandy wash. Eagletail Mountains; Indian Springs Canyon. Infrequent. DN 27.

Poaceae *Tridens muticus* (Torr.) Nash. SLIM TRIDENS. Perennial grass. 475-636 m. Fall. Bajada slope, north-facing, volcanic soil; side of sandy washes, cracks in rocks of volcanic tuff. Eagletail Mountains; Dead Deer Tank Canyon, Indian Springs Canyon, NW base of Double Eagle Peak. Occasional. DN 32, 120, 407; Reina 96-98.

Poaceae *Vulpia octoflora* (Walt.) Rydb. SIXWEEKS FESCUE. Annual grass. 463-637 m. Spring. Side of sandy wash. Eagletail Mountains; Indian Springs Canyon, N of Dead Deer Tank, western boundary stock tank. Infrequent. DN 240, 479, 497, 641; Reina 96-109.

Polemoniaceae *Gilia flavocincta* ssp. *australis* (A. & V. Grant) Day & V. Grant. LESSER YELLOWTHROAT GILIA. Cool season annual. 520 m. April. Bottom of sandy wash. Eagletail Mountains; Indian Springs Wash. Infrequent. DN 200.

Polemoniaceae *Gilia scopulorum* M.E. Jones. ROCK GILIA. Cool season annual. 583 m. March. Bajada slope, north-facing, volcanic soil. Eagletail Mountains; W of Eagle Peak. Rare. DN 473; Lehto 21223.

Polemoniaceae *Gilia stellata* Heller. STAR GILIA. Cool season annual. 369-637 m. February-March. Bajada slope, granitic sandy soil; side of sandy wash; rock outcrop. Eagletail Mountains; N of Dead Deer Tank, W of Eagle Peak, Indian Springs Wash, SW of end of cherry stem road; Granite Mountains; Apache Box. Occasional. DN 348, 361, 473, 478, 516, 626, 660.

Polemoniaceae *Gilia transmontana* (Mason & A. Grant) A. & V. Grant. TRANSMONTANA GILIA. Cool season annual. 610 m. March. Slot canyon. Eagletail Mountains; Natural Bridge. Infrequent. Butterwick 7994.

Polemoniaceae *Langloisia setosissima* (Torr. & Gray ex Torr.) Greene. GREAT BASIN LANGLOISIA. Cool season annual. 443-543 m. March-April. Bajada slope, granitic sandy soil; bottom of sandy wash; bajada slope, volcanic soil. Eagletail Mountains; Triple Eye Catchment, Indian Springs Wash; Granite Mountains. Occasional. DN 207, 444, 584.

Polemoniaceae *Linanthus bigelovii* (Gray) Greene. BIGELOW'S LINANTHUS. Cool season annual. 405 m. March. Bajada slope, granitic sandy soil. Granite Mountains. Infrequent. DN 448.

Polemoniaceae *Linanthus demissus* (Gray) Greene. DESERT SNOW. Cool season annual. 520 m. April. Bottom of sandy soil. Eagletail Mountains; Indian Springs Wash. Infrequent. DN 206.

Polygonaceae *Chorizanthe brevicornu* Torr. BRITTLE SPINEFLOWER. Cool season annual. 487-537 m. February-May. Bottom of sandy wash; bajada slope, granitic sandy soil; bajada slope, volcanic soil. Granite Mountains; Eagletail Mountains; E of Courthouse Rock, Indian Springs Wash. Occasional. DN 231, 256, 292, 431; Lehto 21243.

Polygonaceae *Chorizanthe rigida* (Torr.) Torr. & Gray. RIGID SPINEFLOWER. Cool season annual. 422 m. February. Desert pavement, volcanic soil base and granitic sandy soil base. Granite Mountains; Eagletail Mountains; N of Courthouse Rock. Occasional. DN 349.

Polygonaceae *Eriogonum deflexum* Torr. SKELETON WEED. Non-seasonal annual. 376-549 m. March-May, August-October. Bottom of sandy wash; desert pavement. Apache Box; Eagletail Mountains; Indian Springs Wash, E of Courthouse Rock. Occasional. DN 28, 219, 292, 304, 523; Lehto 21221.

Polygonaceae *Eriogonum fasciculatum* Benth. MOJAVE BUCKWHEAT. Deciduous shrub. 521-736 m. March-April, October-November. Slot canyon; bajada slope, north-facing, volcanic soil; rock outcrop. Eagletail Mountains; Dead Deer Tank Canyon, E of Eagletail Peak, Triple Eye Catchment. Occasional. DN 62, 117, 193, 476, 480, 586.

Polygonaceae *Eriogonum inflatum* var.*deflatum* I.M. Johnson. DESERT TRUMPET. Perennial herb. 580 m. September. Bajada slope, north-facing, volcanic soil. Eagletail Mountains; 2 km W of Eagletail Peak, NW of Courthouse Rock. Infrequent. DN 400; Lehto 21236.

Polygonaceae *Eriogonum inflatum* var. *inflatum* Torr. & Frém. DESERT TRUMPET. Non-seasonal annual. 545 m. May. Desert pavement. Eagletail Mountains; Indian Springs Wash. Occasional. DN 292.

Polygonaceae *Eriogonum thomasii* Torr. WILD BUCKWHEAT. Non-seasonal annual. 449-537 m. February-March, October. Bajada slope, granitic sandy soil; side of sandy wash. Eagletail Mountains; N of Courthouse rock. Occasional. DN 77, 269, 446; Lehto 21220.

Polygonaceae *Eriogonum trichopes* Torr. YELLOW TRUMPET. Non-seasonal annual. 488-545 m. March-May, November. Desert pavement. Eagletail Mountains; road to Indian Springs. Infrequent. DN 53, 291, 625.

Polygonaceae *Eriogonum wrightii* Torr. ex Benth. WILD BUCKWHEAT. Deciduous shrub. 452-579 m. October-November. Rock outcrop; slot canyon; bajada slope, volcanic soil. Eagletail Mountains; canyon E of Indian Springs Canyon, SW of end of cherry stem road, Triple Eye Catchment. Occasional. DN 123, 131, 333, 531, 585.

Polygonaceae *Pterostegia drymarioides* Fisch. & C.A. Mey. PTEROSTEGIA. Cool season annual. 610 m. March. Slot canyon. Eagletail mountains; canyon E of Eagletail peak near Natural Bridge. Infrequent. Butterwick 7984.

Portulacaceae *Portulaca oleracea* L. LITTLE HOGWEED. Warm season annual. 512 m. September. Rock outcrop, north-facing. Eagletail Mountains; Courthouse Rock. Rare. DN 382.

Pteridaceae *Astrolepis cochisensis* (Goodding) Benham & Windham. STAR-SCALED CLOAK FERN. Perennial herb. 512 m. Seasonal. Rock outcrop, north-facing. Eagletail Mountains; Courthouse Rock. Rare. DN 387.

Pteridaceae *Cheilanthes covillei* Maxon. LIP FERN. Perennial herb. 610 m. Seasonal. Rock outcrop, north-facing. Eagletail Mountains; N of Eagle Peak. Rare. Butterwick 7794.

Pteridaceae *Cheilanthes parryi* (D.C. Eat.) Domin. PARRY'S LIP FERN. Perennial herb. 475-610 m. Seasonal. Rock outcrop, north-facing. Eagletail Mountains; Indian Springs Canyon, Courthouse Rock, NW base of Double Eagle Peak, N of Eagle Peak. Occasional. DN 44, 148, 386; Butterwick 7792, 7793; Reina 96-110.

Pteridaceae *Notholaena standleyi* Maxon. STAR CLOAK FERN. Perennial herb. 637 m. Seasonal. Rock outcrop, north-facing. Eagletail Mountains; N of Dead Deer Tank. Rare. DN 483.

Pteridaceae *Pellaea mucronata* (D.C. Eaton) D.C. Eaton. BIRD'S FOOT CLIFF BRAKE. Perennial herb. 500 m. Seasonal. Slot canyon, north-facing. Eagletail Mountains; E of Eagletail Peak. Rare. DN 564.

Ranunculaceae *Anemone tuberosa* Rydb. TUBER ANEMONE. Perennial herb. 490 – 610 m. March. Bajada slope, north-facing, volcanic soil; rock outcrop; slot canyon. Eagletail Mountains; W of Eagle Peak, Indian Springs Canyon, Natural Bridge. Infrequent. DN 58, 70, 470, 628, 632; Butterwick 7991.

Ranunculaceae *Clematis drummondii* Torr. & Gray. VIRGIN'S BOWER. Deciduous shrub, vining. 376-610 m. March, October. Side of sandy wash; slot canyon. Eagletail Mountains; N of Grey Tank, Natural Bridge Canyon; Apache Box. Infrequent. DN 106, 181; Butterwick 8002.

Ranunculaceae *Delphinium parishii* Gray. DESERT LARKSPUR. Perennial herb. 549-640 m. April. Bajada slope, volcanic soil, north-facing. Eagletail Mountains; E of Indian Springs Canyon, W of Eagle Peak, Indian Springs Canyon. Infrequent. DN 573, 605; Butterwick 7374.

Resedaceae *Oligomeris linifolia* (Vahl) J.F. Macbr. DESERT CAMBESS. Cool season annual. 530 m. April. Bottom of sandy wash. Eagletail Mountains; Indian Springs Wash. Infrequent. DN 218.

Rhamnaceae *Colubrina californica* I.M. Johnston. CALIFORNIA SNAKEWOOD. Deciduous shrub. 335-502 m. July-November. Side of sandy wash. Eagletail mountains; Indian Springs Wash; Clanton Well. Infrequent. DN 6, 139; Anderson 2002-4; Butterwick 8010.

Rhamnaceae *Condalia globosa* I.M. Johnston. CRUCILLO. Deep rooted tree. 390-762 m. March-April, October-December. Side of sandy wash; slot canyon; bajada slope, volcanic soil. Eagletail Mountains; Indian Springs Canyon, NW base of Double Eagle Peak, Natural Bridge Canyon, N of Eagle Peak, S of Eagletail Peak. Occasional. DN 45, 109, 129; Anderson 2002-5; Reina 96-106; Butterwick 7993, 7788 –A; Lehto 21199.

Rhamnaceae *Ziziphus obtusifolia* (Hook. ex Torr. & Gray) Gray. GRAYTHORN. Deciduous shrub. 415-583 m. August-October. Side of sandy wash; rock outcrop; bajada slope, volcanic soil. Eagletail Mountains; Indian Springs Canyon, W of Eagle Peak, EPNG pipeline Road. Occasional. DN 87, 298, 306, 462, 604.

Rubiaceae *Galium aparine* L. GOOSEGRASS. Cool season annual. 530-552 m. March-April. Side of sandy wash. Eagletail Mountains; Indian Springs Canyon, N of Triple Eye Arches, SE of Dead Deer Tank. Infrequent. DN 234, 501; Butterwick 7369.

Rubiaceae *Galium proliferum* Gray. BEDSTRAW. Cool season annual. 610 m. March. Slot canyon. Eagletail Mountains; Natural Bridge Canyon. Rare. Butterwick 7992.

Rubiaceae *Galium stellatum* Kellogg. DESERT BEDSTRAW. Deciduous subshrub. 509-686 m. March-April. Bajada slope, north-facing, volcanic soil; rock outcrop; slot canyon. Eagletail Mountains; Anvil Top, Indian Springs Canyon, SW of end of cherry stem road. Occasional. DN 5, 31, 61, 157, 367, 472, 656.

Salicaceae *Salix gooddingii* Ball. GOODING'S WILLOW. Deep rooted tree. 526 m. April. Side of sandy wash in deep canyon. Eagletail Mountains; Indian Springs Canyon. Rare. Area known as Willow Spring since 1917, now called Indian Spring. This tree observed since 1989. Flood in summer, 2004 knocked over main trunk. Now sends up shoots off main trunk. Tree survived fifteen months without rain in 2001/2002 drought. DN 210.

Scrophulariaceae *Castilleja exserta* (Heller) Chuang & Heckard. PURPLE OWL'S CLOVER. Cool season annual. 376-508 m. March-April. Bajada slope, granitic sandy soil; side of sandy wash. Granite Mountains; Eagletail Mountains; Indian Springs Canyon; Apache Box. Common in wet winters. DN 439, 536, 571.

Scrophulariaceae *Keckiella antirrhinoides (*Benth) Straw. BUSH PENSTEMON. Deciduous shrub. 636 m. April. Rock outcrop in deep canyon. Eagletail Mountains; canyon N of Dead Deer Tank. Rare, only seen in two canyons on W side of range. DN 482; Butterwick 7365.

Scrophulariaceae *Mimulus guttatus* Dc. MONKEYFLOWER. Non-seasonal annual. 530 m. April. Wet soils on side of tinaja. Eagletail Mountains; Indian Springs Canyon. Rare. Only seen during wet winters in one location. DN 236.

Scrophulariaceae *Neogaerrhinum filipes* (Gray) Rothm. CLIMBING SNAPDRAGON. Winter annual, vining. 526-583 m. March, April. Bottom of sandy wash; bajada slope, volcanic soil. Eagletail Mountains; Indian Springs Wash, W of Eagle Peak, N of Triple Eye Arches, Indian Springs Canyon. Infrequent. DN 237, 468, 503, 620.

Scrophulariaceae *Penstemon subulatus* M.E. Jones. BEARDTONGUE. Perennial herb. 488-521 m. March. Bottom of sandy wash. Eagletail Mountains; Indian Springs Wash; canyon N of Triple Eye Arches. Rare. Only seen growing in cracks in rocks of volcanic tuff. In the bottom of major washes. DN 63, 619.

Scrophulariaceae *Pseudorontium cyathiferum* (Benth.) Rothm. DESERT SNAPDRAGON. Non-seasonal annual. 452-518 m. February, October. Bottom of sandy wash; bajada slope, volcanic soil. Eagletail Mountains; Indian Springs Canyon, W of Double Eagle Mine. Rare. DN 33, 552.

Simaroubaceae *Castela emoryi* (Gray) Moran & Felger. CRUCIFIXION THORN. Deciduous shrub. 362 m. Late spring. Open valley. Harquahala Valley. Occasional. DN 170.

Simmondsiaceae *Simmondsia chinensis* (Link) Schneid. JOJOBA. Evergreen shrub. 475-736 m. March. Bajada slopes, volcanic soil, north-facing; slot canyon. Eagletail Mountains; NW base of Double Eagle Peak, E of Eagle Peak, 2 km. W of Eagletail Peak. Occasional. During fifteen month period without rain, the leaves and twigs were main source of food for desert mule deer. DN 38, 191, 403; Reina 96-107.

Solanaceae *Datura discolor* Bernh. JIMSONWEED. Warm season annual. 373 m. October. Bottom of sandy wash. Apache Box. Rare. DN 189.

Solanaceae *Lycium andersonii* Gray. DESERT WOLFBERRY. Deciduous shrub. 350-611 m. February-April, August-October. Side of sandy wash; slot canyon; bajada slopes, granitic sandy soils. Eagletail Mountains; Indian Springs Canyon, canyon N of Triple Eye Arches, canyon E of Eagletail Peak, N of Clanton Well, N of Double Eagle Peak; Granite Mountains. Common. DN 166, 174, 185, 233, 255, 274, 277, 354, 493, 558, 561, 702; Baker 15607. Lehto 21196.

Solanaceae *Lycium berlandieri* Dunal. BERLANDIER'S WOLFBERRY. Deciduous shrub. 457-655 m. February, July-October. Slot canyon; bajada slope, granitic sandy soil; side of sandy wash. Eagletail Mountains; N of Double Eagle Peak, E of Clanton Well, canyon E of Eagletail Peak, Indian Springs Canyon; Granite Mountains. Occasional. DN 3, 183, 253, 302, 55; Baker 11513.

Solanaceae *Lycium exsertum* Gray. ARIZONA DESERT-THORN. Deciduous shrub. 450-650 m. February-April, October. Bajada slope, volcanic soil; slot canyon; rock outcrop. Eagletail Mountains; Anvil Top, canyon E of Eagletail Peak, S of Grey Tank, base of rock outcrop SE of Eagletail Peak. Occasional. DN 29, 370, 566, 589, 617, 657, 700.

Solanaceae *Lycium fremontii* Gray. FREMONT WOLFBERRY. Deciduous shrub. 530 m. February-April. Side of sandy wash. Eagletail Mountains; Indian Springs

Canyon. Rare. Produces larger fruits than L. andersonii or L. berlandieri. DN 235, 243.

Solanaceae *Lycium macrodon* Gray WOLFBERRY. Deciduous shrub. 406 m. February. Bajada slope, granitic sandy soil. Granite Mountains. Rare. DN 355, 359.

Solanaceae *Nicotiana obtusifolia* Mertens & Galeotti. DESERT TOBACCO. Perennial herb. 432-540 m. March-May, October. Bajada slope, volcanic soil, north-facing; bottom of sandy wash. Eagletail Mountains; Courthouse Rock, wash SW of Courthouse Rock, rock outcrop SW of end of cherry stem road, wash NW of Courthouse Rock. Occasional. DN 51, 81, 390, 670, 680; Lehto 21235-a.

Solanaceae *Physalis crassifolia* Benth. DESERT GROUND CHERRY. Perennial herb. 518-587 m. March, July-October. Bottom sandy wash; bajada slope, volcanic soil; rock outcrop. Eagletail Mountains; Indian Springs Canyon, wash S of Triple Eye Catchment, rock outcrop SW of end of cherry stem road. Occasional. DN 50, 455, 484, 543, 679; Lehto 21192.

Sterculiaceae *Ayenia filiformis* S. Wats. AYENIA. Deciduous subshrub. 500-611 m. March, October. Slot canyon; rock outcrop. Eagletail Mountains; canyon N of Triple Eye Arches, SW of end of cherry stem road, canyon near Natural Bridge. Infrequent. DN 508. 697; Butterwick 7990.

Tamaricaceae *Tamarix aphylla** (L.) Karst. ATHEL TAMARISK. Deep rooted tree. 463 m. Spring. Bottom of sandy wash. Eagletail Mountains; stock tank W boundary of wilderness. Rare. After Hurricane Nora's exit in September, 1997 seedlings of this genus found growing in favorable locations, but none survived. DN 513, 599.

Ulmaceae *Celtis pallida* Torr. DESERT HACKBERRY. Deciduous shrub. 480-500 m. October. Rock outcrop; slot canyon; bajada slopes, north-facing, volcanic soil.

Eagletail Mountains; canyon E of Eagletail Peak, SE of Eagletail Peak, Grey Tank. Rare. Only seen at points E of Eagletail Peak. DN 101, 701.

Urticaceae *Parietaria hespera* Hinton. DESERT PELLITORY. Cool season annual. 490-610 m. March-April. Rock outcrop. Eagletail Mountains; rock outcrop E of Courthouse Rock, Indian Springs Canyon, canyon N of Triple Eye Arches, canyon SE of Eagletail Peak, canyon N of Dead Deer Tank. Occasional. DN 132, 150, 426, 490, 499, 633; Lehto 21189; Butterwick 7986-a, 8003.

Verbenaceae *Aloysia wrightii* Heller ex Abrams. OREGONILLO. Deciduous shrub. 521-629 m. September-November. Side of sandy wash. Eagletail Mountains; Dead Deer Tank Wash, Indian Springs Canyon. Occasional. DN 14, 114, 136.

Verbenaceae *Glandularia gooddingii* (Briq.) Solbrig. DESERT VERBENA. Perennial herb. 570 m. March. Side of sandy wash. Eagletail Mountains; canyon N of Triple Eye Arches. Rare. DN 68.

Verbenaceae *Tetraclea coulteri* Gray. TETRACLEA. Perennial herb. 542 m. October. Side of sandy wash. Eagletail Mountains; SW of Triple Eye Arches. Rare. DN 125.

Viscaceae *Phoradendron californicum* Nutt. DESERT MISTLETOE. Perennial herb, parasite. 513-521 m. April. Fabaceae is main host. Eagletail Mountains; Indian Springs Canyon, S of Eagletail Peak. DN 133, 149; Lehto 21213.

Zygophyllaceae *Fagonia laevis* Standl. FAGONIA. Perennial herb. 441-518 m. February-April, November. Desert pavement; bajada slope, volcanic soil. Eagletail Mountains; base of Courthouse Rock, EPNG pipeline road W of entrance to Courthouse Rock, NW of base of Double Eagle Peak, S of Eagletail Peak. Infrequent. DN 601, 662; Lehto 21187, 21219. Reina 96 – 90.

Zygophyllaceae *Kallstroemia californica* (S. Wats.) Vail CALIFORNIA CALTROP. Warm season annual. 490 – 549 m. August – October. Side of sandy wash. Eagletail Mountains; Indian Springs Wash, N of Double Eagle peak. Infrequent. Can be locally common after wet summer. DN 305, 551; Baker 15602.

Zygophyllaceae *Kallstroemia grandiflora* Torr. ex Gray. ORANGE CALTROP. Warm season annual. 500 m. July-September. Side of sandy wash. Eagletail Mountains; Indian Springs Canyon, wash below wildlife tank # 726. Infrequent. Can be locally common after wet summers. DN 23.

Zygophyllaceae *Larrea tridentata* (Sesser & Moc. ex DC.) Coville. CREOSOTE BUSH. Evergreen shrub. 426 m. April, July-October. Bajada slope, volcanic soil; bajada slope, granitic sandy soil; desert pavement, side of sandy washes, rock outcrops; Open valley. Eagletail Mountains; EPNG pipeline road along sandy wash, S of Eagletail Peak, NW of Courthouse Rock. Abundant. DN 85; Lehto 21247, 21188.

Zygophyllaceae *Tribulus terrestris** L. PUNCTURE VINE. Warm season annual. 362 m. August. Open valley. Harquahala Valley along Courthouse Road. Occasional. DN 164.

APPENDIX B

RAINFALL IN EAGLETAIL MOUNTAINS

EAGLETAIL MOUNTAIN

RAINFALL (IN)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1992										1.50			
1993	6.00	2.00	1.25	0.20	0.00	0.05	0.00	0.15	0.65	0.00	0.25	0.00	10.55
1994	0.35	0.00	0.00	1.25	0.00	0.00	0.25	0.00	2.35	0.75	0.25	1.60	6.80
1995	0.00	1.15	0.00	1.40	0.00	0.00	1.10	0.75	0.35	0.00	0.80	0.00	5.55
1996	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	2.45	0.00	0.00	0.00	2.95
1997	0.10	0.70	0.00	0.80	0.00	0.45	0.00	1.00	0.00	4.00	0.00	1.10	8.15
1998	0.00	2.30	3.60	0.55	0.40	0.00	0.00	1.50	1.20	0.00	0.00	1.00	10.55
1999	0.70	0.00	0.00	0.00	1.50	0.30	2.65	0.60	0.25	0.00	0.00	0.00	6.00
2000	0.00	0.15	1.10	0.25	0.00	0.50	1.50	0.15	1.00	0.00	3.30	0.00	7.95
2001	0.90	0.00	2.10	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	3.20
2002	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	1.00	0.50	0.00	0.00	2.00
2003	1.35	0.00	0.00	1.75	0.00	0.00	0.00	1.50	2.00	0.00	1.15	0.00	7.75
2004	0.30	0.00	0.00	1.00	0.00	0.00	0.25	3.85	0.45	3.70	0.00	0.00	9.55
2005	5.75	0.00	0.00	0.00	3.75	0.00	0.00	4.10	1.85	0.00	1.65	0.00	17.10
2006	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.40	2.10	0.00	0.00	0.00	2.75
2007	0.25	0.00	0.45	0.40	0.00	0.00	0.00	0.75	0.00	0.00	0.25	1.25	3.35
2008	0.35	1.20	0.00	0.00	0.20	0.00	2.55	2.00	0.00	1.30	0.00	0.00	7.60
2009	1.50	0.00	0.00	0.00	0.00	0.00	0.00	3.75	0.00	0.00	0.00	0.50	5.75
2010	6.00	0.00	1.20	0.00	0.00	0.00	0.00	1.95	0.00	0.35	0.00	0.00	9.50
2011	0.75	0.00	1.00	0.00	0.00	0.00	1.80	0.00	0.50	No data	No data	No data	No data
Average	1.31	0.39	0.57	0.44	0.31	0.07	0.56	1.18	0.86	0.59	0.43	0.37	7.07