

# THE VASCULAR FLORA OF THE HUMMINGBIRD SPRINGS WILDERNESS, MARICOPA COUNTY, ARIZONA

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## ABSTRACT

The goal of this study was to inventory the vascular plants of the Hummingbird Springs Wilderness (HSW), an area covering 31,000 acres of the Sonoran Desert and located about 60 miles west of Phoenix, Arizona. In order to obtain an accurate biodiversity assessment, plants were collected in the field from January 2006 to December 2007, in a variety of vegetation zones (defined by different parameters such as elevation, aspect, or soil) in all seasons. In addition, samples of the seed bank were collected from several locations, and grown in conditions similar to a wet year in the field. A total of 270 species were collected belonging to 64 families, including 199 genera. Five families accounted for 46% of the collection: Asteraceae (38 genera, 49 species), Poaceae (20 genera and 31 species), Fabaceae (13 genera and 19 species), Boraginaceae (six genera and 13 species) and Euphorbiaceae (five genera and 12 species). Thirty-six species were collected from the greenhouse, including six species that were not collected in the field but are now presumed to grow in HSW. The flora of the Hummingbird Springs Wilderness provides a plant community snapshot that can be used in the future by a variety of researchers and government agencies.

## INTRODUCTION

At a time when biodiversity is threatened by habitat loss, invasive species, and human impacts, lands designated as wilderness are important as a refugia for species, and may be examples of less disturbed ecosystems. With the passing of the 1990 Arizona Desert Wilderness Act, over two million acres of desert terrain were set aside throughout the state, increasing the total acreage of protected land to 4.8 million acres (Warren 2002). The passage of the act created nineteen areas managed by the Bureau of Land Management (BLM), including Hummingbird Springs Wilderness (HSW).

Although there have been many floras completed in Arizona, there have been no plant checklists or floristic studies done within twenty-five miles of the Wilderness (Moore and Cole 2004). In fact, most localities in western Arizona are sparsely documented botanically compared to the rest of the state. Prior to the creation of this flora, less than 40 plant species had been collected in the Hummingbird Springs Wilderness and nearby areas, with the most recent collection in 1996 by BLM botanist John Anderson (SEINet 2008). Floras completed nearest to HSW include the White Tank Mountains Regional Park and the Buckeye Hills

Recreational Area. A flora is in progress at the Eagletail Mountains Wilderness.

## STUDY AREA

**Overview**—Hummingbird Springs Wilderness is located about 60 miles west of Phoenix in the Sonoran Desert, and about 11 miles north of Interstate 10 and the town of Tonopah. Nearby ranges include the Harquahala Mountains to the northwest, and the Eagletail Mountains to the southwest. The Wilderness boundary outlines over 31,000 acres and is accessible from the north and south by gravel roads. The topography varies greatly, containing 8 miles of the Big Horn Mountain Range with the peak elevation at Sugarloaf Mountain (3,418 ft) and the low valleys at 1,550 ft.

Seasonal water sources throughout the Wilderness include Hummingbird Springs, livestock tanks and washes. Several wells have been built in the past and still exist today for a variety of purposes. Within three miles of Sugarloaf Mountain is a large mine owned by the federal government, nicknamed the Belmont Pit. It actively mines gold, copper, silver, and lead (USBM 1994). Arizona had an extensive mining boom that started in the 1870s, and several inactive mines dot the area around the Wilderness (Trimble 2004).

**Geology and Soils**—The HSW contains six different geological units defined by geological age and type, ranging in age from the middle Pleistocene Epoch (0.78 to 0.13 Mya) to the early Proterozoic Eon (1650-1800 Mya). Volcanic rocks, granitoid rocks and older surficial deposits dominate the landscape of HSW. Other minor layers consist of sedimentary rocks, metamorphic rocks such as gneiss, and granitoid rocks such as granite, quartz diorite and gabbro (Reynolds 1988).

Two soil associations are dominant in Hummingbird Springs Wilderness. The first is the Gunsight-Rillito-Pinal Association (HA4) that includes well-drained, limey, gravelly soils on alluvial surfaces and valley slopes. Calcareous mixed alluvium resulting from volcanic rocks, schist, limestone, and granite formed the soils of HA4. Shallow depth and low water capacity in the Pinal soils restrict plant growth (Hendricks 1986). The second soil association, Lithic Camborthids-Rock Outcrop-Lithic Haplargids (HA6), consists of gravelled and cobbled shallow sloping soils, and rock outcrops on hills and low mountains. Because of the steep and rocky terrain, livestock grazing on this soil association is minimal. Weathered materials from granitic rocks, schists, basalt, volcanic tuffs and conglomerates, sandstone and some shale formed the soils of HA6 (Hendricks 1986).

**Climate**—The weather in central Arizona was dry and hot during the period of collection for this flora, which was conducted from the January 2006 to December 2007. The longest drought ever recorded in Arizona occurred from October 18, 2005 to March 11, 2006 lasting 143 days (Giblin 2006). HSW has a similar climate to that of the city of Phoenix, with the Wilderness climate being drier and less predictable from year to year. The average temperatures range from 106.5 °F in July to 36.4 °F in December, with recorded extremes of 121 °F and 14 °F (WRCC 2008). Precipitation averages from 1.18 inches (3 cm) in August to 0.03 inches (0.1 cm) in May with recorded extremes of 4.84 inches (12.3 cm) and 0.00 inches (0 cm) (WRCC 2008). In the town of Tonopah, 11 miles south of HSW,

temperatures reached a record high mean of 92.5 °F in the summer of 2006 (June, July, August) compared to the summer average of 89 °F. In the winter (December, January, February) of 2006, precipitation hit a record low of 1.05 inches (2.7 cm), compared to the winter average of 2.98 inches (7.6 cm) in Tonopah (WRCC 2008).

**Fauna**—The Sonoran Desert is home to a diversity of mammals, reptiles, birds and insects. Those noted while plant collecting include mule deer, jackrabbits, roadrunners, tarantulas, desert tortoises, rattlesnakes, and various other birds and lizards. Many other species typical of the Sonoran Desert are most likely present, including javelina, coyote and vultures.

Two introduced animals are also prominent in the landscape surrounding and inside the Wilderness: wild burros and cattle. About 1500 wild burros are estimated to live in Arizona. Since the land in the area is owned by the BLM, wild burro herds and the permits for cattle grazing are regulated by this agency. Although the HSW area is not managed for wild burros, a small herd (estimated at 47) has been documented in the Harquahala Mountains to the northwest. Another 100 burros do not fall into a particular herd, but roam the areas outside herd management (BLM 2008). While the Wild Horse and Burro Act of 1971 provides federal protection for wild burros, they cause problems for native wildlife and can therefore affect ecosystem health (Bleich 2005).

Cattle grazing became a large industry in Arizona in the 1880s and continues to varying degrees today (Trimble 2004). Due to the long-standing tradition of open cattle grazing, it is not surprising that when wilderness areas were created, grazing was not banned. In fact, according to the Wilderness Act of 1964, grazing levels established prior to wilderness designation must be maintained. Active sheep and cattle grazing is present in about 35% of wilderness areas in the western states, and threatens native plant and animal life (Cole and Landres 1996).

Three grazing allotments outlined by the BLM include parts of the HSW and the nearby land: Aguila, Ohaco and Echeverria. These areas are allowed a certain number of cattle per month within the assigned acreage according to the amount of forage available, measured in Animal Unit Months (AUMs) (Bedell 1992). In total, over 7000 AUMs are given for over 275,000 acres within and around HSW. The actual number of cattle present on these acres is 630, which are allowed to roam in and around the Wilderness (BLM RAS 2008).

**Vegetation**—The Sonoran Desert is a Tropical-Subtropical Desertland (Brown 1994). The Hummingbird Springs Wilderness boundary encompasses two distinct vegetation zones of the Sonoran Desert: Arizona Upland Sonoran Desertscrub (Fig. 1A), and Lower Colorado River Sonoran Desertscrub, as defined by Brown and Lowe (1980).

The HSW area primarily contains plant communities common to the Arizona Upland division of the Sonoran Desert. The landscape is a scrubland of armed leguminous trees and intervening spaces filled with perennial shrubs and cacti. The most common plant association in the HSW area is Paloverde-Cacti-Mixed Scrub, in which the dominant species are Paloverde (*Parkinsonia microphylla*), Saguaro (*Carnegiea gigantea*) and Creosote (*Larrea tridentata*). Many other species are common and can become dominant in localized areas including Triangle Leaf

Bursage (*Ambrosia deltoidea*), White Thorn Acacia (*Acacia constricta*), Teddy Bear Cholla (*Cylindropuntia bigelovii*; Fig. 1B), and Ocotillo (*Fouquieria splendens*).

Other plant associations in the area, in this Arizona Upland division, are less common but are present in small pockets. The eastern edge of the Wilderness contains a Jojoba-Mixed Scrub community, with the dominant species being Jojoba (*Simmondsia chinensis*), but also includes many of the species mentioned above. Other areas include stands of Creosote and Crucifixion Thorn (*Canotia holacantha*), or hillsides of Brittlebush (*Encelia farinosa*). Large Ironwood trees (*Olneya tesota*) are more commonly seen in the southern portion of the wilderness, along with Saguaro and perennial shrubs.

As a person travels south, it becomes evident that the plant communities are changing, becoming less dense and adapting to an area of lower elevation and drier climate. This transition between the two divisions of the Sonoran Desert is gradual and in HSW, plant associations of the two divisions can be found overlapping throughout its center section.

Across the Wilderness, ephemeral and annual species are present after late summer monsoons or winter rains, but the recent drought created a limited estimate of these species in this study. Those that are common to the Wilderness even in dry years include grasses such as *Schismus* spp., members of Boraginaceae such as *Cryptantha* spp., and members of Euphorbiaceae such as *Chamaesyce* spp.

The southeastern portion of the HSW is sparse and contains plant communities common to the Lower Colorado River division of the Sonoran Desert (Brown 1994). Sections of desert pavement dot the area, with expanses of perennial shrubs such as Creosote and White Bursage (*Ambrosia dumosa*) throughout. The larger washes in this area house other more water dependent species, such as Paloverde, White Thorn Acacia and Ironwood.

## METHODS

Plants were collected in the field (Fig. 2A) at least once a month throughout the floristic study (January 2006 to December 2007), with more frequent collecting during peak growing seasons or after heavy rains. A total of 29 days were spent in the field gathering plants and hiking the Wilderness. With each collection, location and elevation were recorded using a GPS, and associated species, habitat description and relative abundance were noted. With the goal of visiting every section within the Wilderness boundary, a variety of vegetation zones were surveyed in all seasons as defined by different parameters such as elevation, aspect or soil. Some areas of the Wilderness were not surveyed due to limited access and time constraints.

Specimens were identified using *Arizona Flora* (Kearney and Peebles 1960) with appropriate revisions and updates from the Flora of Arizona Project in the *Journal of Arizona-Nevada Academy of Science* and *Canotia* ([www.canotia.org](http://www.canotia.org)). Nomenclature, author names and abbreviations follow the United States Department of Agriculture's National Plants Database (USDA 2008), with exceptions for certain species when the new treatments for Arizona were available. Experts including Elizabeth Makings and Dr. Leslie Landrum were consulted as needed for particular genera, and species identification was verified using the Arizona State University

(ASU) Herbarium collections. Over 800 voucher specimens were made and are housed in the ASU Herbarium.

**Greenhouse Methods**—In the fall of 2005, when the planning of the floristic study began, Arizona experienced the driest winter ever recorded. In dry years, the ephemerals in the area are not likely to germinate. To capture the diversity of the ephemerals, samples of the seed bank were collected and grown in a greenhouse on the ASU campus. Previous studies have shown that in desert soils, the seed bank is present in the top two centimeters of the soil (Reichman 1984). Samples were collected in the field twice in 2006 and twice in 2007, at various locations in the Wilderness (Fig. 2B). Several microhabitats were sampled with an effort made to minimize the impact of soil removal. The greenhouse conditions were maintained to mimic wet seasons in the field, with frequent watering and approximate field temperatures. Each soil sample was evenly distributed over a mix of sterile soil and coarse sand in a 13 by 9 inch tray, with a total of 29 sample trays and two control trays containing only soil and coarse sand (Fig. 1C). Soil samples were between 100 and 200 cm<sup>3</sup>. Specimens grown from seed were collected, pressed and identified in the same manner as the field collections as soon as they reached reproductive maturity. The greenhouse study began in February 2006 and continued through November 2007. Voucher specimens were made of each species from each sample site and are housed at the ASU Herbarium.

## RESULTS AND DISCUSSION

Plant collecting in and around the boundaries of HSW yielded 864 individual collections. A total of 270 species were collected belonging to 64 families, including 199 genera (Table 1). Five families accounted for 46% of the collection: Asteraceae (38 genera, 49 species), Poaceae (20 genera and 31 species), Fabaceae (13 genera and 19 species), Boraginaceae (six genera and 13 species) and Euphorbiaceae (five genera and 12 species).

**Table 1.** Taxonomic\* composition of the 864 collections from HSW.

Taxonomic Group	Families	Genera	Species		Species Total
			Native	Introduced	
Pteridophyta	1	4	5	0	5
Lycopodiophyta	1	1	1	0	1
Pinophyta: Gnetopsida	1	1	2	0	2
Magnoliophyta	61	193	243	19	262
Magnoliopsida	57	170	217	11	228
Liliopsida	4	23	26	8	34
<b>Column Total</b>	<b>64</b>	<b>199</b>	<b>251</b>	<b>19</b>	<b>270</b>

\*Species characteristics from USDA PLANTS database (2008)

The origin of each species was determined using the USDA PLANTS database. Species are considered “native” when we presume they were present at the time of Columbus (USDA 2008). Introduced species (Table 2) reproduce spontaneously in the wild and are believed to have arrived in the U.S after the time of Columbus. Nineteen of the species collected (7%) are listed as introduced to Arizona, eight of these from Poaceae. One genus, *Cuscuta* is listed as a prohibited, restricted noxious weed in the U.S, even though it is a native species. In California, *Orobanche cooperi* is listed as a noxious weed due to its parasitic nature. All *Tamarix* species are listed as noxious weeds in several states including Nevada, but not in Arizona or California (USDA 2008).

**Table 2.** Introduced species collected in or around HSW.

<i>Amaranthus albus</i>	<i>Phalaris minor</i>
<i>Brassica tournefortii</i>	<i>Polygonum argyrocoleon</i>
<i>Bromus rubens</i>	<i>Polypogon monspeliensis</i>
<i>Chenopodium murale</i>	<i>Schismus arabicus</i>
<i>Cynodon dactylon</i>	<i>Schismus barbatus</i>
<i>Echinochloa crus-galli</i>	<i>Sisymbrium altissimum</i>
<i>Eragrostis cilianensis</i>	<i>Sisymbrium irio</i>
<i>Erodium cicutarium</i>	<i>Sonchus oleraceus</i>
<i>Gossypium hirsutum</i> (agricultural escape)	<i>Tamarix chinensis</i>
<i>Malva parviflora</i>	

The Arizona Wildlands Invasive Plant Working Group (AWIPWG), a group made up of over 20 federal and state agencies, created a list recording invasive species, with rankings of high, medium, and low, depending on their impact and ability to invade plant communities. Species that are of high concern are *Bromus rubens* and *Tamarix* spp. due to their severe ecological impact, wide distribution, and high rates of dispersal and establishment. Species of medium concern that have substantial ecological impacts, moderate rates of dispersal often enhanced by disturbance, and a generally limited distribution are: *Brassica tournefortii*, *Cynodon dactylon*, *Erodium cicutarium*, *Schismus* spp. and *Sonchus oleraceus* (AWIPWG 2008).

Invasive plants reported in Sonoran Desert wildernesses such as *Bromus rubens* and *Brassica tournefortii* can affect fire regimes. Others, like *Tamarix* spp., alter hydrology (Marler 2000). According to a recent study, invasive species are not in the top ten priorities for wilderness management for 90% of managers surveyed in the southwest. About 40% of respondents did not even have any information about invasive species in their wilderness areas (Marler 2000). HSW was included on the list of participating wilderness areas in the survey. Thus, this is the first report of invasive species within the HSW.

In comparison to other published floras in the Sonoran Desert, the flora of HSW has an average to low percent of invasive species (7%), most likely due to its

distance from major cities or lack of water sources. Other invasive species percentages include 10% at Phoenix South Mountain Park (Daniel and Butterwick 1992), 11% at Sierra Estrella Mountains Regional Park (Sundell 1974), 6.7% at White Tank Mountains Regional Park (Keil 1973), and 8% at McDowell Mountain Regional Park (Lane 1981).

In addition to collecting plants within the HSW, plants were collected in the surrounding areas when opportunities presented themselves. These collections added a few species to the total found and are considered to probably grow within the HSW. One species that was found in abundance outside the Wilderness but not found within is *Castela emoryi*. It is included in the flora list as a probable species.

This study adds no new or threatened species to the flora of Arizona but there are a few notable collections. One species, *Glinus radiatus* (spreading sweetjuice, Molluginaceae; Fig. 1D) has only been collected a few times in the state in places over 50 miles from HSW in areas near McDowell Mountain Park, Nogales and Cabreza Prieta Game Range (SEINet 2008). It is usually found at the bottom of drying ponds or tanks, and flowers during late summer. In HSW it was found in Dead Horse Tank, a large dry cow tank, in May 2007. This collection may represent an extension of its range.

Another interesting collection was of *Gossypium hirsutum* (upland cotton, Malvaceae), found in October 2006, in a roadside wash. Cotton is grown in fields south of the Wilderness near Tonopah and seems to have migrated via wind or by vehicle to the vicinity of HSW. This agricultural escape has not been seen in other floras and *Gossypium hirsutum* has only been collected in the wild twice in Arizona (SEINet 2008). Cotton has been an important crop in Arizona since 1916, and in 2007 about 190,000 acres were grown. Over 40 strains of cotton are in use across Arizona, but most of these are varieties of *Gossypium hirsutum* (CALSMART 2008).

Previous plant collections in HSW and the surrounding area are sparse. In comparing the species previously collected with the more complete checklist created as a result of this study, it was found that nearly all the species were recollected. Those that were not found in the present study are: *Gaillardia arizonica* (Asteraceae), *Rafinesquia californica* (Asteraceae), *Astragalus nuttallianus* (Fabaceae), *Calliandra eriophylla* (Fabaceae), and *Prunus fasciculata* (Rosaceae). These plants may still be present in HSW but perhaps were not found due to variations in climate, collection locations, or accessibility. For example, *R. californica* is most likely present but was not found due to the drier than average climate conditions. Another possibility is that these species are locally uncommon or no longer occur in the area.

Two areas thought to be similar to the HSW are the Kofa National Wildlife Refuge (KNWR), which is located to the southwest of HSW and has a high elevation of 4,877 ft, and the Sierra Estrella Mountain Range (SEMR), located to the southeast with a high elevation of 4,511 ft. These two places are also in the Sonoran Desert and have similar climate conditions although their elevation is higher than that of HSW. Twenty-seven species that have been collected during this study, in the HSW vicinity, have not been found in either the Kofa or Sierra Estrella regions (Russo 1987, SEINet 2008, Sundell 1974). These species are listed in Appendix A

and represent those species that are perhaps difficult to find, rare or uncommon or are outside of their usual range. For example, one of these species, *Echinomastus johnsonii*, is typically found in the Mojave Desert and is therefore uncommon in the Sonoran Desert.

Of the 186 species found in both the KNWR and the SEMR, 37 were not found in HSW (Russo 1987, SEINet 2008, Sundell 1974). These plants are likely to be found in the HSW area, and are predicted to be part of the HSW flora (Appendix A). Future collectors are urged to search for them.

This flora study aimed to collect in all habitats across the HSW area, but inevitably, not every inch of the Wilderness can be explored. The western area of the Wilderness is difficult to access, as are the jagged peaks in the southeastern portion. Also, the drought during the study greatly restricted the diversity of winter and spring ephemerals. Continuing collection of this area and those places nearby will create a more complete picture of the flora.

**Greenhouse Results and Discussion**—The soil samples collected from HSW contained enough viable seeds to produce 374 greenhouse collections with a total of 36 species plus two species that are unlikely to have come from the field: *Oxalis corniculata* and *Nicotiana benthamiana*. The first is a greenhouse weed and the second escaped from another study in the greenhouse.

Only one out of the seven soil locations was free of any invasive species. A little over 25% (11) of the species collected are invasive species. Six species were not collected in the field but are now presumed to grow in HSW. Appendix B contains a complete list of greenhouse species.

The greenhouse study was carried out in order to add a few more species to the flora list that may not be collected in a drought year. It was a small study and only one type of climate regime was implemented. In order to germinate more species, many more soil samples should be taken, using various treatments to generate the largest amount of species. One species, *Sonchus oleraceus*, was originally present in only one tray until it spread profusely to every other tray in the room. In future studies, great care should be taken to avoid contamination by collecting specimens before mature seeds are produced. Another species, *Oxalis corniculata*, most likely does not occur in the HSW area, though it was present in every sample tray. It is a common greenhouse weed and spreads quickly. Towards the end of the study, *Sonchus* and *Oxalis* were weeded out in order to stop their continuing germination cycle. The two control trays containing sterile soil had only these two problematic species, illustrating that they originated from the greenhouse and not from the soil samples.



## CATALOG OF THE VASCULAR FLORA OF THE HUMMINGBIRD SPRINGS WILDERNESS

Taxa are arranged alphabetically by family, genus and then by species. Nomenclature, author names and abbreviations follow the USDA PLANTS Database (2008), with exceptions for certain species when the new treatments for Arizona were available in the *Journal of Arizona-Nevada Academy of Science* and in *Canotia*. This database also provided common names and the origin of each species. Parts of the checklist are described below:

- A. Plants that are considered non-native in North America, are listed as "INTRODUCED" after the authority. Plants are called native if they are presumed to have been present before the time of Columbus.
- B. Common names are given as listed in USDA PLANTS Database (2008).
- C. General habitat is given along with collection localities (see Fig. 2C) to indicate where the species is most likely to be found. Collection localities are variable in size and sometimes cover several hectares.
- D. Collection numbers are from the field unless preceded by "G" which indicates they are collections from the greenhouse study. The primary collector for all collections is the author and all are deposited at the Arizona State University Herbarium.
- E. The abundance determinations are based on field observations taken over the duration of the study (January 2006 to December 2007) and is rated subjectively using terms and definitions adapted from Palmer et al. (1995) are as follows: Abundant = dominant or co-dominant in one or more common habitats; Frequent = easily found in one or more common habitats, but not dominant; Occasional = widely scattered but not difficult to find; Infrequent = difficult to find with few individuals or colonies, found in several locations; Rare = very difficult to find, limited to one/few locations or uncommon habitats; Absent = found only in a previous survey from the same or similar sites.

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### **Acanthaceae**

*Justicia californica* (Benth.) D. Gibson. Beloperone. Large gravel wash. Infrequent. OCW: 393, 718.

### **Agavaceae**

*Yucca elata* (Engelm.) Engelm. Soap tree yucca. Gravel roadside. Rare. AG: 599b.

### **Amaranthaceae**

*Amaranthus albus* L. INTRODUCED. Prostrate pigweed. Flooded roadside, large gravel wash. Frequent. SPR, EER, DHT: 200, 283, 368, 760, G59.

*Amaranthus fimbriatus* (Torr.) Benth. ex S. Watson. Fringed amaranth. Flooded roadside, cow tank. Occasional. SPR, EER, DHT: 285, 351, 805.

*Amaranthus palmeri* S. Watson. Careless weed. Flooded roadside, tank. Infrequent. SPR, EER: 286, 353.

*Tidestromia lanuginosa* (Nutt.) Standl. Woolly tidestromia. Gravel roadside, large wash. Frequent. SPR, MT: 297, 333, 343, 361, 416.

### **Anacardiaceae**

*Rhus aromatica* Aiton. Fragrant sumac. North facing canyon. Rare. SM: 804.

### **Apiaceae**

*Bowlesia incana* Ruiz & Pav. Hoary bowlesia. Dry rocky area, large wash. Occasional. SPR: 646, 678.

*Yabea microcarpa* (Hook. & Arn.) Koso-Pol. False carrot. North rocky slope. Occasional. SM: 635.

*Daucus pusillus* Michx. American wild carrot. Gravel road, ridgeline, large wash. Frequent. SPR, SM, MT: 75, 153, 203, 674, 706, G53, G97.

### **Aristolochiaceae**

*Aristolochia watsonii* Woot. & Standl. Watson's dutchman's pipe. Large wash. Rare. EER: 299.

### **Asclepiadaceae**

*Asclepias nyctaginifolia* A. Gray. Mojave milkweed. Small wash. Rare. MT: 433.

*Matelea parviflora* (Torr.) Woodson. Spearleaf. Dry rocky north facing slope. Rare. SM: 448.

*Sarcostemma cynanchoides* Decne. Fringed twinevine. Dry wash. Infrequent. DHT: 363.

### **Asteraceae**

*Acamptopappus sphaerocephalus* (Harv. & A. Gray ex A. Gray) A. Gray. Rayless goldenhead. Gravel road. Infrequent. MT: 595.

*Acourtia nana* (A. Gray) Reveal & King. Dwarf desert peony. Dusty roadside. Rare. AG: 777.

*Acourtia wrightii* (A. Gray) Reveal & King. Brownfoot. Low desert hills, large gravel wash. Occasional. MT, OCW, SPR: 16, 399, 431, 757.

*Adenophyllum porophylloides* (A. Gray) Strother. Dogweed. Low desert hills, large gravel wash, dry rocky north facing slope. Frequent. MT, SM, SPR: 24, 426, 430, 449, 521.

*Ambrosia ambrosioides* (Cav.) Payne. Ambrosia leaf bur ragweed. Large gravel wash. Frequent. SPR, OCW: 128, 181, 748.

*Ambrosia deltoidea* (Torr.) Payne. Triangle bur ragweed. Rocky slopes, dry tank bed, large gravel wash. Abundant. MT, DHT, SPR, OCW: 27, 61, 114, 215, 741.

*Ambrosia dumosa* (A. Gray) Payne. Burrobush. Along ridgeline, large wash, gravel roadside. Frequent. SPR, SM: 17, 86, 152, 222, 334, 693.

*Artemisia ludoviciana* Nutt. White sagebrush. Rocky area. Rare. SM: 462, 802.

*Baccharis salicifolia* (Ruiz & Pav.) Pers. Mulefat. Rocky bank of large wash. Rare. SPR: 479.

*Baccharis sarothroides* A. Gray. Desert broom. Rocky slopes, gravel parking lot, large wash. Frequent. MT, DHT, OCW: 29, 365, 432, 727, G266.

*Baileya multiradiata* Harv. & A. Gray ex A. Gray. Desert marigold. Gravel roadside. Frequent. EER, MT: 45, 277, 704.

*Bebbia juncea* (Benth.) Greene. Sweetbush. Rocky slopes, ridgeline, large wash. Abundant. MT, SPR, OCW: 34, 225, 238, 359, 747.

*Brickellia coulteri* A. Gray. Coulter's brickell bush. Large gravel wash. Occasional. OCW, SM, SPR: 130, 392, 442, 820.

*Brickellia frutescens* A. Gray. Shrubby brickell bush. Rocky ridgeline, large wash. Occasional. SPR, OCW, MT, SM: 100, 163, 214, 397, 422, 434, 459, 819.

*Chaenactis stevioides* Hook. & Arn. Esteve's pincushion. Flat dry rocky area, large wash. Infrequent. SPR, EER: 649, 682, 850.

*Cirsium neomexicanum* A. Gray. New Mexico thistle. Rocky ridgeline, large wash. Occasional. SM: 162, 564, 602.

*Encelia farinosa* A. Gray ex Torr. Brittlebush. Washes, north gravel slope. Abundant. SPR, OCW, MT: 20, 101.

*Ericameria laricifolia* (A. Gray) Shinners. Turpentine bush. Large gravel wash, rocky area. Rare. OCW, SM: 402, 453, 818.

*Erigeron divergens* Torr. & A. Gray. Spreading fleabane. South slope, open rocky area. Infrequent. SM, MT: 542, 697.

*Erigeron lobatus* A. Nelson. Lobed fleabane. Rocky ridgeline, small wash. Infrequent. SM: 96, 506.

*Filago arizonica* A. Gray. Arizona cottonrose. Greenhouse Study. Occasional. MT, SPR: G93, G303, G72, G118, G83.

*Filago californica* Nutt. California cottonrose. South slope, open rocky area. Infrequent. SM: 552, G310.

*Gutierrezia sarothrae* (Pursh) Britton & Rusby. Broom snakeweed. Low desert hills, small wash. Abundant. MT, SM: 7, 68, 106, 379, 440, 796.

*Gutierrezia serotina* Greene. Late snakeweed. Dusty roadside. Rare. AG: 776.

- Hymenoclea monogyra* Torr. & A. Gray. Singlewhorl burrobrush. Large wash. Infrequent. EER: 383.  
*Hymenoclea salsola* Torr. & A. Gray. Burrobrush. Large wash. Infrequent. EER: 589.  
*Isocoma acradenia* (Greene) Greene. Alkali goldenbush. Roadside. Infrequent. EER: 318.  
*Laennecia coulteri* (A. Gray) G. L. Nesom. Coulter's horseweed. Large wash. Infrequent. SPR: 196, G250.  
*Lasthenia californica* DC. ex Lindl. California goldfields. Gravel road, ridgeline, dry tank bed, south slope. Infrequent. DHT, SM: 76, 119, 549.  
*Machaeranthera pinnatifida* (Hook.) Shinners. Lacy tansyaster. Low desert hills, large wash, rocky ridgeline. Infrequent. SPR, SM, MT: 6, 155, 234, 266, 561.  
*Machaeranthera tagetina*. Greene. Mesa tansyaster. Large gravel wash. Infrequent. EER: 386.  
*Microseris lindleyi* (DC.) A. Gray. Lindley's silverpuff. Gravel wash. Infrequent. EER: 847.  
*Monoptilon bellioides* (A. Gray) H. M. Hall. Mojave desertstar. Flat dry rocky area, wash. Occasional. SM, SPR, EER: 534, 648, 853.  
*Pectis papposa* Harv. & A. Gray. Manybristle chinchweed. Rocky slopes, wash, disturbed areas. Frequent. MT, EER, SPR, DHT: 44, 258, 314, 323, 375, 767, 837.  
*Perityle emoryi* Torr. Emory's rockdaisy. Large gravel wash, rocky slope. Occasional. SPR, SM: 154, 224, 614, 669, 788.  
*Pluchea sericea* (Nutt.) Coville. Arrowweed. Large gravel wash. Infrequent. SPR: 150, 195.  
*Porophyllum gracile* Benth. Slender poreleaf. Large wash, gravel roadside. Occasional. MT, SPR: 129, 233, 340.  
*Psilostrophe cooperi* (A. Gray) Greene. Whitestem paperflower. Wash, gravel roadside. Occasional. MT, SPR: 259, 345.  
*Rafinesquia neomexicana* A. Gray. New Mexico plumeseed. Dry cow tank. Infrequent. DHT: 861.  
*Senecio* sp. L. Ragwort. Infrequent. SM: 821a.  
*Senecio flaccidus* Less. var. *monoensis* (Greene) B. L. Turner & T. M. Barkley. Smooth threadleaf ragwort. Large gravel wash. Infrequent. EER: 716.  
*Senecio lemmonii* A. Gray. Lemmon's ragwort. Large gravel wash, rocky slope. Occasional. SPR, SM: 232, 525, 606, 809.  
*Sonchus oleraceus* L. INTRODUCED. Common sowthistle. Large gravel wash. Infrequent. SPR: 188, 764, G290, G199.  
*Stephanomeria pauciflora* (Torr.) A. Nelson. Brown plume wirelettuce. Rocky slope, wash. Abundant. MT, SPR, EER, SM, OCW: 58, 229, 300, 336, 467, 722.  
*Stylocline micropoides* A. Gray. Woolly head neststraw. Gravel wash. Occasional. EER: 851.  
*Symphotrichum divaricatum* (Nutt.) G. L. Nesom. Annual saltmarsh aster. Greenhouse Study. Infrequent. MT, SPR: G208, G193, G194, G187.  
*Trichoptilium incisum* (A. Gray) A. Gray. Yellow dome. Low desert hills, washes. Rare. SPR: 1.  
*Trixis californica* Kellogg. American threefold. Rocky slopes, gravel parking lot, large wash. Frequent. MT, SPR, OCW: 28, 127, 213, 321, 692, 743.  
*Viguiera parishii* Greene. Parish's goldeneye. Rocky slopes, gravel parking lot, wash. Frequent. MT, SM, OCW: 9, 33, 94, 167, 230, 518, 750.  
*Xylorhiza tortifolia* (Torr. & A. Gray) Greene. Mojave woodyaster. Large rocky wash, gravel slope. Rare. SM, MT: 532, 540, 863.

### **Berberidaceae**

- Berberis haematocarpa* Woot. Red barberry. Rocky slope. Rare. SM: 473, 605, 822.

### **Bignoniaceae**

- Chilopsis linearis* (Cav.) Sweet. Desert willow. Large gravel wash. Rare. EER: 717.

### **Boraginaceae**

- Amsinckia menziesii* (Lehm.) A. Nelson & J. F. Macbr. Menzies' fiddleneck. Gravel roadside, large wash. Abundant. EER, SPR, SM, OCW: 48, 145, 492, 515, 522, 548, 654, 658, 756, G36, G291.  
*Amsinckia tessellata* A. Gray. Bristly fiddleneck. Large open gravel wash. Rare. EER: 590.  
*Cryptantha* sp. Lehm. ex G. Don. *Cryptantha*. Gravel roadside. EER: 53b.

- Cryptantha angustifolia* (Torr.) Greene. Panamint cryptantha. Large open gravel wash. Rare. EER: 574b.
- Cryptantha barbiger* (A. Gray) Greene. Bearded cryptantha. Dry tank bed, large wash. Abundant. DHT, SPR, EER, SM, MT, OCW: 123, 131, 185, 565, 569, 574a, 624, 651, 665, 671, 684, 699, 710, 719, G296.
- Cryptantha maritima* (Greene) Greene. Guadalupe cryptantha. North rocky slope, large wash. Infrequent. SM, SPR: 621, 685.
- Cryptantha micrantha* (Torr.) I. M. Johnst. Redroot cryptantha. Large gravel wash. Infrequent. EER: 593.
- Cryptantha pterocarya* (Torr.) Greene. Wingnut cryptantha. Gravel road, ridgeline, large wash. Infrequent. SM, SPR, EER: 72, 512, 670, 848.
- Harpagonella palmeri* A. Gray. Palmer's grappling hook. Rocky slopes. Occasional. SM: 556, 626, G317.
- Pectocarya* sp. DC. ex Meisn. Combseed. Flat wash. MT: 54.
- Pectocarya platycarpa* (Munz. & I. M. Johnst.) Munz. & I. M. Johnst. Broadfruit combseed. Gravel roadside, dry tank bed, large wash. Frequent. EER, DHT, SPR: 51, 121, 583, 656, G4, G307.
- Pectocarya recurvata* I. M. Johnst. Curvenut combseed. Gravel road, ridgeline, south slope, rocky wash. Abundant. MT, EER, SM, DHT, SPR: 42, 52, 80, 89, 491, 495, 533, 568, 620, 655, G306, G309.
- Plagiobothrys* sp. Fisch. & C. A. Mey. Popcorn flower. Flat wash. MT: 55.
- Plagiobothrys arizonicus* (A. Gray) Greene ex A. Gray. Arizona popcorn flower. Gravel roadside, rocky wash, south slope. Occasional. MT, EER, DHT: 47, 496, 530, 546, G325.
- Plagiobothrys jonesii* A. Gray. Mojave popcorn flower. Large gravel wash. Infrequent. SPR: 184.
- Tiquilia canescens* (DC.) A. T. Richardson. Woody crinklemat. Dry rocky north slope, gravel roadside. Occasional. SM, MT: 450, 864.

### Brassicaceae

- Arabis* sp. L. Rockcress. SM: 821b.
- Arabis perennans* S. Watson. Perennial rockcress. Rocky outcrop near wash. Infrequent. SM: 446, 508.
- Brassica tournefortii* Gouan INTRODUCED. Asian mustard. Large gravel wash, rocky area. Occasional. SPR, EER: 183, 484, 676, G46, 79d, G365, G366.
- Descurainia pinnata* (Walter) Britton. Western tansy mustard. Large wash. Rare. SPR: 668.
- Draba cuneifolia* Nutt. ex Torr. & A. Gray. Wedgeleaf draba. South slope, open rocky area. Rare. SM: 537, 550.
- Guillenia lasiophylla* (Hook. & Arn.) Greene. California mustard. Gravel wash. Rare. MT: 858, G63, G68, G82, G102, G104.
- Lepidium lasiocarpum* Nutt. Shaggyfruit pepper weed. Gravel road, along ridgeline, dry tank bed, large gravel wash. Abundant. SM, DHT, SPR, EER, MT: 74, 122, 148, 235, 490, 535, 555, 567, 575, 657, 707, G312, G315, G258.
- Lesquerella gordonii* (A. Gray) S. Watson. Gordon's bladderpod. Rocky wash, open gravel wash. Occasional. SM, EER: 493, 513, 588.
- Sisymbrium altissimum* L. INTRODUCED. Tall tumble mustard. Greenhouse Study. Rare. MT: G139.
- Sisymbrium irio* L. INTRODUCED. London rocket. Low desert hills, dry tank bed, large wash. Occasional. DHT, SPR, SM: 5, 115, 566, 659, G121, G364.
- Thysanocarpus curvipes* Hook. Sand fringe pod. Rocky wash. Infrequent. SM: 494, 499, 623, 633.

### Cactaceae

- Carnegiea gigantea* (Engelm.) Britton & Rose. Saguaro. Open gravel. Abundant. SPR, OCW: 176, 754.
- Cylindropuntia acanthocarpa* (Engelm. & Bigelow) F. M. Knuth. Buck-horn cholla. Gravel roadside. Abundant. SPR: 349, 835.
- Cylindropuntia bigelovii* (Engelm.) F. M. Knuth. Teddy bear cholla. Large wash. Abundant. MT: 160.

*Cylindropuntia leptocaulis* (DC.) F. M. Knuth. Christmas cactus. Along ridgeline, gravel wash, roadside. Frequent. SM, SPR: 83, 251, 356, 436, 528.

*Cylindropuntia ramosissima* (Engelm.) F. M. Knuth. Pencil cholla. Dry gravel. Infrequent. SPR: 836.

*Echinocereus engelmannii* (Parry ex Engelm.) Lem. Engelman's hedgehog cactus. Rocky slope. Occasional. SM: 562.

*Echinomastus johnsonii* (Parry ex Engelm.) E.M.Baxter. Johnson's fishhook cactus. Rocky south slope. Infrequent. MT: 596.

*Ferocactus cylindraceus* (Engelm.) Orcutt. California barrel cactus. Gravel wash. Frequent. SPR: 178.

*Mammillaria grahamii* Engelm. Graham's nipple cactus. Rocky area, ridgeline. Frequent. SM: 452, 829.

*Opuntia chlorotica* Engelm. & Bigelow. Dollarjoint pricklypear. Open gravel slope. Frequent. MT, SM: 695, 834.

*Opuntia engelmannii* Salm-Dyck ex Engelm. Cactus apple. Gravel wash, flat rocky area. Frequent. SM: 263, 601.

### **Campanulaceae**

*Nemacladus glanduliferus* Jeps. Glandular threadplant. Large gravel wash. Rare. SPR, EE: 143, 845.

### **Caryophyllaceae**

*Silene antirrhina* L. Sleepy silene. Large gravel wash, north rocky slope. Occasional. SPR, SM, OCW: 134, 147, 220, 616, 636, 681, 732, G67.

### **Celastraceae**

*Canotia holacantha* Torr. Crucifixion thorn. Gravel wash, rocky area. Occasional. MT, SM: 246, 252, 428, 472.

### **Chenopodiaceae**

*Atriplex canescens* (Pursh) Nutt. Fourwing saltbush. Along large gravel wash. Infrequent. SM: 810.

*Chenopodium berlandieri* Moq. Pitseed goosefoot. Large gravel wash. Infrequent. SPR: 193.

*Chenopodium murale* L. INTRODUCED. Nettleleaf goosefoot. Flat dry rocky area. Infrequent. SPR: 661.

*Monolepis nuttalliana* (Schult.) Greene. Nuttall's poverty weed. Large wash. Rare. SPR: 664.

### **Crossosomataceae**

*Crossosoma bigelovii* S. Watson. Ragged rockflower. Large gravel wash, north rocky slope. Infrequent. OCW, SM: 391, 454, 456, 519, 612, 725.

### **Cucurbitaceae**

*Brandegea bigelovii* (S. Watson) Cogn. Desert starvine. Wet area, cow tank. Infrequent. SPR: 772.

### **Cuscutaceae**

*Cuscuta umbellata* Kunth. Flatglobe dodder. Gravel roadside. Rare. MT: 862.

### **Ephedraceae**

*Ephedra aspera* Engelm. ex S. Watson. Rough jointfir. Low wash, rocky slope. Frequent. SPR, MT, SM: 19, 60, 486.

*Ephedra nevadensis* S. Watson. Nevada jointfir. Rocky slopes, gravel parking lot, large gravel wash. Frequent. MT, SM: 32, 138, 509, 511.

### **Euphorbiaceae**

*Argythamnia lanceolata* (Benth.) Mull. Arg. Narrowleaf silverbush. Rocky slopes, gravel parking lot, roadside, large rocky wash. Frequent. MT, SPR, SM: 12, 25, 136a, 268, 339, 437, 485, 517.

- Argythamnia neomexicana* Mull. Arg. New Mexico silverbush. Rocky slopes, large gravel wash, dry tank bed, roadside. Frequent. MT, DHT, EER, SPR, SM: 13, 65, 124, 136b, 256, 311, 327, 489, 765.
- Chamaesyce abramsiana* (L. C. Wheeler) Koutnik. Abram's sandmat. Gravel roadside, large wash, disturbed area, near cow tank. Frequent. MT, EER, DHT, SPR: 294, 315, 367, 770b.
- Chamaesyce albomarginata* (Torr. & A. Gray) Small. White margin sandmat. Gravel wash. Frequent. MT, EER: 257, 435a, 580.
- Chamaesyce arizonica* (Engelm.) Arthur. Arizona sandmat. Ridge, rocky area, north slope. Frequent. MT, SM: 360, 463, 634, 782.
- Chamaesyce micromera* (Boiss. ex Engelm.) Woot. & Standl. Sonoran sandmat. Wet area, cow tank nearby. Infrequent. SPR: 770a.
- Chamaesyce pediculifera* (Engelm.) Rose & Standl. Carrizo mountain sandmat. Small flat wash, gravel roadside, cow tank, rocky area. Frequent. MT, SPR, SM, EER, OCW: 103, 133, 274, 338, 355, 403, 457, 592, 723.
- Chamaesyce polycarpa* (Benth.) Millsp. ex Parish. Smallseed sandmat. Large gravel wash, rocky ridgeline, near road, wet area near cow tank. Frequent. SPR, MT: 205, 240, 279, 329, 358, 771.
- Chamaesyce setiloba* (Engelm. ex Torr.) J. B. S. Norton. Yuma sandmat. disturbed muddy area, large gravel wash. Frequent. DHT, EER, MT: 374, 387, 404, 419, 435b.
- Euphorbia eriantha* Benth. Beetle spurge. Rocky ridgeline, gravel roadside. Occasional. SPR, SM: 241, 332, 466, 560, 789.
- Tetracoccus hallii* Brandegee. Hall's shrubby spurge. Large gravel wash, gravel roadside, dry rocky area. Occasional. SPR: 144, 189, 341, 481, 643, 840.
- Tragia nepetifolia* Cav. Catnip noseburn. Shaded gravel wash crossing the road. Rare. MT: 779.

## Fabaceae

- Acacia constricta* Benth. Whitethorn acacia. Low desert hills, gravel wash, gravel roadside. Abundant. SPR, MT, OCW: 23, 208, 247, 298, 745.
- Acacia greggii* A. Gray. Catclaw acacia. Large gravel wash, disturbed muddy area. Abundant. SPR, DHT, OCW, SM: 210, 250, 364, 742, 794.
- Dalea mollis* Benth. Hairy prairie clover. Wash, south slope, flat dry rocky area. Infrequent. SM, SPR: 10, 558, 642.
- Desmodium procumbens* (Mill.) Hitchc. Western trailing ticktrefoil. North facing canyon. Rare. SM: 787.
- Hoffmannseggia glauca* (Ortega) Eifert. Indian rushpea. Flat dusty area, roadside. Rare. AG: 599, 775.
- Lotus humistratus* Greene. Foothill deervetch. Rocky gentle slope, large gravel wash. Occasional. SM, EER, SPR, MT: 488, 584, 672, 708, G338.
- Lotus rigidus* (Benth.) Greene. Coastal bird's foot trefoil. Large rocky wash. Rare. SM, OCW: 516, 720.
- Lotus salsuginosus* Greene. Shrubby deervetch. Large wash. Infrequent. SPR: 673, 680.
- Lotus strigosus* var. *tomentellus* (Nutt.) Greene. Strigose bird's foot trefoil. Large wash. Infrequent. SPR: 679.
- Lupinus shockleyi* S. Watson. Purple desert lupine. Moist cow tank bed. Rare. DHT: 860.
- Lupinus sparsiflorus* Benth. Coulter's lupine. Large wash. Infrequent. EER, MT: 582, 598, 849.
- Marina parryi* (Torr. & A. Gray) Barneby. Parry's false prairie clover. South slope, large gravel wash, ridge. Frequent. SM, SPR, MT, EER, SM: 22, 92, 228, 357, 381, 405, 690, 803.
- Olneya tesota* A. Gray. Desert ironwood. Gravel road, large gravel wash. Abundant. MT, SPR, OCW: 175, 204, 737.
- Parkinsonia florida* (Benth. ex A. Gray) S. Watson. Blue paloverde. Roadside, recently flooded, large gravel wash. Abundant. EER, SPR, OCW: 284, 320, 739.
- Parkinsonia microphylla* Torr. Yellow paloverde. Gravel wash, dry tank bed. Abundant. SPR, DHT, OCW: 170, 182, 712, 753.
- Phaseolus filiformis* Benth. Slimjim bean. Rocky area, north rocky slope. Infrequent. SM: 470, 630, 815.

*Prosopis velutina* Woot. Velvet mesquite. Gravel road, large wash. Abundant. MT, SPR, OCW: 174, 179, 662, 746.

*Senna covesii* (A. Gray) Irwin & Barneby. Coues' cassia. wash, rocky slopes, gravel parking lot, disturbed muddy area. Frequent. MT, SPR, DHT: 21, 31, 64, 104, 226, 276, 370.

*Vicia ludoviciana* Nutt. ssp. *ludoviciana*. Louisiana vetch. North rocky slope. Rare. SM: 608.

### **Fagaceae**

*Quercus turbinella* Greene. Sonoran scrub oak. Large rocky wash. Rare. SM: 520, 798.

### **Fouquieriaceae**

*Fouquieria splendens* Engelm. Ocotillo. South gravel slope, wash. Abundant. MT, SPR: 11, 173, 694.

### **Gentianaceae**

*Centaurium calycosum* (Buckley) Fernald. Arizona centaurium. Large gravel wash. Infrequent. SPR: 180.

### **Geraniaceae**

*Erodium cicutarium* (L.) L'Her. ex Aiton. INTRODUCED. Redstem stork's bill. Gravel roadside, gravel wash, south rocky slope. Abundant. EER, MT, SPR, SM: 46, 56, 198, 545, G136, G269.

*Erodium texanum* A. Gray. Texas stork's bill. South slope, rocky area. Occasional. SM, SPR: 544, 653.

### **Hydrophyllaceae**

*Eucrypta chrysanthemifolia*. (Benth.) Greene. Spotted hideseed. Large wash. Infrequent. SPR: 677.

*Eucrypta micrantha* (Torr.) A. Heller. Dainty desert hideseed. Gravel slope. Occasional. SM: 536.

*Nama hispidum* A. Gray. Bristly nama. Large open gravel wash. Occasional. EER: 576.

*Phacelia* sp. Juss. Phacelia. SM, EER: 541, 855, 857.

*Phacelia crenulata* Torr. ex S. Watson. Clefleaf wild heliotrope. Large open gravel wash, north rocky slope. Occasional. EER, MT, SM: 572, 597, 622.

*Phacelia distans* Benth. Distant phacelia. Large open gravel wash, north rocky slope. Occasional. EER, SM, SPR: 581, 619, 647.

*Phacelia pedicellata* A. Gray. Pedicellate phacelia. North rocky slope. Infrequent. SM: 637.

*Pholistoma auritum* (Lindl.) Lilja. Blue fiesta flower. Rocky area, near small wash. Occasional. SM: 505.

### **Krameriaceae**

*Krameria erecta* Willd. ex Schult. Littleleaf ratany. Gravel roadside. Frequent. SPR: 761.

*Krameria grayi* Rose & Painter. White ratany. Rocky slope, ridgeline, south gravel slope. Frequent. MT, SM, SPR: 62, 87, 166, 177, 264.

### **Lamiaceae**

*Hyptis emoryi* Torr. Desert lavender. Rocky slopes, gravel parking lot, large gravel wash. Frequent. MT, SPR, OCW: 41, 137, 199, 726.

*Monardella arizonica* Epling. Arizona monardella. Rocky area. Rare. SM: 475, 799.

*Salazaria mexicana* Torr. Mexican bladdersage. Small wash, large gravel wash, gravel roadside. Frequent. MT, SPR, EER, OCW, SM: 69, 109, 141, 301, 348, 698, 752, 785.

*Salvia columbariae* Benth. Chia. Large gravel wash. Infrequent. SPR, EER: 151, 192, 586, 666, 686.

### **Liliaceae**

*Dichelostemma capitatum* (Benth.) Alph. Wood. Bluedicks. Rocky gentle slope, near wash. Infrequent. SM: 487, 500.

**Loasaceae**

*Petalonyx thurberi* A. Gray. Thurber's sandpaper. Large wash. Rare. EER: 305, 380.

**Malpighiaceae**

*Janusia gracilis* A. Gray. Slender janusia. Rocky slope, large wash, gravel roadside. Frequent. MT, SPR, SM: 265, 322, 427, 793, 839.

**Malvaceae**

*Abutilon incanum* (Link) Sweet. Pelotazo. Small gravel flat wash, gravel roadside, rocky slope. Frequent. MT, OCW, SM: 107, 262, 278, 296, 406, 439, 744, 831.

*Gossypium hirsutum* L. AGRICULTURAL ESCAPE. Upland cotton. Large wash. Rare. EER: 382.

*Herissantia crispa* (L.) Briz. Bladder mallow. Large gravel wash. Occasional. OCW: 390, 730.

*Hibiscus coulteri* Harv. ex A. Gray. Desert rosemallow. Gravel wash, north rocky slope. Infrequent. OCW, SM: 443, 640.

*Malva parviflora* L. INTRODUCED. Cheeseweed mallow. Flat dry rocky area. Occasional. SPR: 660.

*Sphaeralcea ambigua* A. Gray. Desert globemallow. Rocky slope, rocky ridgeline, large gravel wash, wet cow tank near road. Frequent. MT, SPR: 63, 97, 161, 216, 253, 354.

**Martyniaceae**

*Proboscidea parviflora* (Woot.) Woot. & Standl. Doubleclaw, Devil's claw, Unicorn plant. Large gravel wash. Infrequent. EER: 389.

**Molluginaceae**

*Glinus radiatus* (Ruiz. & Pav.) Rohrb. Spreading sweetjuice. Dusty dry tank bed. Rare. DHT: 713.

**Nyctaginaceae**

*Allionia incarnata* L. Trailing windmills. Large wash, north rocky slope, wet area near tank. Occasional. EER, SPR, DHT, SM: 313, 326, 378, 629, 774.

*Boerhavia coccinea* Mill. Scarlet spiderling. Large gravel wash. Occasional. EER: 388.

*Boerhavia intermedia* M. E. Jones. Fivewing spiderling. Wet area near cow tank. Occasional. SPR, SM: 768, 790.

*Boerhavia wrightii* A. Gray. Largebract spiderling. Rocky slope, large wash, wet area near tank. Occasional. MT, EER, SPR: 267, 316, 773.

*Mirabilis* sp. L. Four o'clock. Small wash near road, rocky ridgeline. SM, SPR: 98, 324.

*Mirabilis bigelovii*. Wishbone bush. Large wash. Occasional. SPR, OCW, SM: 219, 396, 570, 811.

**Oleaceae**

*Forestiera shrevei* Standl. Desert olive. Large rocky wash, north slope. Rare. SM: 465, 469, 523, 641.

*Menodora scabra* A. Gray. Rough menodora. North gravel slope, large gravel wash. Occasional. OCW: 102, 169, 751.

**Onagraceae**

*Camissonia brevipes* (A. Gray) P. H. Raven. Yellow cups. Large gravel wash. Rare. EER: 856.

*Epilobium ciliatum* Raf. Fringed willow herb. Greenhouse Study. Rare. SPR: G125.

**Orobanchaceae**

*Orobanche cooperi* (A. Gray) A. Heller. Desert broomrape. Gravel roadside. Rare. EER: 846.

**Papaveraceae**

*Argemone gracilentia* Greene. Sonoran prickly poppy. Flat open dusty area. Rare. AG: 600.

*Eschscholzia californica* Cham. California poppy. Large rocky wash, large open gravel wash. Infrequent. SM, EER, OCW: 531, 585, 724.

*Eschscholzia glyptosperma* Greene. Desert poppy. Large wash. Infrequent. SPR: 683.



## Plantaginaceae

*Plantago ovata* Forssk. Desert Indian wheat. Gravel roadside, large gravel wash, south gravel slope. Frequent. EER, MT, SM, SPR, OCW: 50, 57b, 78b, 197, 554b, 591, 755, G112, G103.

*Plantago patagonica* Jacq. Woolly plantain. Gravel roadside, dry tank bed, south rocky slope. Frequent. EER, MT, SM, DHT, SPR: 53a, 57a, 78a, 126, 554a, 645, G313, G314, G320, G64.

## Poaceae

*Achnatherum speciosum* (Trin. & Rupr.) Barkworth. Desert needlegrass. Rocky slope. Infrequent. SM: 826.

*Aristida adscensionis* L. Sixweeks threeawn. Rocky ridgeline, large wash, roadside, north slope. Abundant. SM, SPR, MT: 15, 85, 95, 139, 201, 325, 347, 407, 468, 476, 571, 627, 709, 827.

*Aristida purpurea* Nutt. var. *purpurea*. Purple threeawn. Rocky ridgeline, large gravel wash, open gravel. Abundant. SPR, MT, SM, OCW: 93, 172, 187, 412, 418, 514, 702, 729, 813.

*Aristida purpurea* Nutt. var. *longiseta* (Steud.) Vasey. Fendler threeawn. Gravel wash, open gravel. Occasional. MT: 255, 705.

*Bothriochloa barbinodis* (Lag.) Herter. Cane bluestem. Rocky bank of large wash. Infrequent. MT: 409.

*Bouteloua aristidoides* (Kunth) Griseb. Needle grama. Large wash, gravel roadside. Infrequent. EER, SPR: 304, 331, 410.

*Bouteloua barbata* Lag. Sixweeks grama. Large wash, gravel roadside, wet area near tank. Frequent. EER, SPR, MT: 303, 346, 415, 762.

*Bouteloua curtipendula* (Michx.) Torr. Sideoats grama. Rocky bank of large wash. Frequent. MT, SM: 411, 784, 824.

*Bromus arizonicus* (Shear) Stebbins. Arizona brome. Greenhouse Study. Rare. SPR: G21.

*Bromus rubens* L. INTRODUCED. Red brome. Rocky slopes, gravel parking lot, road, dry tank bed, large wash. Frequent. MT, SM, DHT, SPR, EER: 36, 77, 112, 125, 186, 483, 504, 547, 618, 700, G111, G324, G329, G330, G334, G336, G359.

*Cynodon dactylon* (L.) Pers. INTRODUCED. Bermuda grass. Gravel roadside, large gravel wash. Occasional. SPR, EER: 344, 385.

*Dasyochloa pulchella* (Kunth) Willd. ex Rydb. Low woolly grass. Gravel roadside, wash, ridgeline. Abundant. SM, MT, OCW: 8, 81, 260, 289, 734.

*Digitaria californica* (Benth.) Henr. Arizona cottontop. Rocky bank of large wash. Occasional. MT, SM: 408, 792.

*Echinochloa crus-galli* (L.) P. Beauv. INTRODUCED. Barnyard grass. Roadside, recently flooded. Rare. EER: 287.

*Enneapogon desvauxii* Desv. ex P. Beauv. Nineawn pappus grass. . Infrequent. SM: 828.

*Eragrostis cilianensis* (All.) Vign. ex. Janchen. INTRODUCED. Stinkgrass. Roadside, recently flooded, large wash. Occasional. EER, MT: 288, 312, 423.

*Leptochloa panicea* (Retz.) Ohwi. Mucronate sprangletop. Large wash. Rare. EER: 306.

*Leptochloa viscida* (Scribn.) Beal. Sticky sprangletop. Disturbed muddy area. Rare. DHT: 366.

*Muhlenbergia appressa* C. O. Goodding. Devil's canyon muhly. North rocky slope. Infrequent. SM: 617.

*Muhlenbergia microsperma* (DC.) Trin. Littleseed muhly. Large gravel wash, north rocky slope. Frequent. MT, SM: 3, 111, 421, 527, 625, 703, G42.

*Muhlenbergia porteri* Scribn. ex Beal. Bush muhly. Large gravel wash, rocky outcrop. Abundant. MT, SM: 110, 429, 445, 503, 801, 843.

*Phalaris minor* Retz. INTRODUCED. Littleseed canary grass. Large gravel wash. Rare. SPR: 190.

*Pleurophis mutica* Buckley. Tobosagrass. Flat rocky area. Occasional. SM: 502.

*Pleurophis rigida* Thurb. Big galleta. Gravel road, large wash, rocky ridgeline. Frequent. SM, MT: 84, 171, 239, 420.

*Poa bigelovii* Vasey & Scribn. Bigelow's bluegrass. Wash, south rocky slope. Frequent. SM, SPR: 2, 91, 652, G130.

*Polypogon monspeliensis* (L.) Desf. INTRODUCED. Annual rabbit's foot grass. Dry tank bed, large gravel wash. Occasional. DHT, SPR: 117, 212.

*Schismus arabicus* Nees. INTRODUCED. Arabian schismus. Large gravel wash. Abundant. SPR, EER: 142, 587, G113, G254.

*Schismus barbatus* (Loefl. ex L.) Thell. INTRODUCED. Common Mediterranean grass. Rocky ridgeline, tank bed, large wash. Abundant. DHT, SPR, SM: 14, 99, 116, 227, 628, 701, G123, G142.

*Tridens muticus* (Torr.) Nash. Slim tridens. Roadside, large wash. Occasional. MT, OCW: 292, 733.

*Vulpia microstachys* (Nutt.) Munro. Small fescue. North rocky slope. Infrequent. SM: 615.

*Vulpia octoflora* (Walter) Rydb. Sixweeks fescue. Open gravel south slope, large gravel wash. Abundant. SM, SPR: 90, 146, 202, 501, 538, 644, 663, G311, G316, G321, G328, G49, G273.

### **Polemoniaceae**

*Eriastrum eremicum* (Jeps.) H. Mason. Desert woolly star. Gravel road, ridgeline, south rocky slope, large wash. Occasional. SM, EER, SPR: 79, 551, 577, 650, 691, 852.

*Gilia* sp. Ruiz. & Pav. *Gilia*. Rocky wash. SM, EER: 497, 854.

*Gilia minor* A. D. Grant & V. E. Grant. Little *gilia*. South slope, open rocky area, large wash. Infrequent. SM, EER: 557, 594.

*Gilia scopulorum* M. E. Jones. Rock *gilia*. Large wash. Infrequent. SPR: 688.

*Linanthus bigelovii* (A. Gray) Greene. Bigelow's *linanthus*. Large wash. Infrequent. SPR: 689.

### **Polygonaceae**

*Chorizanthe brevicornu* Torr. Brittle spineflower. Gravel road, along ridgeline, large wash. Infrequent. SM, EER: 73, 478, 579.

*Chorizanthe rigida* (Torr.) Torr. & A. Gray. Devil's spineflower. Large gravel wash. Rare. SPR: 237.

*Eriogonum deflexum* Torr. Flatcrown buckwheat. Gravel wash, open gravel, disturbed muddy area. Occasional. MT, EER, DHT: 254, 302, 373, 711, G95, G131.

*Eriogonum fasciculatum* Benth. Eastern Mojave buckwheat. Rocky slopes, gravel parking lot, large gravel wash. Frequent. MT, SPR, OCW: 30, 211, 401a, 749.

*Eriogonum inflatum* Torr. & Frem. Desert trumpet. Gravel road, along ridgeline, large gravel wash. Frequent. SM, MT, SPR, EER: 71, 290, 335, 715.

*Eriogonum trichopes* Torr. Little desert trumpet. Large gravel wash. Rare. EER: 384.

*Eriogonum wrightii* Torr. ex Benth. Bastardsage. Gravel roadside, dry tank bed, large wash. Frequent. MT, DHT, OCW, SM: 37, 118, 401b, 807.

*Polygonum argyrocoleon* Steud. ex Kunze INTRODUCED. Silversheath knotweed. Low desert hills, wash. Rare. SPR: 4.

*Pterostegia drymarioides* Fisch. & C. A. Mey. Woodland *pterostegia*. North rocky slope. Rare. SM: 611.

### **Portulacaceae**

*Claytonia perfoliata* Donn. ex Willd. Miner's lettuce. North facing rocky slope. Rare. SM: 610.

### **Primulaceae**

*Androsace occidentalis* Pursh. Western rock jasmine. Rocky area, near small wash. Rare. SM: 510.

### **Pteridaceae**

*Astrolepis cochisensis* (Goodding) Benham & Windham. Cochise scaly cloakfern. Large gravel wash, north rocky slope. Occasional. OCW, SM: 395, 613.

*Cheilanthes covillei* Maxon. Coville's lipfern. Rocky area, north rocky slope. Occasional. SM: 461, 632.

*Cheilanthes parryi* (D. C. Eaton) Domin. Parry's lipfern. Rocky area. Occasional. SM: 455.

*Notholaena californica* D. C. Eaton. California cloakfern. Rocky bank of wash. Occasional. MT: 413.

*Pellaea truncata* Goodding. Spiny cliffbrake. Gravel slope. Occasional. SM: 441, 447, 464, 791.

### **Ranunculaceae**

*Clematis drummondii* Torr. & A. Gray. Drummond *clematis*. Large wash. Occasional. EER, MT, SM: 309, 414, 482, 833.

**Rhamnaceae**

*Condalia globosa* I. M. Johnst. Bitter snakewood. Large gravel wash. Occasional. SM: 108, 603, 781.  
*Ziziphus obtusifolia* (Hook. ex Torr. & A. Gray) A. Gray. Lotebush. Gravel roadside, south slope, large wash. Occasional. MT, SM, SPR: 38, 88, 261, 425, 539, 823, 841.

**Rubiaceae**

*Galium aparine* L. Stickywilly. Large wash, north rocky slope. Infrequent. SM: 604, 631.  
*Galium stellatum* Kellogg. Starry bedstraw. North rocky slope, large wash. Frequent. SM, OCW: 444, 507, 529, 638, 721, 795.

**Salicaceae**

*Populus fremontii* S. Watson. Fremont cottonwood. Disturbed muddy area. Rare. DHT: 371.  
*Salix gooddingii* C. R. Ball. Goodding's willow. Dry tank bed, disturbed. Rare. DHT: 113, 377, 714.

**Scrophulariaceae**

*Castilleja exserta* (A. Heller) T. I. Chuang & Heckard. Exserted Indian paintbrush. Large gravel wash. Infrequent. SPR, EER: 149, 578, 675.  
*Keckiella antirrhinoides* (Benth.) Straw. Snapdragon penstemon. Large rocky wash, north rocky slope. Infrequent. SM: 524, 639, 786.  
*Maurandella antirrhiniflora* (Humb. & Bonpl. ex Willd.) Rothm. Roving sailor. Rocky area, north rocky slope. Infrequent. SM: 471, 607.  
*Penstemon* sp. Schmidl. Beard tongue. Rocky area. SM: 474.  
*Penstemon subulatus* M. E. Jones. Hackberry beard tongue. Large wash, rocky slope. Occasional. SPR, SM, OCW: 191, 480, 498, 728.  
*Veronica peregrina* L. Neckweed. Greenhouse Study. Rare. SPR: G345.

**Selaginellaceae**

*Selaginella arizonica*. Maxon. Arizona spikemoss. Large gravel wash, north rocky slope. Occasional. MT, SM: 135, 451, 460.

**Simaroubaceae**

*Castela emoryi* (A. Gray) Moran & Felger. Crucifixion thorn. Roadside. Infrequent. EER, AG: 317, 778.

**Simmondsiaceae**

*Simmondsia chinensis* (Link) C. K. Schneid. Jojoba. Large gravel wash. Occasional. OCW: 394, 740.

**Solanaceae**

*Datura discolor* Bernh. Desert thorn-apple. Gravel roadside, large wash, disturbed bare soil. Occasional. MT, EER, SPR: 293, 310, 759.  
*Lycium berlandieri* Dunal. Berlandier's wolfberry. Rocky ridgeline, large wash, rocky slope, gravel roadside. Frequent. SPR, MT, OCW: 165, 223, 242, 272, 330, 400, 758.  
*Lycium cooperi* A. Gray. Peach thorn. Wet area near cow tank. Occasional. SPR: 766.  
*Lycium fremontii* A. Gray. Fremont's desert-thorn. Small wash, disturbed muddy area, rocky ridgeline. Frequent. MT, DHT, SM: 70, 376, 559, 830.  
*Lycium parishii* A. Gray. Parish's desert-thorn. Rocky slope. Infrequent. MT: 269.  
*Nicotiana obtusifolia* M. Martens & Galeotti. Desert tobacco. Large wash, gravel roadside, disturbed muddy area. Frequent. SPR, EER, DHT, SM: 158, 168, 218, 280, 308, 342, 369, 812, G152.  
*Physalis crassifolia* Benth. Yellow nightshade ground cherry. East rocky slope, ridgeline. Occasional. MT, SM: 273, 362, 797.  
*Quincula lobata* (Torr.) Raf. Chinese lantern. Roadside, recently flooded. Rare. EER: 281.

**Tamaricaceae**

*Tamarix chinensis* Lour. INTRODUCED. Five-stamen tamarisk. Large gravel wash. Rare. SPR: 156, 231.

**Typhaceae**

*Typha domingensis* Pers. Southern cattail. Large gravel wash. Rare. SPR: 221.

**Ulmaceae**

*Celtis pallida* Torr. Spiny hackberry. Large rocky wash. Rare. SM: 526.

**Urticaceae**

*Parietaria hespera* Hinton. Rillita pellitory. Wash, north slope. Frequent. SPR, SM: 194, 609, 667, G5.

**Verbenaceae**

*Aloysia wrightii* (A. Gray) A. Heller. Wright's beebrush. Small gravel flat wash, gravel slope. Frequent. SM: 105, 249, 438, 783.

*Glandularia gooddingii* (Briq.) Solbrig. Southwestern mock vervain. Open gravel. Infrequent. MT: 696.

**Viscaceae**

*Phoradendron californicum* Nutt. Mesquite mistletoe. Large gravel wash. Frequent. SPR, OCW, MT: 209, 248, 319, 398, 417, 738.

**Zygophyllaceae**

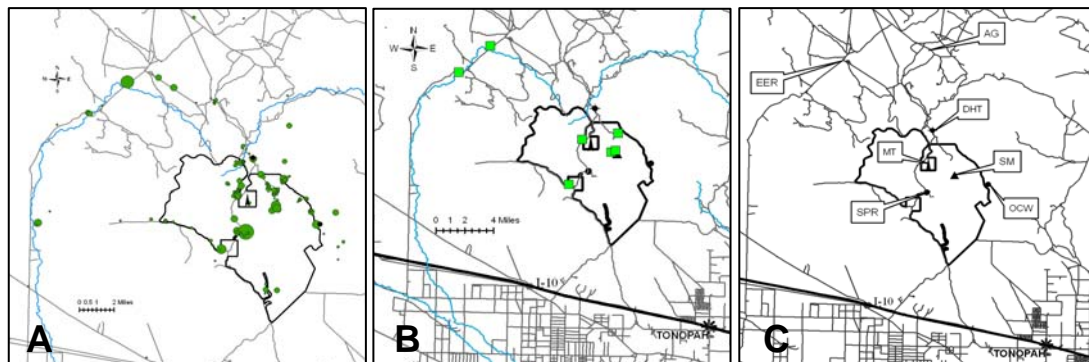
*Fagonia californica* Benth. [excluded]. Fagonbush. Along old gravel road. Rare. OCW: 735.

*Kallstroemia californica* (S. Watson) Vail. California caltrop. Gravel roadside, wet area near tank. Infrequent. MT, SPR: 295, 763.

*Larrea tridentata* (DC.) Coville. Creosote bush. Rocky slope, gravel parking lot, large wash. Abundant. MT, OCW, SPR: 18, 35, 736.



**Vascular Flora of Hummingbird Springs.** Figure 1. (A) Large wash in Hummbird Springs Wilderness representing Arizona Upland Sonoran Desertscrub with Paloverde, White Thorn Acacia and Creosote; (B) Large stand of Teddy Bear Cholla (*Cylindropuntia bigelovii*) with the Big Horn Mountains in the background; (C) Seedlings in Greenhouse Study; (D) *Glinus radiatus* in May 2007 at Dead Horse Tank.



**Vascular Flora of Hummingbird Springs.** Figure 2. (A) Field Collection Points. The size of the circle is relative to the number of collections at that point; (B) Soil Sample Collections Sites for greenhouse study. Minor roads and major streams (Tiger Wash on the left and Jackrabbit Wash on the right) are also shown; (C) General Collection Localities in Hummingbird Springs Wilderness. Abbreviations used: OCW = Old Camp Well, EER = Eagle Eye Road area (where it crosses Tiger Wash and Pump Mine Wash), MT = Microwave tower, SM = Sugarloaf Mountain, SPR = Hummingbird Springs, AG = Aguila Road area.

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## APPENDIX A: COMPARISONS BETWEEN FLORAS

Species found in the Kofa National Wildlife Refuge and in the Sierra Estrella Mountains, but not found in Hummingbird Springs Wilderness.

### **Asclepiadaceae**

*Asclepias albicans* S. Watson

### **Asteraceae**

*Brickellia atractyloides* A. Gray

*Chaenactis carphoclinia* A. Gray

*Malacothrix sonora* W. S. Davis & P. H. Raven

### **Boraginaceae**

*Cryptantha decipiens* (M. E. Jones) A. Heller

### **Cactaceae**

*Peniocereus greggii* (Engelm.) Britton & Rose

### **Euphorbiaceae**

*Bernardia myricifolia* (Scheele) S. Watson

### **Fabaceae**

*Astragalus nuttallianus* D. C.

*Lupinus arizonicus* (S. Watson) S. Watson

### **Grossulariaceae**

*Ribes quercetorum* Greene

### **Hydrophyllaceae**

*Phacelia cryptantha* Greene

*Phacelia rotundifolia* Torr. ex. Watson

### **Lamiaceae**

*Hedeoma nana* (Torr.) Briq

### **Loasaceae**

*Mentzelia involocrata* S. Watson

*Mentzelia affinis* Greene

### **Malvaceae**

*Hibiscus denudatus* Benth.

*Horsfordia newberryi* (S. Watson) A. Gray

*Sphaeralcea coulteri* (S. Watson) A. Gray

*Sphaeralcea emoryi* Torr. ex. A. Gray

### **Onagraceae**

*Camissonia boothii* (Douglas ex. Lehm.) P. H.

Raven

*Camissonia californica* (Nutt.ex. Torr.& A. Gray)

P.H.Raven

*Camissonia chamaenerioides* (A. Gray) P. H.

Raven

*Camissonia claviformis* (Torr. & Frem.) P. H.

Raven

### **Papaveraceae**

*Eschscholzia minutiflora* S. Watson

### **Polemoniaceae**

*Eriastrum diffusum* (A. Gray) H. Mason

*Gilia flavocincta* A. Nelson

*Gilia stellata* A. Heller

*Langloisia setosissima* (Torr. & A. Gray ex.

Torr.) Greene

*Linanthus demissus* (A. Gray) Greene

### **Polygonaceae**

*Eriogonum thomasi* Torr.

### **Pteridaceae**

*Astrolepis sinuata* (Lag. ex. S. W.) Benham &

Windham

*Cheilanthes villosa* Davenport ex. Mason

### **Ranunculaceae**

*Delphinium parishii* A. Gray

### **Resedaceae**

*Oligomeris linifolia* (Vahl) J. F. Macbr.

### **Scrophulariaceae**

*Mimulus guttatus* D. C.

### **Solanaceae**

*Lycium andersonii* A. Gray

### **Sterculiaceae**

*Ayenia filiformis* S. Watson

\* indicates this species has been collected in greenhouse from seed bank samples only.

\*\*indicates this species is not likely part of the flora, but is a greenhouse weed.



Species that are in Hummingbird Springs Wilderness, but have not been found in the Kofa National Wildlife Refuge or in the Sierra Estrella Mountains.

### **Apiaceae**

*Yabea microcarpa* (Hook. & Arn.) Koso-Pol.

### **Asteraceae**

*Machaeranthera tagetina* Greene

*Gutierrezia serotina* Greene

*Brickellia frutescens* A. Gray

*Lasthenia californica* DC. ex Lindl.

*Senecio flaccidus* var. *monoensis* (Greene) B. L.

Turner & T. M. Barkley

### **Brassicaceae**

*Sisymbrium altissimum* L.

### **Cactaceae**

*Echinomastus johnsonii* (Parry ex Engelm.) E. M.

Baxter

### **Euphorbiaceae**

*Chamaesyce micromera* (Boiss. Ex Engelm.)

Woot. & Standl.

### **Fabaceae**

*Desmodium procumbens* (Mill.) Hitchc.

*Hoffmannseggia glauca* (Ortega) Eifert

*Lotus humistratus* Greene

*Vicia ludoviciana* Nutt. ssp. *ludoviciana*

### **Malvaceae**

*Gossypium hirsutum* L.

### **Molluginaceae**

*Glinus radiates* (Ruiz & Pav.) Rohrb.

### **Onagraceae**

*Epilobium ciliatum* Raf.\*

### **Oxalidaceae**

*Oxalis corniculata* L.\*\*

### **Papaveraceae**

*Eschscholzia glyptosperma* Greene

### **Poaceae**

*Muhlenbergia appressa* C. O. Goodding

*Eragrostis cilianensis* (All.) Vign. ex Janchen

*Pleuraphis mutica* Buckley

*Vulpia microstachys* (Nutt.) Munro

### **Polemoniaceae**

*Gilia minor* A. D. Grant & V. E. Grant

### **Primulaceae**

*Androsace occidentalis* Pursh

### **Rubiaceae**

*Galium aparine* L.

### **Simmaroubaceae**

*Castela emoryi* (A. Gray) Moran & Felger

### **Solanaceae**

*Lycium cooperi* A. Gray

\* indicates this species has been collected in greenhouse from seed bank samples only.

\*\*indicates this species is not likely part of the flora, but is a greenhouse weed.

## APPENDIX B: Species Collected in the Greenhouse Study

Table listing species collected in the greenhouse study, germinated from soil samples. Months given indicate when the species was in flower or fruit (I = introduced, N = native).

Family	Species	Month Collected	Number of Collections	Origin
<b>Amaranthaceae</b>	<i>Amaranthus albus</i> L.	Mar, Apr, May, Jun, Jul, Sept	10	I
<b>Apiaceae</b>	<i>Daucus pusillus</i> Michx.	Apr, May	2	N
<b>Asteraceae</b>	<i>Baccharis sarothroides</i> A. Gray	Jan	1	N
	<i>Filago arizonica</i> * A. Gray	Mar, May, Jun	5	N
	<i>Filago californica</i> Nutt.	Aug	2	N
	<i>Laennecia coulteri</i> (A. Gray) G. L. Nesom	Dec	1	N
	<i>Sonchus oleraceus</i> L.	Jan, Feb, Mar, May, Aug, Sept, Oct, Nov, Dec	61	I
	<i>Symphyotrichum divaricatum</i> (Nutt.) G. L. Nesom*	Oct	11	N
	<i>Symphyotrichum divaricatum</i> (Nutt.) G. L. Nesom*	Oct	11	N
<b>Boraginaceae</b>	<i>Amsinckia menziesii</i> (Lehm.) A. Nelson and J. F. Macbr.	Feb, Mar	6	N
	<i>Cryptantha barbiger</i> (A. Gray) Greene	Mar	4	N
	<i>Harpagonella palmeri</i> A. Gray	Apr	1	N
	<i>Pectocarya platycarpa</i> (Munz. & I. M. Johnst.) Munz. & I. M. Johnst.	Mar, Apr	2	N
	<i>Pectocarya recurvata</i> I. M. Johnst.	Feb, Mar, Apr, May	12	N
	<i>Plagiobothrys arizonicus</i> (A. Gray) Greene ex. A. Gray	May	2	N
<b>Brassicaceae</b>	<i>Brassica tournefortii</i> Gouan	Apr, May, Jun	5	I
	<i>Guillenia lasiophylla</i> (Hook. & Arn.) Greene	May	5	N
	<i>Lepidium lasiocarpum</i> Nutt.	Jan, Feb, Mar, Apr, Jun	21	N
	<i>Sisymbrium altissimum</i> L.*	Jun	1	I
	<i>Sisymbrium irio</i> L.	Apr, Jun	8	I
<b>Caryophyllaceae</b>	<i>Silene antirrhina</i> L.	May	1	N
<b>Fabaceae</b>	<i>Lotus humistratus</i> Greene	May	1	N

\* indicates this species has been collected in greenhouse from seed bank samples only.

\*\*indicates this species is not likely part of the flora, but is a greenhouse weed.

Family	Species	Month Collected	Number of Collections	Origin
<b>Geraniaceae</b>	<i>Erodium cicutarium</i> (L.) L'Her. ex Aiton	Feb, May, Jun	9	I
<b>Onagraceae</b>	<i>Epilobium ciliatum</i> * Raf.	Jun	1	N
<b>Oxalidaceae</b>	<i>Oxalis corniculata</i> L.**	Jan, Feb, Apr, May, Jun, July, Aug, Sept, Oct, Nov	34	I
<b>Plantaginaceae</b>	<i>Plantago ovata</i> Forssk.	May	3	N
	<i>Plantago patagonica</i> Jacq.	May, Apr	11	N
<b>Poaceae</b>	<i>Bromus arizonicus</i> (Shear) Stebbins*	Mar	1	N
	<i>Bromus rubens</i> L.	Feb, Apr, May, Jun, Jul	19	I
	<i>Muhlenbergia microsperma</i> (DC.) Trin.	Mar, Apr	2	N
	<i>Poa bigelovii</i> Vasey & Scribn.	Mar, Apr, May, Jun	11	N
	<i>Schismus arabicus</i> Nees	Jan, Apr, May, Dec	16	I
	<i>Schismus barbatus</i> (Loefl. ex L.) Thell.	Feb, Jun, Oct	5	I
	<i>Vulpia octoflora</i> (Walter) Rydb.	Feb, Mar, Apr, May, Jun	60	N
<b>Polygonaceae</b>	<i>Eriogonum deflexum</i> Torr.	May, Jun	2	N
<b>Scrophulariaceae</b>	<i>Veronica peregrina</i> L.*	Apr	2	N
<b>Solanaceae</b>	<i>Nicotiana benthamiana</i> Domin. variety**	Oct	1	I
	<i>Nicotiana obtusifolia</i> A. Gray	Jul, Aug	3	N
<b>Urticaceae</b>	<i>Parietaria hespera</i> Hinton	Mar	3	N

\* indicates this species has been collected in greenhouse from seed bank samples only.

\*\*indicates this species is not likely part of the flora, but is a greenhouse weed.