REVISITING THE FLORA OF WHITE TANK MOUNTAIN REGIONAL PARK

Cass Blodgett and Dawn Goldman
blodgett.cass@gmail.com
dawn380@cox.net

ABSTRACT: White Tank Mountain Regional Park is a 12,140-ha desert mountain preserve on the western edge of the Phoenix metropolitan area. A floristic study of the park was conducted by David Keil from 1968 to 1970 as a graduate student thesis project, and formally published in 1973 as "Vegetation and Flora of the White Tank Mountain Regional Park," the first detailed accounting of the park's flora. We here report a new floristic inventory of the park, conducted between 2016 and 2022 and compare the data sets from the two surveys. Our survey documents 327 vascular plant species, including 43 previously not known to grow in the park. The number of non-native species has increased from 20 to 29 since 1968; 31 previously unreported native species were found; 63 species, native and non-native, from the prior study were not encountered. We discuss environmental changes that have occurred in the last 50 years in local climate, land and groundwater use, and fire that may explain changes in species composition.

INTRODUCTION

White Tank Mountain Regional Park (WTMRP), northwest of the city of Phoenix, Arizona, was created as part of Maricopa County's park system in 1961. At 12,140 ha (nearly 30,000 acres), it is the largest regional park in Maricopa County (Maricopa County Parks and Recreation [MCPR], 2014a). In 1968, Arizona State University graduate student David Keil began work on a flora of the new park as part of his Master of Science degree (Keil 1970), which he later published as the "Vegetation and Flora of the White Tank Mountain Regional Park" (Keil 1973). Until this plant inventory (the Keil flora), few plant collections had been made in the area, so the park's flora was poorly known. Keil collected 1148 plant specimens that documented 332 vascular plant species (Keil 1973).

Today, the floristic diversity of WTMRP faces several challenges due to the development of roads, parking areas, trails and facilities to accommodate a growing number of visitors. Urban development is planned to surround the mountains and isolate it from nearby natural areas (White Tank Mountains Conservancy [WTMC] 2021). Additionally, several non-native species have arrived since the Keil flora, a few of which are beginning to dominate in some areas of the park.

In 2016, the Central Arizona Conservation Alliance commissioned a new floral inventory (the Blodgett-Goldman flora, or B-G flora) to generate an updated plant checklist for the park. In this paper we present data from our survey and make comparisons with the Keil flora to highlight changes that have occurred in the last 50 years.

STUDY AREA

WTMRP is at the northern boundary of the Sonoran Desert in Arizona and lies just west of the greater Phoenix metropolitan area (Figure 1). It covers part of a larger (ca. 32,000 ha) north-south trending mountain island in the Phoenix Basin (Henderson et al. 2020). The elevations in the park range from 411 m (1350 ft) on the south-east corner on the alluvial apron surrounding the mountains to 1244 m (4083 ft) on the highest peak.

Revisiting the Flora of White Tank Mountain Regional Park. Canotia 19: 1–38. 2023.

Geology

The White Tank Mountains are a metamorphic core complex of Proterozoic rocks (1.7 bya) intruded by two late Cretaceous to early Tertiary aged granitic plutons. The range is surrounded by Quaternary alluvium from early Pleistocene to present (Reynolds 2002). The soils in and around the mountains are derived from the mountains' metamorphic and igneous rocks.

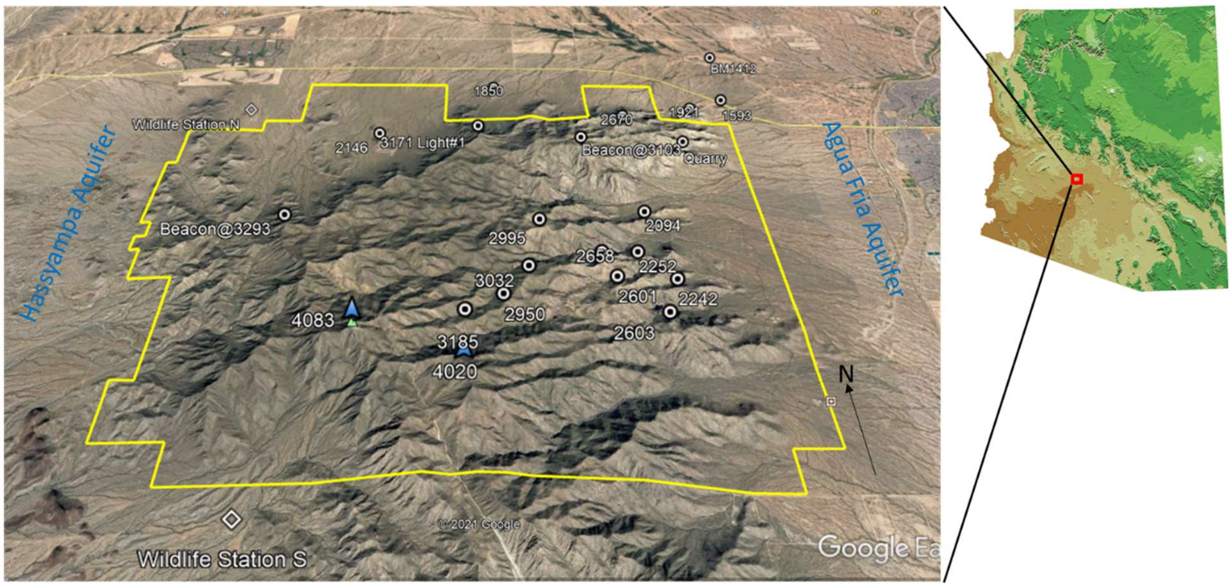


Figure 1. Map of White Tank Mountain Regional Park. Satellite imagery from Google Earth was used to create the figure.

The west side of the mountains is part of the Hassayampa River watershed. It rises abruptly from the desert floor and features rough, rocky terrain with thin soils. The east side of the mountains is part of the Agua Fria River watershed and rises more gradually from the valley floor. It contains areas with deeper soils, some of which can temporarily hold water from wetter seasons and features at least two permanent springs. The north end of the mountains is also abrupt but rises from sandy Creosote Bush (*Larrea tridentata*) flats that generally drain to the east and into the Agua Fria River watershed. The southern boundary of the park cuts across the mountain range, which continues to the south and meets the valley floor near Interstate Highway 10.

History

When the park was established, an archeological survey discovered several prehistoric sites, including some with rock art and artifacts. The rock art is mostly attributed to the Hohokam people, who occupied the area between 500 AD and 1100 AD, with some attributed to the Western Archaic people who preceded the Hohokam. The Western Yavapai people controlled the area more recently (Rasmussen 2014).

A: Rock Art B: Metate Fragment (basalt) C: Pottery Sherd

Figure 2. Evidence of Past Land Use.

Prior to the completion of a rail route from Phoenix to Prescott in 1895, the White Tank Wagon Road followed a series of wells and watering holes from south of the Gila River to Prescott. One of these was a natural water tank in the northeast part of the mountains that offered year-round water. This “white tank” became the namesake of the mountains (MCPR 2014b).

From the late nineteenth to mid-twentieth century more than 100 mining claims were filed. However, there is no evidence of significant production from any mines. Roughly during the same period, the mountains supported ranching operations with goats, sheep and cattle. Evidence of the ranching history of the mountains, thought to have ended in the 1930s, can still be found throughout the range, and stray cattle sometimes wander into the park (MCPR 2014b).

During World War II, navigational beacons were installed on several peaks. Evidence of these and their later conversion from battery to powerline sources is still present (MCPR 2014c).

Several of the highest peaks support antenna farms. In July 1993 equipment used to service the antennas ignited a fire and burned 1214 ha (3000 ac) in the northeast quadrant of the park (MCPR 2014d).

CLIMATE

The US Climate Normals for 1991–2021 reports the following for the Phoenix area: the average annual temperature is 75.6°F (24 °C) with an average annual high of 87.1°F (31 °C) and an annual average low of 64.1°F (18 °C). The hottest month is July with an average high of 106.5°F (41 °C) and the coolest month is December with an average low of 45.3°F (7 °C) (National Weather Service [NWS] 2021a).

Rainfall near the northern edge of the Sonoran Desert is bimodal, having peaks in both winter and summer and with winter typically delivering about two-thirds of the annual rainfall. Average annual precipitation is 7.22 in (183 mm). Peak rains fall from the months of December through March and from July through August (NWS 2021a). Fall and late spring are typically drier and windy. Annual rainfall can be highly variable year to year. In seasons of greater than average rainfall, annual plants may dominate the landscape. However, it is common for there to be so little rain in either the winter or summer peaks that few, if any, annuals germinate.

For much of the flora of WTMRP, growth and flowering is triggered by winter rains. A subset of the park's plants can respond to both winter and summer rains, and a smaller but distinct cohort of the flora responds only to the summer monsoon rainfall.

VEGETATIVE COMMUNITIES

The vegetation of WTMRP falls within two of the major subdivisions of the Sonoran Desert described by Forrest Shreve (Brown 1994). The Lower Colorado River Valley subdivision describes the plant community and distribution on the flats surrounding the mountain slopes. Where the flats meet the slopes of the mountains, the plant community immediately transitions to the Arizona Upland subdivision, which continues upslope to the peaks.

Within these divisions, several series as defined by Brown (1994) can be recognized, but not very distinctly, as they intergrade with one another. The Lower Colorado River Valley subdivision is predominantly represented by the Creosote-Bursage and Mixed Scrub series. The Arizona Upland subdivision is best represented here as the Palo Verde–Mixed Cactus Scrub series below 853 m (2800 ft) and a mix of other higher elevation series above 853 m.

Departing from Brown's definitions, a more detailed picture of the plant communities and habitats of WTMRP can be formed by adapting and extending the zones of vegetation Keil employed to partition the habitats and floral communities of the park. To this end we identified eight distinct habitat types with characteristic plant assemblages. These are:

- Alluvial Plain Desert Scrub
- Upper Sonoran Desert Scrub
- Desert Grasslands
- Sheltered Sites
- Drainages and Canyons
- Springs
- Constructed Wetlands
- Secondary Succession Landscape (from fire)

Alluvial Plain Desert Scrub. Alluvial Plain Desert Scrub occupies the gentle slopes leading from the park boundaries to the steeply rising slopes of the mountains. *Larrea tridentata* and *Ambrosia deltoidea* dominate much of this community. *Parkinsonia microphylla*, *Olneya tesota*, and *Encelia farinosa* are occasional on the flats but are more common in the shallow drainages. On the west side of the mountains, *Prosopis velutina* occasionally joins this cohort of trees, and *Ambrosia dumosa* replaces *A. deltoidea* on coarser substrates. *Carnegiea gigantea*, *Cylindropuntia acanthocarpa,* *Cylindropuntia bigelovii*, and *Ferocactus cylindraceus* are the most common cacti.

There are occasional areas of desert pavement that are only sparsely populated, usually with annuals in such genera as *Chorizanthe*, *Cryptantha*, *Pectocarya*, *Chaenactis*, *Plantago* and *Erodium*, and even fewer perennial shrubs and trees. Plants on this substrate achieve only diminutive form compared with their size in other habitats.

A B

Figure 3. Alluvial Plain Desert Scrub. (A) Alluvial plain on the eastern side of the range. *Larrea tridentata* is in the foreground with *Olneya tesota*, *Encelia farinosa*, and *Parkinsonia microphylla*. (B) Alluvial plain on the north side of the range. *Ambrosia deltoidea* dominates with scattered *Carnegiea gigantea*, *Larrea tridentata*, and *Parkinsonia microphylla*.

Upper Sonoran Desert Scrub. Upper Sonoran Desert Scrub occupies the rocky slopes from the base of the mountains at 442 m to 884 m (1450 ft to 2900 ft), making it the largest plant community in the park. The dominant plants here are *Parkinsonia microphylla*, *Olneya tesota*, *Senegalia greggii*, and *Fouquieria splendens,* which provide the upper story. A wide variety of shrubs are present but *Encelia farinosa*, *Lycium* spp., *Sphaeralcea ambigua*, and *Krameria bicolor* are ubiquitous, as is *Bahiopsis parishii* on north-facing slopes. On north-facing slopes, *Simmondsia chinensis* often replaces *Larrea tridentata* as a middle story shrub. *Cylindropuntia bigelovii* is common on south-facing slopes and is scattered on some of the flats below the mountains, but is usually absent from other slope aspects.

A B

Figure 4. Upper Sonoran Desert Scrub. (A) A typical spring assemblage with *Encelia farinosa* and *Olneya tesota* in bloom with *Ambrosia deltoidea*, *Parkinsonia microphylla*, *Eschscholzia californica* subsp. *mexicana*, *Lupinus sparsiflorus*, and *Phacelia crenulata*. (B) A slope at the upper edge of the bioregion with a southern aspect. *Cylindropuntia bigelovii* appears with *Carnegiea gigantea* (including crested example in foreground), *Parkinsonia microphylla*, *Encelia farinosa*, and *Fouquieria splendens*.

Desert Grasslands. Desert Grasslands occur at higher elevations from 853 m (2800 ft) to the mountain-top at 1244 m (4083 ft). *Hilaria rigida* and *Aristida purpurea var. nealleyi* are the main bunchgrasses that make up this grassland. *Cirsium neomexicanum* is frequent in this community, as is *Calliandra eriophylla*. *Canotia holacantha* and *Agave simplex* can only be found in this community on north-facing slopes. At these higher elevations, *Melampodium leucanthum* and *Psilostrophe cooperi* are occasional caespitose shrubs and *Krameria erecta* replaces *Krameria bicolor*. Rocky outcrops support occasional *Penstemon subulatus.* None of these plants occur below this zone. For slopes with Southern exposure, *Bromus rubens* often dominates the space between shrubs.

A B

Figure 5. Desert Grassland. (A) Valley at ca. 880 m (2900 ft) with north-west aspect. *Hilaria rigida* carries down to the bottom of the valley with *Bromus rubens* in the foreground, along with *Cirsium neomexicanum* and *Cylindropuntia acanthocarpa*. *Parkinsonia microphylla* is the foreground tree and *Senegalia greggii* is in the background. (B) Slope with south-east aspect. *Bromus rubens* dominates with *Ephedra* spp., *Ferocactus cylindraceus*, and *Fouquieria splendens*. *Canotia holacantha* is barely visible on ridgeline.

A B C

Figure 6. Desert Grassland. (A) Slope above 850 m (2800 ft) with north-facing aspect. *Canotia holacantha* with *Cylindropuntia acanthocarpa*, *Encelia farinosa* and *Ambrosia deltoidea*. *Bromus rubens* is in the foreground. (B) *Agave simplex* with *Cylindropuntia acanthocarpa*, *Parkinsonia microphylla,* and *Bromus rubens* with *Delphinium parishii* in the foreground. (C) *Penstemon subulatus* may be found in crevices of rocky outcrops of the upper elevations.

Sheltered Sites. Sheltered sites at the bases of abrupt, high cliffs with a northern exposure, provide extended shade throughout the day and may also provide seasonal water seepage to the soils protected by these cliffs. These sites support *Celtis pallida*, *Keckiella antirrhinoides*, *Artemisia ludoviciana*, and *Salazaria mexicana*. Smaller sheltered sites such as rock overhangs and grottos harbor *Galium* spp., *Delphinium* spp., ferns (Pteridaceae), *Dudleya arizonica* and *Boechera perennans*. Many of the plants found at these specialized sites do not occur elsewhere.

Drainages and Canyons. Six major drainages and canyons on the east side of the park carry runoff toward the Agua Fria River. These drainages can be divided into their xeric and mesic segments. The xeric segments, usually at lower elevations, feature nearly barren sandy bottoms due to occasional flash floods, but their loamier banks harbor *Prosopis velutina*, *Olneya tesota*, *Hyptis emoryi*, *Trixis californica*, *Ambrosia ambrosioides*, *Salazaria mexicana, Senegalia greggii*, and *Simmondsia chinensis.* Mesic segments of the major drainages are usually found in an elevation window between 609 m and 732 m (2000 ft and 2400 ft). Their soils retain moisture after rain events and may feature seeps at canyon wall bases but do dry out in the warmer season. They may feature *Erythranthe guttata*, *Tamarix chinensis*, *Cynodon dactylon*, *Juncus bufonius*, *Polypogon monspeliensis*, *Hordeum murinum, Aristida purpurea var. nealleyi*, *Cenchrus ciliaris* and *C. setaceus* in addition to many of the plants found in the xeric segments.

Springs. There are two springs with year-round water that support the park's only populations of *Salix gooddingii*. Additionally, *Prosopis velutina, Ambrosia ambrosioides, Brickellia coulteri,* and *Abutilon incanum* occur at these springs but are also common occurrences elsewhere in the major drainages. The other plant, aside from *Salix gooddingii*, that is conspicuous at these springs is a thick covering of *Cynodon dactylon*, the common perennial used in residential lawns known as Bermudagrass.

Constructed Wetlands. Constructed wetlands in the park have been made by creating earthen dams across shallow drainages and building levees on the sides to impound water after rain events. These may have preceded the park's establishment during its ranching history as livestock watering tanks, but they now are apparently maintained, and some are augmented with artificial water supplies to support the park's wildlife. They feature fine, silty substrates and are dominated by the introduced annual grass *Hordeum murinum*.

Secondary Succession Landscape. A large secondary succession landscape was created in 1993 when the Bug Fire burned 2430 ha (6000 ac) in the northern half of the mountain range. Parts of the burn area are nearly devoid of upper and medium story plants such as *Parkinsonia microphylla* and *Lycium* spp. that are otherwise ubiquitous throughout the park. *Encelia farinosa* is the dominant shrub in most of these patches and forms near monocultures in a few areas such as the southern exposed slopes along the Mesquite Trail. Where the higher elevations burned, *Bromus rubens,* an introduced annual grass, can dominate the landscape, especially on southern exposures.

Figure 7. Sheltered sites. (A, B) Large Scale. A) Steep, north-facing slope with large boulders forming shelter needed for *Keckiella antirrhinoides* to thrive. B) Tall, north-east facing cliff face shelters *Celtis pallida* and *Quercus turbinella* with *Senegalia greggii.* (C, D) Small Scale. C) Base of near-vertical, north-facing slope with large rocks prolongs soil moisture for *Delphinium scaposum* to grow with *Phacelia distans, Cottsia gracilis* and *Bromus rubens.* D) *Dudleya arizonica* requires the partial shade of steep, north-facing slopes, or the shade provided by rock overhangs, seen here with *Echinocereus engelmannii.*

Figure 8. Drainages and Canyons. (A, B) Drier segments. A) Typical xeric segment of a major drainage featuring *Prosopis velutina* with *Parkinsonia microphylla* as well as *Olneya tesota* and *Senegalia greggii.* B) Both the xeric and mesic segments of major drainages can be thick with *Cenchrus ciliaris* and/or *Cenchrus setaceus.* (C, D) Wetter segments. C) Mesic segments of major drainages like this one usually support *Tamarix chinensis* with *Cynodon dactylon* and *Hordeum murinum.* D) *Erythranthe guttata* is found only in drainages with soils that hold water for extended periods of time like this wet crevice.

A B

Figure 9. Springs and Constructed Wetlands. (A) Black Canyon Spring in WTMRP. In the foreground is *Cynodon dactylon* with *Prosopis velutina*, *Ambrosia ambrosioides* and *Salix gooddingii* in the background. (B) One of the constructed wetlands in WTMRP featuring a wildlife watering tank. *Hordeum murinum* covers all the interior with *Prosopis velutina* and *Olneya tesota* on the levees.

A B C D

Figure 10. Fire Succession Landscape. (A) Remains of *Carnegiea gigantea* with other burn-scarred examples in background with *Ambrosia deltoidea* and *Lupinus sparsiflorous*. (B) Burn-scarred *Ferocactus cylindraceus* with *Encelia farinosa*, *Lupinus sparsiflorus*, *Senegalia greggii*, and *Ambrosia deltoidea*. *Bromus rubens* densely fills the space between plants. (C) *Encelia farinosa*-dominated areas without upper story plants are typical of the burn area. (D) *Calochortus kennedyi* is frequent in the burn zone but not often encountered outside of it.

Methods

Sixty-two collection trips were made to the park between February 2016 and October 2022. Collections were made in all months except July.

Nearly all travel in the park was on foot. Most collection sites were near hiking trails or in the drainages on the eastern and northern slopes of the mountains. More difficult-to-access locations were selected based on our estimate for the sites' potential of harboring unvouchered species. Google Earth was used extensively to reconnoiter the study area and identify sites for visitation.

Collections were limited to vascular plants. All collections were deposited in the herbarium of Desert Botanical Garden (DES) in Phoenix. Most plants were identified using Arizona Flora (Kearney et al. 1960). Additional taxonomic treatments used include Vascular Plants of Arizona Project (Vascular Plants of Arizona Editorial Committee 1992+), Flora of North America (Flora of North America Editorial Committee 1993+), and eFloras (2009). Grasses (Poaceae) were identified using Barkworth et al. (2007) as the principal reference. Confirmations of plant identification were made by comparison with reference herbarium specimens at DES. Native vs. non-native classifications adhere to USDA Plants Database (United States Department of Agriculture 2021), with the exception of *Matthiola parviflora*, which is not included in the USDA list for Arizona but is an introduced species (Horst et al. 2014). Scientific names conform to SEINet's Central Taxonomic Resource with few exceptions (i.e. genus *Cenchrus* instead of *Pennisetum*, and *Senegalia* and *Vachellia* instead of *Acacia*).

A checklist of plants present around the time of Keil's study was assembled using herbarium specimens recorded in the Southwest Environmental Information Network database (SEINet 2013). These records include Keil's vouchers and those of all other collectors who made sporadic collections in the area from 1932 through 1976. Subsequent to these collections, few others were made, but no new plants were added to the known flora until our work. Based on these data, the baseline flora ca. 1968 is 357 species and infraspecific taxa. The checklist, including links to all voucher records, is available to the public on SEINet (White Tank Mountains Regional Park 1968). This superset of the list presented in Keil's 1973 publication is what we refer to going forward as the Keil flora.

A checklist for the B-G flora was also created, with links to all of our vouchers, plus those of any contemporary collectors made between 2016 and 2022 and is publicly available on SEINet (White Tank Mountains Regional Park 2016).

Additional searches were made of databases including SEINet (SEINet 2013), GBIF (GBIF: The Global Biodiversity Information Facility, 2020), and iNaturalist (INATURALIST) for recent collections and observations of plants in and near the park boundaries, that were not encountered in our fieldwork. These were evaluated for inclusion into the B-G checklist.

RESULTS AND DISCUSSION

We present the findings from our fieldwork, compare our data with a similar survey done over 50 years ago and look for indications of changes that have occurred.

Over the course of our 62 collection trips, 1200 specimens were collected including 327 vascular plant species in 63 families.

Figure 11 shows our plant checklist accumulation approximating a logarithmic curve. At collection trip 62 our accumulation rate is about 1.4 new plants per trip. So, while additional collecting trips are projected to still increase the checklist, the effort for each addition is increasingly high.

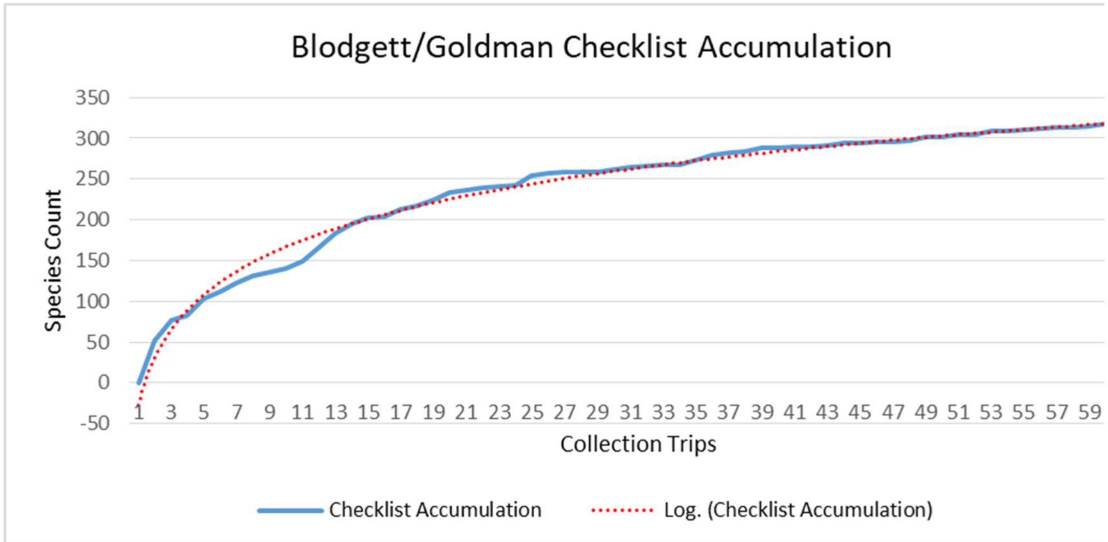


Figure 11. Species accumulation curve showing rate of collections of new plants approximating a logarithmic curve.

Figure 12 shows the collection region with a red marker at each site where one or more vouchers were taken during the present study, precision afforded by the use of a GPS device. Such precision was difficult to obtain prior to the advent of GPS, and field notes prior to the GPS era often did not include precise coordinate data. For this reason, a map of exact collection sites for the Keil flora is not possible, so an approximation of the region collected then is shown in Figure 12 with a cyan colored polygon. The region was estimated by analyzing all the labels from Keil flora vouchers, making a best effort to estimate the focus of those collections, and drawing an enclosing polygon on the map.

It is evident that the southern end of the park was covered more by the B-G flora and the northern end of the park was covered more by the Keil flora. Despite these differences, the areas of coverage for the two studies are similar, making comparisons appropriate.

A few important facts are evident from a simple side by side comparison of basic collection data between the Keil and B-G floras (Table 1).

First, the number of introduced species in the park has increased from 20 to 29, however the composition has changed between the two floras (Table 4). Second, 43 species collected in the B-G study were not previously known in the park. Third, 64 species from the Keil flora checklist were not encountered during this study.

The plant family represented by the most species in WTMRP is the Asteraceae family, followed by Poaceae, Boraginaceae, Fabaceae, Malvaceae, and Cactaceae (Figure 13). Together these six families comprise more than 50 percent of the species in the park.

The flora of WTMRP is almost exactly half annual and half perennial, as measured by both the Keil and B-G studies. Most of the vascular plant species (52.5%) in WTMRP are herbaceous (Figure 14). Herbaceous plants include all the annuals as well as a subset of the perennials that have no woody parts, such as geophytes (e.g., *Dichelostemma* and *Delphinium*). Ferns include *Pteridaceae* and *Selaginellaceae*. Graminoids (12.3%) are all the *Poaceae* but include one species from each of *Cyperaceae*, *Juncaceae,* and *Typhaceae*. Succulents (4.9%) are all the *Cactaceae* and *Crassulaceae* plus one species each from the genera *Bursera* and *Agave.*

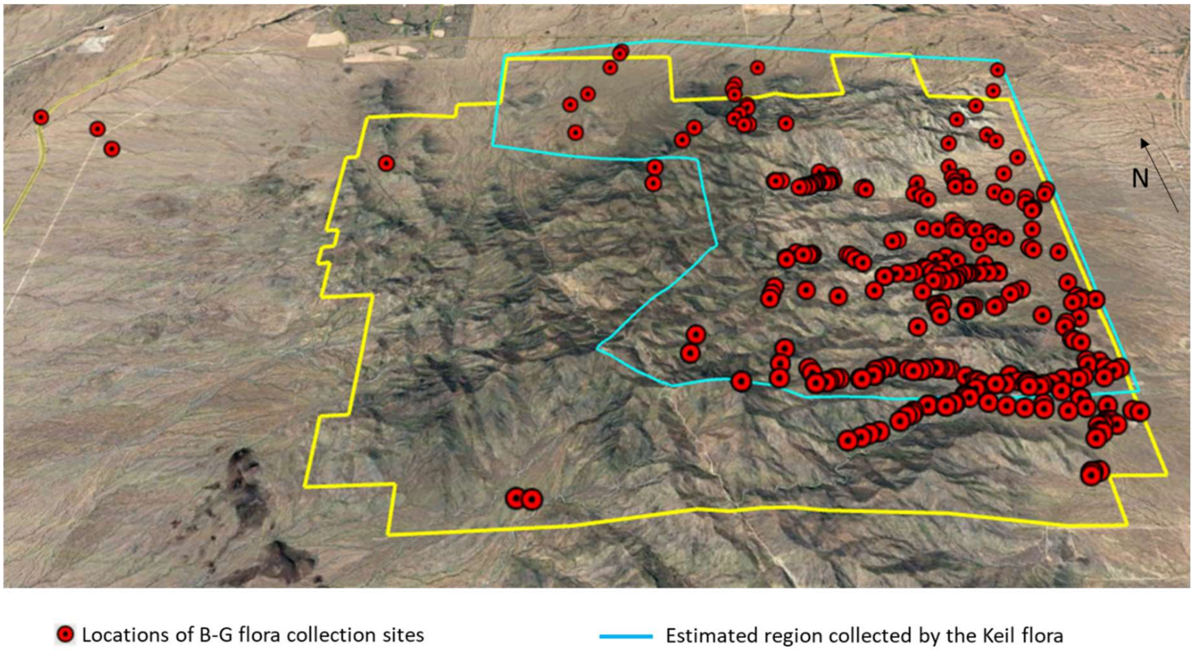


Figure 12. WTMRP boundaries outlined in yellow. B-G flora collection sites are marked with red spots. The estimated region collected by the Keil flora is outlined in cyan. Satellite imagery from Google Earth was used to create the figure.

Table 1. Basic Collection data from the Keil and B-G floras.

Measure	Keil Flora	B-G Flora
Plants Collected	1148	1241
Vascular Plant Species	357	327
Introduced Species	20	29
Added Species	NA	43
“Missing” Species	NA	64

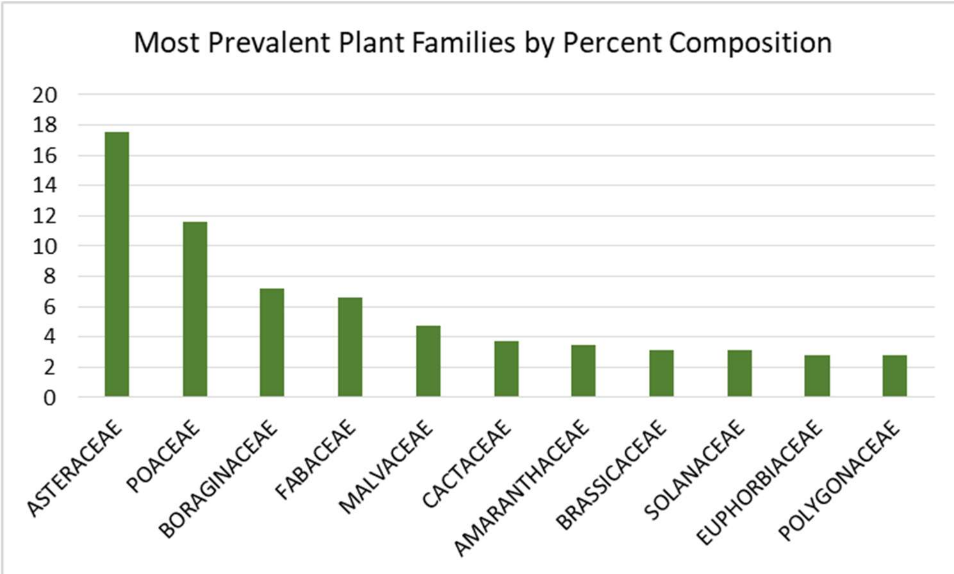


Figure 13. Most Common Plant Families in the White Tanks by Percent of Species.

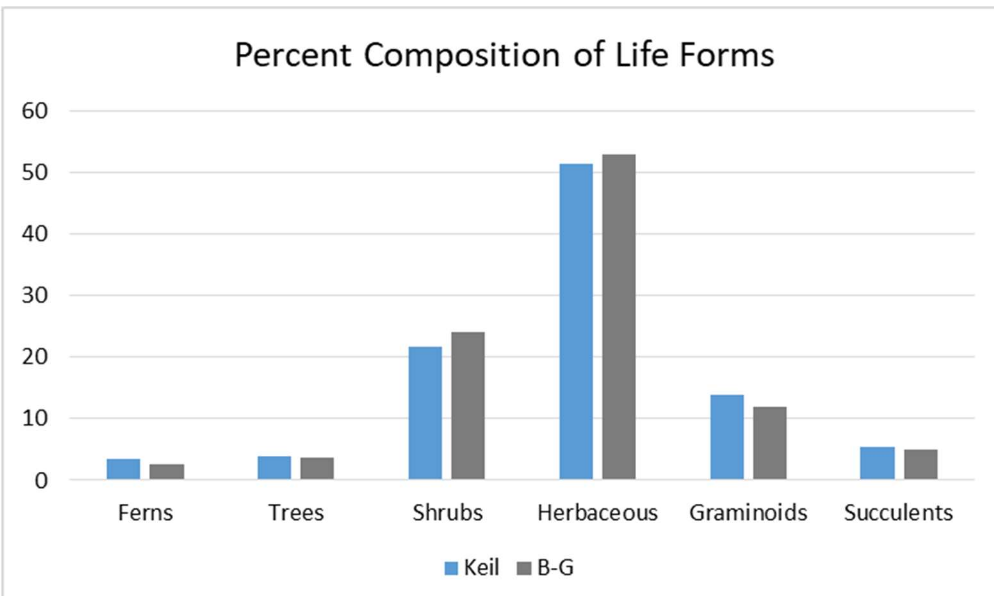


Figure 14. Plant composition of the White Tanks measured as life forms.

An interesting subset of the WTMRP flora are the 12 percent of plants whose reproductive phenology is brought on exclusively or nearly so by summer rain events (Table 2). The species listed in Table 2 meet two criteria. First, is that we collected them in the summer and fall seasons (August through November). Second, for each species, we analyzed a SEINet database of all collections made over time in the Phoenix Basin. We regard the months with the most collections made as a proxy for the peak flowering months for these species. Species with peak collection rates from August to November are listed in Table 2. Sixty percent of these species are annuals.

Table 2. Plants predominantly responding to summer rain.

Family	Species	Dur	Family	Species	Dur
Aizoaceae	*Trianthema portulacastrum**	A		*Abutilon palmeri*	P
Amaranthaceae	*Amaranthus albus*	A	Nyctaginaceae	*Allionia choisyi*	A
	Amaranthus fimbriatus	A		*Boerhavia intermedia*	A
	Amaranthus obcordatus	A	Poaceae	*Bouteloua aristidoides*	A
	Amaranthus palmeri	A		*Bouteloua barbata*	A
	Chenopodium neomexicanum	A		*Dasyochloa pulchella*	P
	Tidestromia lanuginosa	A		*Heteropogon contortus**	P
Asteraceae	*Ambrosia monogyra*	P		*Muhlenbergia porteri*	P
	Ericameria laricifolia	P		*Panicum hirticaule*	A
	*Gutierrezia sarothrae**	P		*Sporobolus airoides**	P
	Pectis papposa	A		*Tridens muticus* var. *elongatus**	P
	Pectis rusbyi	A		*Urochloa arizonica*	A
	Stephanomeria tenuifolia	P	Polygonaceae	*Eriogonum wrightii*	P
Convolvulaceae	*Cuscuta indecora**	A	Solanaceae	*Datura discolor*	A
Cucurbitaceae	*Brandegea bigelovii*	A		*Lycium berlandieri**	P
Euphorbiaceae	*Chamaesyce florida*	A	Talinaceae	*Talinum aurantiacum*	P
	Chamaesyce revoluta	A	Verbenaceae	*Aloysia wrightii*	P
	Euphorbia abramsiana	A	Zygophyllaceae	*Kallstroemia grandiflora*	A
Malvaceae	*Abutilon abutiloides**	P		*Kallstroemia parviflora*	A
	*Abutilon incanum**	P			

*Exhibit some bimodal response to rain, but mainly summer. Duration: A-Annual, P-Perennial.

NATIVE SPECIES NOT PREVIOUSLY VOUCHERED

There were 43 species encountered in this study not previously documented, 31 of which are native and listed in Table 3. Some of these plants may have always been in the park but were not vouchered before this study, and others are more recent introductions either by natural or human vectors. Three species on this list were probably introduced into an artificial pond, which has since dried out, and do not occur elsewhere in the park. These are *Nymphaea mexicana*, *Hydrocotyle verticillata*, and *Juncus torreyi*.

INTRODUCED SPECIES

Twenty-nine introduced plants were identified among our collections, including 12 that were not previously documented in the park. They include a few species that may have been present in the time of Keil's flora but were not found then. Most are species that are first known from the Phoenix Basin after 1970.

Table 4 lists the 29 introduced plants encountered in the present flora; the new arrivals are noted with an asterisk. Four introduced plants reported during the Keil flora were not found by the B-G flora. They are *Carthamus tinctorius*, *Ayenia insulicola*, *Eragrostis cilianensis* and *Polypogon viridis*. The last two are commonly encountered grasses, and possibly still reside in the park. The report of *Ayenia insulicola* is a misidentification of *Ayenia filiformis* (Sussman 2020). *Carthamus tinctorius* is rare in the Phoenix area and may only have been a transient resident.

Among the introduced plants that were not present in WTMRP in 1968 are four that are concerning due to their potential for negative ecological impacts. These are *Oncosiphon pilulifer* and *Brassica tournefortii*, listed as Class B noxious weeds by the Arizona Department of Agriculture (AZDA), and *Cenchrus ciliaris* and *Cenchrus setaceus*, listed as Class C noxious weeds by AZDA. (Arizona Department of Agriculture [AZDA] 2023).

Table 3. Newly Vouchered Native Plants of WTMRP.

Family	Species	Family	Species
Acanthaceae	*Justicia californica*	Caryophyllaceae	*Loeflingia squarrosa*
Aizoaceae	*Trianthema portulacastrum*	Convolvulaceae	*Cuscuta indecora*
Amaranthaceae	*Amaranthus albus*	Fabaceae	*Lupinus succulentus*
	Blitum nuttallianum	Gentianaceae	*Zeltnera calycosa*
	Chenopodium neomexicanum	Juncaceae	*Juncus torreyi**
Araliaceae	*Hydrocotyle verticillata**	Malvaceae	*Abutilon abutiloides*
Asteraceae	*Ambrosia monogyra*		*Ayenia compacta*
	Geraea canescens	Montiaceae	*Claytonia perfoliata*
	Malacothrix coulteri	Nyctaginaceae	*Abronia villosa*
	Stephanomeria tenuifolia	Nymphaeaceae	*Nymphaea mexicana**
	Verbesina encelioides	Plantaginaceae	*Penstemon parryi*
Boraginaceae	*Eremocarya micrantha*	Polemoniaceae	*Gilia scopulorum*
	Johnstonella angustifolia	Polygonaceae	*Eriogonum pusillum*
	Phacelia affinis	Solanaceae	*Nicotiana clevelandii*
	Phacelia tanacetifolia	Talinaceae	*Talinum aurantiacum*
Cactaceae	*Cylindropuntia fulgida*		

*Plants collected in temporary, artificial pond.

Table 4. Introduced plants of WTMRP.

Family	Species	Family	Species
Amaranthaceae	*Chenopodiastrum murale*	Malvaceae	*Malva neglecta**
	Salsola tragus		*Malva parviflora*
Asteraceae	*Centaurea melitensis**	Poaceae	*Avena fatua*
	*Dimorphotheca sinuata**		*Bromus rubens*
	*Oncosiphon pilulifer**		*Cenchrus ciliaris**
	Sonchus asper		*Cenchrus setaceus**
	Sonchus oleraceus		*Cynodon dactylon*
Brassicaceae	*Brassica tournefortii**		*Eragrostis lehmanniana**
	*Matthiola parviflora**		*Hordeum murinum*
	Sisymbrium irio		*Phalaris minor*
Caryophyllaceae	*Herniaria hirsuta**		*Polypogon monspeliensis*
Cucurbitaceae	*Citrullus lanatus**		*Schismus arabicus*
Fabaceae	*Melilotus indicus*		*Schismus barbatus*
Geraniaceae	*Erodium cicutarium*	Tamaricaceae	*Tamarix chinensis*
Linaceae	*Linum grandiflorum**		

*New record for the B-G flora.

A B C D

Figure 15. Four species of concern in the White Tanks. (A) *Oncosiphon pilulifer*. Known in the region since 1997. Currently sparse but occuring everywhere in the park. (B) *Brassica tournefortii*. Known in the region since 1965. Distributed throughout the park, becoming dominant in the lower segments of the larger drainages. (C) *Cenchrus setaceus.* Known in the region since 1962. It occupies all the major drainages, becoming dominant in the wetter segments. Currently confined to the drainage channels. (D) *Cenchrus ciliaris.* Known in the region since 1972. It is ubiquitous in all major drainages and occasional along the park roads including OHV roads on the remote north and west sides of the mountains. It is becoming established outside drainages and roadsides.

CHANGES NOTED IN WETLAND PLANT ABUNDANCE

An early focus of field work for this study was to try to locate examples of perennial wetland plants vouchered in the Keil flora. This set of plants includes *Schoenoplectus americanus*, *Typha domingensis*, *Stemodia durantifolia*, (assigned wetland obligate [OBL] status by NWPL Plant Ratings [Lichvar 2013]), *Salix gooddingii*, *Salix exigua* and *Pluchea sericea* (assigned facultative wetland [FACW] status), and *Baccharis salicifolia* and *Populus fremontii* (assigned facultative [FAC] status). Even though not all these species are assigned OBL status, we assert that within the study area these species occur only in soils that are saturated nearly year-round and thus are all reliable indicators of the wettest locations in the park. Contrast that to the present when *Salix gooddingii* and *Pluchea sericea* are the only members of this group that remain in these locations.

Historically, springs are known in the park from four locations. These are documented in the Maricopa County Regional Park System Master Plan Update (MCRP 2014e).

Table 5. Known Springs in White Tank Mountain Regional Park

Location	**Source**
Section 23, T3N-R3W	Willow Spring
Section 23, T3N-R3W	Mesquite Spring
Section 26, T3N-R3W	Dripping Spring
Section 35, T3N-R3W	Unnamed spring (Here named Black Canyon Spring)

The locations of Willow and Mesquite springs are well known because the park trail system takes hikers to them. The exact location of Dripping Springs is not documented, but the segment of Dripping Springs Canyon where it likely occurs can be deduced from location information found on Keil's voucher labels and from images from Google Earth. Nothing published about the unnamed spring was found, but the section and township information place it in the southernmost drainage within the park known as Black Canyon. A reconnoitering via Google Earth provided clues to possible locations. We explored the canyon and found that indeed a spring does occur there (referred to as Black Canyon Spring going forward). Figure 16 is a model of the mountain's eastern profile that depicts how the wetland-dependent perennials collected by both studies are distributed.

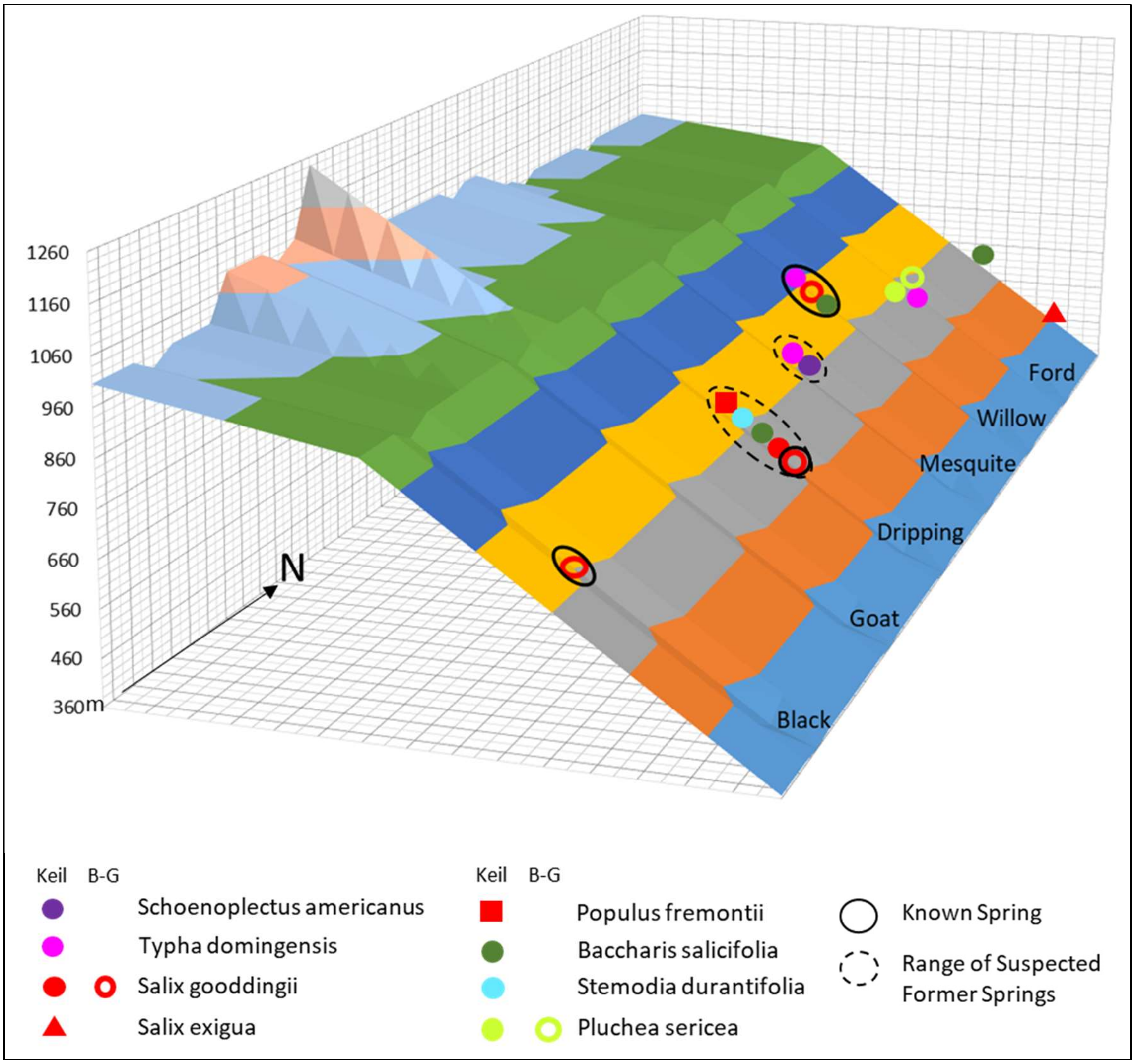


Figure 16. Approximate Locations of Wetland Perennial Vouchers. The north-south trend of the mountains is marked with the major east-west drainages. The voucher plot points are color-coded as indicated in the legend below the plot. Vouchers from the Keil flora are plotted with solid-colored markers and those of the B-G flora are plotted with hollow-bodied markers. Color bands indicate 100 m elevation increments.

It is clear that the variety of wetland obligate plants was richer in 1968 than today. Of the four locations, historically referred to as springs, none support any of the former cohort of wetland plants, except for *Salix gooddingii* and *Pluchea sericea*, and only Willow Spring and Black Canyon Spring feature surface water. Each of these locations occurs at an elevation band between ca. 600 m and 750 m (ca. 2000 ft and 2500 ft). All the major drainages level out within this elevation band and feature a stretch of mesic drainage for prolonged periods during wetter winters and springs. These may support wetland annuals such as *Erythranthe guttata* and

Juncus bufonius, along with introduced plants with wetland affiliations including *Cynodon dactylon*, *Tamarix chinensis*, *Polypogon monspeliensis* and *Hordeum murinum*.

The few wetland habitats in the park are no longer hospitable to the cohort of plants they once supported. It is likely they have experienced a drying trend since the Keil flora.

CHANGES NOTED IN OTHER PLANT ABUNDANCE

Figure 17 is another attempt to visualize differences between 1968 and present. It is notable that Keil vouchered four *Castilleja lanata* specimens in the northern part of the park while the present study did not encounter any.

The region where they were collected is within the footprint of the 1993 Bug Fire, which burned on the northeast side of the park from the north side of Goat Camp Canyon to north of Ford Canyon. The burn zone now has many areas where legume trees and cacti are sparse, where *Encelia farinosa* dominates and, where in upper elevations and southern exposures, *Bromus rubens* is dense. If *Castilleja lanata* was still present prior to the burn, it is possible that the fire eliminated those plants and/or the hosts this population may have relied upon.

Keil vouchered a single specimen of *Calochortus kennedyi*. We don't know if he observed any others, but we have reasons to believe he did not. Keil collected most species (75%) multiple times over the course of his field work, as he did with *Castilleja lanata* above. It seems likely he would have collected a specimen from another location if he had found it. Since this single *Calochortus* voucher had fruit but no other flower parts, it seems likely that he would have made at least one other voucher if he had encountered another one with flowers. Finally, in his paper, Keil indicated that *C. kennedyi* is rare and from a single habitat type (Keil 1973). Therefore, we believe the voucher was likely made at the only location he encountered the plant.

The present study however, found the plant to be a common occurrence, particularly in the northern range of the park, within the burned region.

It is possible the 1993 Bug Fire may have eliminated competing plants, freeing up *C. kennedyi* to grow in the newly opened habitat. Alternatively, it may be that *C. kennedyi* was not all that rare, but was inconspicuous due to mule deer browsing which eliminated flowers prior to anthesis. Post-fire, the same landscape now more dominated by *Bromus rubens* may no longer be as heavily browsed (Heffelfinger et al. 2006), allowing more flowers to fully develop and the plant to propagate more successfully.

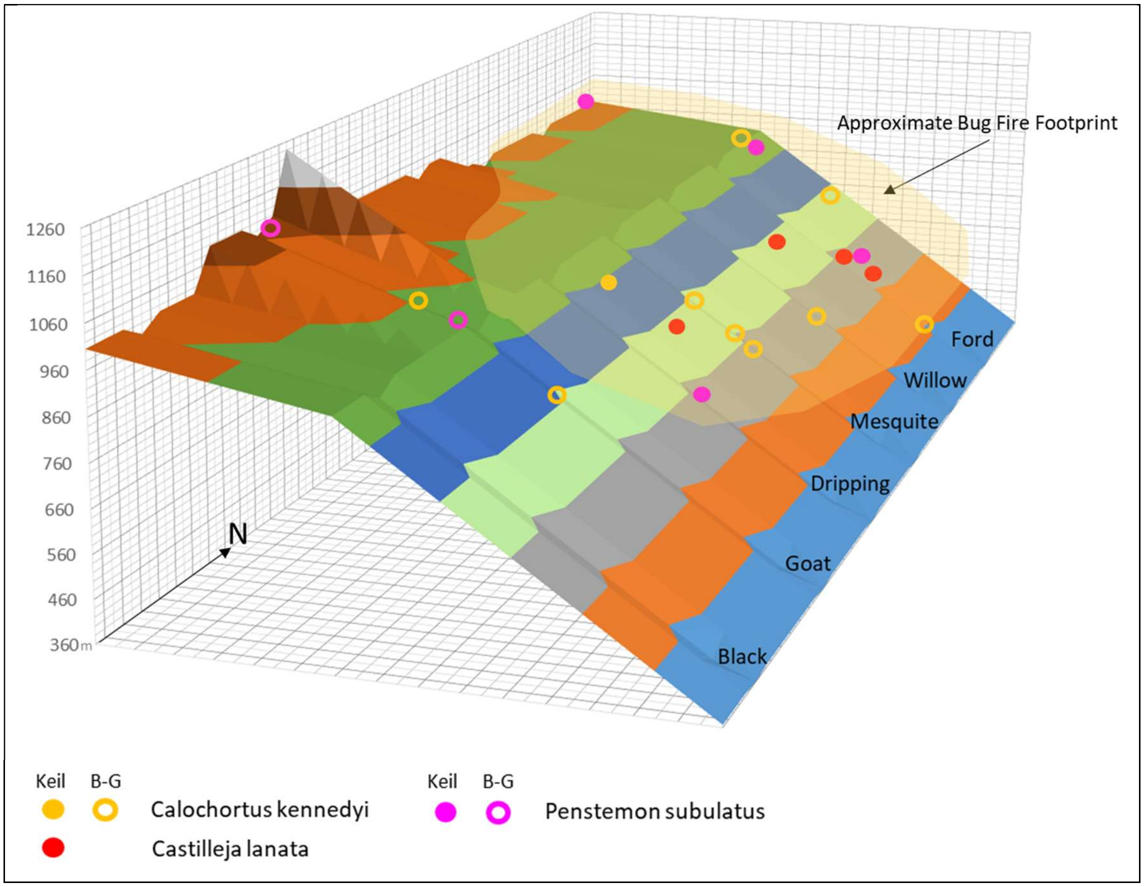


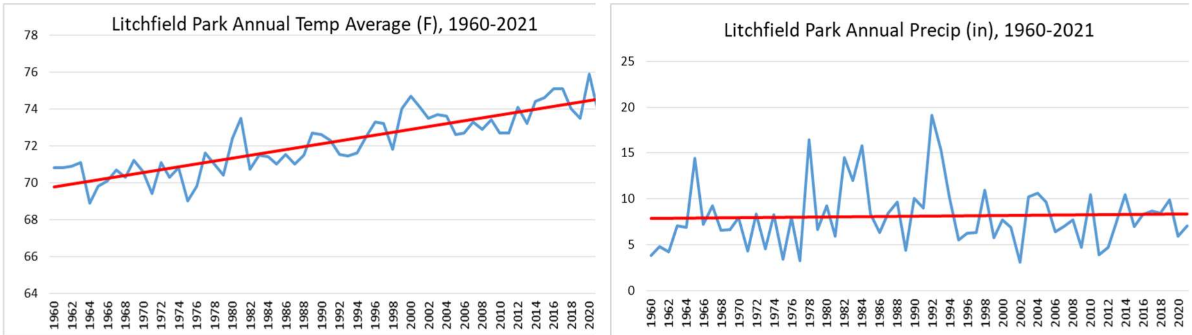
Figure 17. Plants with occurrence or range change potentially associated with the 1993 Bug Fire. The north-south trend of the mountains is marked with the major east-west drainages. The voucher plot points are color-coded as indicated in the legend below the plot. Vouchers from the Keil flora are plotted with solid-colored markers and those of the B-G flora are plotted with hollow-bodied markers. Color bands indicate 100 m elevation increments.

Penstemon subulatus is also absent from within the burn footprint. There were several collected in the earlier study throughout that area. The present study only encountered these plants to the south of the burn area and only at the highest elevations of the mountains. This may be additional evidence of changes due to the Bug Fire.

In the text of his thesis, Keil noted evidence of a fire pre-dating his study. On the north-facing slopes of ridgelines north of Ford Canyon and north of most of the Bug Fire footprint he observed charred remains of shrubs and trees (Keil 1970).

CHANGES IN CLIMATE AT WTMRP

The average annual temperature at WTMRP has increased in the decades since the Keil flora. Temperature data are available from several NOAA monitors situated in and around the city of Phoenix, but not from directly within the preserve. We use data from nearby Litchfield Park as a proxy for WTMRP and, where data points are missing from this record going back to 1960, points from nearby Youngtown and Wittman are used. Figure 19A is a plot of this data set with an added trend line showing a 0.774 °F (0.43 °C) per decade increase in average annual temperature. (NWS 2022a).



A B

Figure 18. Climate trends measured near WTMRP. (A) Temperature trend, 1960-2021 (°F). (B) Annual precipitation, 1960-2021 (inches).

Additionally, the Phoenix area has experienced a doubling of the number of days per year with temperatures at or above 110°F (43 °C), from an average of 10 in the decade of the 1960s to an average of over 20 in the decade of the 2010s. It is projected to exceed 40 by the decade of the 2040s, with some years surpassing 60 (NWS 2021b).

Annual precipitation from 1960 to 2021 is shown in Figure 19B. Again, we refer to nearby Litchfield Park data as a WTMRP proxy (NWS 2022b). Even though precipitation can vary widely from year to year, there is no clear trend over time, with an average annual rainfall of 8 inches (203 mm). Despite there being no significant change to rainfall inputs, a state of drought has been in place in the region since 1994 (Arizona Climate Office 2022). This is illustrated by the Standardized Precipitation-Evapotranspiration Index (SPEI) (Figure 19) for the region. SPEI is able to measure drought conditions caused by persistent heat-driven evapotranspiration in the absence of rain deficits (Vincente-Serrano et al. 2010).

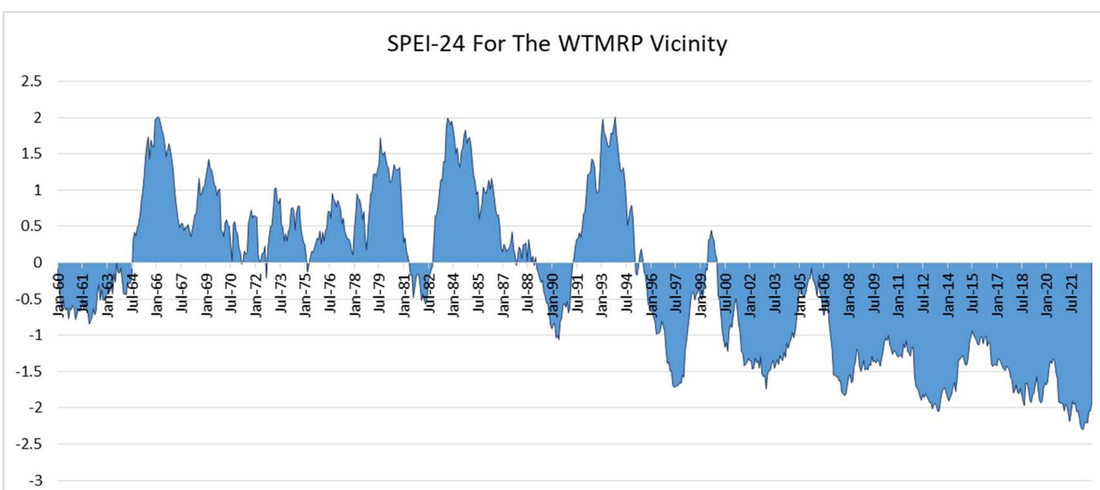


Figure 19. Twenty-four-month intervals of the Standardized Precipitation-Evapotranspiration Index (SPEI), a measure of moisture surplus (positive) or deficit (negative) for the vicinity of WTMRP from 1960–2021. Each vertical bar indicates the departure from the average condition over the period in standard deviations. Conditions of drought emerged in 1995–1996 that persist and have intensified to the present. Data source: SPEI Global Drought Monitor (spei.csic.es), Accessed 11/2022.

CHANGES IN SURROUNDING AQUIFER

The hydrology of WTMRP's few springs and other mesic habitats may be affected by the change in the level of the surrounding valley aquifers. According to Hipke et al. (2014), groundwater pumping accelerated in the 1950s to support agriculture and by 1983, the Agua Fria water table had dropped 61–76 m (200–250 ft) near the eastern flanks of the mountains. This depletion has been accompanied by up to 5.5 m (18 ft) of subsidence in some areas. Groundwater use projections out to 2025 forecast another 30–46 m (100–150 ft) of decline in the aquifer.

This is a striking loss and prompts us to speculate what coupling, if any, there may be between the depletion of the Aqua Fria aquifer and the amount and duration of surface water in the White Tank Mountains. It is a question beyond our expertise to answer. This study does, however, document the loss of a cohort of wetland obligate species, which is consistent with such coupling (Figure 16).

Interestingly, a 1973 voucher of *Populus fremontii* (Figure 19), a tree dependent on a proximate water table, includes this description: "One large tree, partially fallen, but still alive." This field note may have captured the early effects of a declining surrounding aquifer on the mountains in real time. While there is no evidence of living *P. fremontii* trees within the preserve today, we encountered interesting remains of a tree in a location that roughly correlate with Keil's location description. Testing is in progress to determine if this is a *P. fremontii* remnant.

A B

Figure 19. (A) 1973 voucher of *Populus fremontii* from Dripping Springs Canyon. (B) Possible remains of this tree in Dripping Springs Canyon, 2020.

MISSING SPECIES

Among the species in the Keil flora checklist, 64 of them (ca. 18%) were not encountered by the B-G flora. These are listed in Table 6. Two of the species, *Typha domingensis* and

Schoenoplectus americanus, were vouchered from an artificial pond, which is now dry. We include them in the missing species list since the Keil flora found them growing naturally, while we found them in an artificial habitat.

Table 6. Species previously collected at WTMRP not encountered in the B-G study.

Amaranthaceae	Convolvulaceae	Poaceae
Amaranthus crassipes	_Cuscuta tuberculata_	_Aristida ternipes_
Chenopodium leptophyllum	_Cuscuta umbellata_	_Bouteloua trifida_
Anacardiaceae	Cucurbitaceae	_Chloris virgata_
Rhus aromatica	_Cucurbita digitata_	_Digitaria californica_
Apiaceae	Cyperaceae	_Diplachne fusca_
Yabea microcarpa	_Schoenoplectus americanus_*	_Eragrostis cilianensis_
Asparagaceae	Ephedraceae	_Muhlenbergia rigens_
Hesperocallis undulata	_Ephedra aspera_	_Phalaris caroliniana_
Asteraceae	Euphorbiaceae	_Polypogon viridis_
Baccharis salicifolia	_Bernardia incana_	_Setaria leucopila_
Calycoseris wrightii	_Chamaesyce capitellata_	_Sporobolus contractus_
Carthamus tinctorius	_Chamaesyce setiloba_	Polygalaceae
Gaillardia arizonica	Lamiaceae	_Polygala macradenia_
Helianthus annuus	_Hedeoma nana_	Primulaceae
Isocoma acradenia	Loasaceae	_Androsace occidentalis_
Malacothrix sonorae	_Mentzelia jonesii_	Pteridaceae
Malacothrix stebbinsii	Malvaceae	_Myriopteris wrightii_
Pseudognaphalium canescens	_Abutilon parvulum_	_Notholaena californica_
Boraginaceae	Martyniaceae	Ranunculaceae
Cryptantha decipiens	_Proboscidea parviflora_	_Myosurus cupulatus_
Cryptantha juniperensis	Molluginaceae	Resedaceae
Nama hispida	_Mollugo cerviana_	_Oligomeris linifolia_
Pectocarya setosa	Nyctaginaceae	Salicaceae
Brassicaceae	_Boerhavia wrightii_	_Populus fremontii_
Dimorphocarpa wislizeni	Onagraceae	_Salix exigua_
Lepidium virginicum	_Eremothera chamaenerioides_	Solanaceae
Cactaceae	Orobanchaceae	_Solanum elaeagnifolium_
Cylindropuntia arbuscula	_Castilleja lanata_	Typhaceae
Campanulaceae	Plantaginaceae	_Typha Domingensis_*
Triodanis perfoliata	_Maurandya antirrhiniflora_	Zygophyllaceae
Caryophyllaceae	_Stemodia durantifolia_	_Kallstroemia californica_
Stellaria nitens		

* Indicates that the species was only vouchered by the B-G flora at an artificial pond that is no longer present.

Those familiar with the flora of the Phoenix Basin will recognize some of the species in Table 6 as being common in the region. For example, *Nama hispida*, *Helianthus annuus*, and *Oligomeris linifolia* have been vouchered at numerous locations in recent decades. It is also possible we have overlooked plants such as *Cryptantha* spp. and some Pteridaceae, which include species that are difficult to distinguish in the field. It is likely that some of these will be found in WTMRP in the future.

Conversely, there are species from Table 6 that are rare or even unknown from any other locales in the region. For example, *Castilleja lanata,* collected from what is now the Bug Fire burn footprint and known historically only from one other place in the Phoenix Basin may no longer be present. Species that might be at the extreme of their range in WTMRP such as *Triodanis perfoliata* and *Rhus aromatica* may no longer be present. Considering the apparent reduction of wetland habitats in WTMRP, *Populus fremontii* and *Salix exigua* that depend on such habitats are unlikely to be found.

Comparison with Other Preserves

It is reasonable to assume that the floras of other mountain preserves in the Phoenix Basin would have most species in common. We considered five of these: San Tan Mountain Regional Park, Estrella Mountain Regional Park, South Mountain Preserve, McDowell Sonoran Preserve, and White Tank Mountain Regional Park. Voucher records from SEINet were used to generate checklists which were then compared. The shaded (gray) regions in Figure 20 show the SEINet search polygons used to extract records for each park or preserve region.

Figure 20. Database Search Polygons (gray shading) superimposed on a map encompassing the area. (A) White Tank Mountain Regional Park (B) McDowell Sonoran Preserve (C) Estrella Mountain Regional Park (D) South Mountain Preserve (E) San Tan Mountain Regional Park. Imagery from SEINet.

Species common to two or more checklists were labeled "common," while species restricted to just one checklist were labeled "unique." The results (Figure 21, enclosed in the rectangle) show that from 11 to 19 percent of each flora is restricted to that mountain preserve; with 15 percent of WTMRP's flora in that "unique" category.

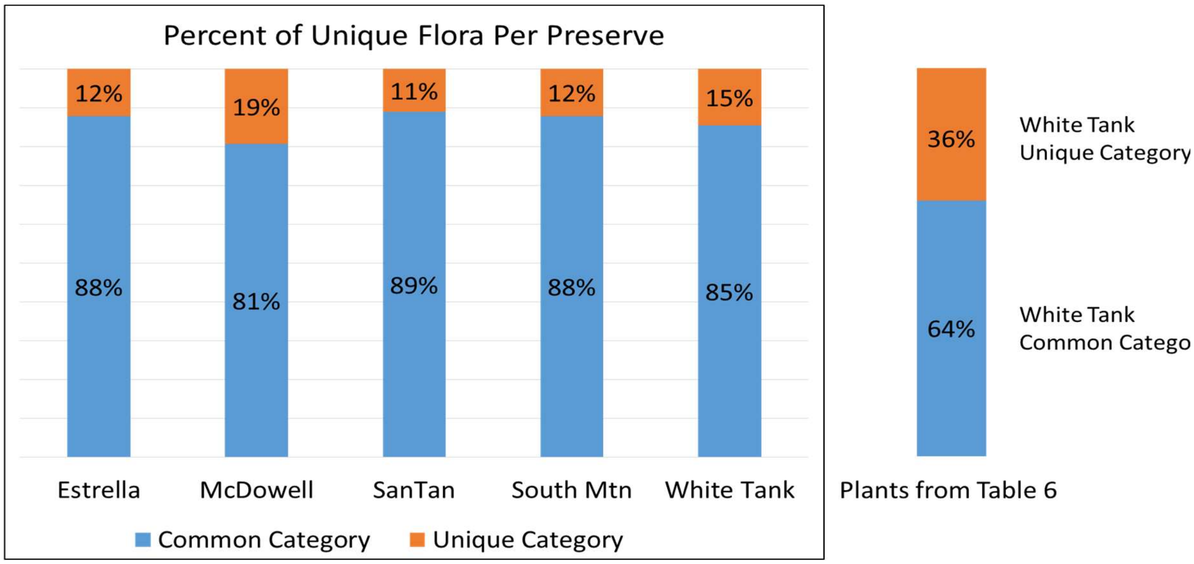


Figure 21. Composition of the flora of five mountain preserves in the Phoenix area expressed as the percent of species common to more than one preserve and the percent of species restricted to just one. The additional bar to the right shows the composition of plants from Table 6 expressed as the percent of species in White Tank's "common" and "unique" categories.

The far-right portion of the bar graph in Figure 21 puts the plants from Table 6 in this context. Since Table 6 lists species that are potentially lost from the WTMRP flora, it is interesting to note that they are not proportionally distributed among the two categories of White Tank plants but are skewed toward the "unique" category.

ANNOTATED CHECKLIST

The checklist presented here is the superset of plants in both the Keil and B-G floras. Species are arranged alphabetically, first by family, and then by scientific name. The plant name is followed by an indication of which flora study vouchered the plant (Keil or B-G, or both) and a list of at least one voucher per species. If a species was found only by Keil, his voucher is listed. Indication of non-native status is made with an asterisk (*) appended to the plant name.

Vouchers are cited by the collector's initials appended with the collection number. Table 7 is a list of collectors and their initials. Some voucher citations include an explicit herbarium identifier in square brackets, following Index Herbariorum https://sweetgum.nybg.org/science/ih. See also Table 8.

For example, the voucher citation DA17400A [BRY], cites a collection by Duane Atwood, with collection number 17400A, which is housed at the Brigham Young University, S. L. Welsh Herbarium.

The vouchers of collectors CB and DG (see Table 7) are all housed in the Herbarium of Desert Botanical Garden (DES). Unless otherwise noted, the vouchers of collector DK are housed in the Herbarium at Arizona State University (ASU). The vouchers of all other collections are cited with an explicit herbarium identifier (see Table 8).

Table 7. Collectors and Initials

Initials	Collector
CB	Cass Blodgett
DG	Dawn Goldman
DK	David Keil
EL	Elinor Lehto
CS	Cindy Smith
200PS-	CAPLTER Program
WH	Wendy C. Hodgson
RP	Raul Puente
ZB	Zachery Berry
DS	David Sussman
DA	Duane Atwood
CM	C. W. McClellan
MM	Malcolm G. McLeod

Table 8. Herbarium Names and Abbreviations

Abrev	Herbarium
DES	Desert Botanical Garden Herbarium
ASU	Arizona State University Vascular Plant Herbarium
UNM	University of New Mexico Herbarium
BRY	Brigham Young University, S. L. Welsh Herbarium
SEINet	General Research Observations*

*Photo-only vouchers entered into the SEINet database https://swbiodiversity.org/seinet.

	Keil	B-G	
ACANTHACEAE			
Carlowrightia arizonica A. Gray	●	●	DG847, CB675, DG680
Justicia californica (Benth.) D. Gibson		●	200PS-J111-30 [ASU]
AIZOACEAE			
Trianthema portulacastrum L.		●	CB1185
AMARANTHACEAE			
Amaranthus albus L.		●	CB1188
Amaranthus crassipes Schlecht.	●		DK5779
Amaranthus fimbriatus (Torr.) Benth. ex S. Wats.	●	●	CB1075, DG828, CB1223
Amaranthus obcordatus (A. Gray) Standl.	●	●	CB1184
Amaranthus palmeri S. Watson	●	●	CB1087
Atriplex canescens (Pursh) Nutt.	●	●	CB1129
Atriplex elegans (Moq.) D. Dietr.	●	●	CB726
Blitum nuttallianum Schult.		●	CB813
Chenopodiastrum murale (L.) S. Fuentes-B, Uotila & Borsch*	●	●	CB893, DG729, CB795
Chenopodium leptophyllum (Moq.) Nutt. ex S. Wats.	●		DK4779
Chenopodium neomexicanum Standl.		●	DG832
Salsola tragus L.*	●	●	DG689
Tidestromia lanuginosa (Nutt.) Standl.	●	●	CB1074, CB769, DG883
ANACARDIACEAE			
Rhus aromatica Aiton	●		DK11208
APIACEAE			
Bowlesia incana Ruiz & Pav.	●	●	CB871, CB700, CB548
Daucus pusillus Michx.	●	●	CB649, DG785
Yabea microcarpa (Hook. & Arn.) K.-Pol.	●		DK4184, DK3139
APOCYNACEAE			
Funastrum heterophyllum (Engelm. ex Torr.) Standl.	●	●	CB1011, CB703
Matelea parvifolia (Torr.) Woods.	●	●	DG805, CB580
Metastelma arizonicum A. Gray	●	●	CB1434
ARALIACEAE			
Hydrocotyle verticillata Thunb.		●	CB729
ARISTOLOCHIACEAE			
Aristolochia watsonii Woot. & Standl.	●		DK5787
ASPARAGACEAE			
Agave simplex (Gentry) Salywon & W.C. Hodgson	●	●	DG856, DG858A, CB1170, CB1169
Dichelostemma capitatum (Benth.) Alph. Wood	●	●	CB826, CB865, CB910
Hesperocallis undulata A. Gray	●		EL17625 [ASU], CM274, DA17400A [BRY]
ASTERACEAE			
Acamptopappus sphaerocephalus (Harv. & A. Gray) A. Gray	●	●	CB968
Acourtia wrightii (A. Gray) Reveal & R. M. King	●	●	CB1005, CB620
Adenophyllum porophylloides (A. Gray) Strother	●	●	DG685, CB1408, DG818
Ambrosia ambrosioides (Cav.) W.W. Payne	●	●	DG796, CB664, DG666
Ambrosia confertiflora DC.	●	●	CB1469 [SEINet Obser.]
Ambrosia deltoidea (Torr.) W.W. Payne	●	●	CB421, DG841, CB563
Ambrosia dumosa (A. Gray) W.W. Payne	●	●	CB465, CB672
Ambrosia monogyra (Torr. & A. Gray) Strother & B.G. Baldwin		●	CB1465
Ambrosia salsola (Torr. & A. Gray) Strother & B.G. Baldwin	●	●	CB1030, CB535, DG773
Artemisia ludoviciana Nutt.	●	●	CB1138, CB631, CB1105
Baccharis salicifolia (Ruiz & Pav.) Pers.	●		DK5983, DK4737, DK6232
Baccharis sarothroides A. Gray	●	●	CB1086, CB1155
Baccharis sergiloides A. Gray	●	●	CB1440
Bahiopsis parishii (Greene) E.E. Schilling & Panero	●	●	DG872, CB686, CB565
Baileya multiradiata Harv. & A. Gray	●	●	CB1402
Baileya pleniradiata Harv. & A. Gray	●		EL17634 [ASU]
Bebbia juncea (Benth.) Greene	●	●	DG845, CB696, CB1410
Brickellia atractyloides A. Gray	●	●	CB1141
Brickellia coulteri A. Gray	●	●	CB1140, CB559, DG653

Calycoseris wrightii A. Gray	●		DK3205
Carthamus tinctorius L.*	●		EL17635 [ASU]
Centaurea melitensis L.*		●	CB1350
Chaenactis carphoclinia A. Gray	●	●	CB499, CB935
Chaenactis stevioides Hook. & Arn.	●	●	CB480, CB432, DG745
Cirsium neomexicanum A. Gray	●	●	CB1313, DG808, CB1409
Conyza canadensis (L.) Cronquist	●	●	200PS-K121-26 [ASU]
Dimorphotheca sinuata Dc.*		●	CB828
Encelia farinosa A. Gray ex Torr.	●	●	CB533, CB458, CB483
Ericameria laricifolia (A. Gray) Shinners	●	●	CB1347, CB1237, CB1230
Erigeron divergens Torr. & A. Gray	●	●	CB707
Erigeron lobatus A. Nels.	●	●	CB588, CB1264, DG789
Erigeron oxyphyllus Greene	●	●	CB630, CB1235
Eriophyllum lanosum (A. Gray) A. Gray	●	●	CB847, CB471, DG754
Gaillardia arizonica A. Gray	●		DK6280
Geraea canescens Torr. & A. Gray		●	CB1462
Gutierrezia sarothrae (Pursh) Britton & Rusby	●	●	CB765, CB583
Helianthus annuus L.	●		DK1973-12-21
Isocoma acradenia (Greene) Greene	●	●	CB1473
Lasthenia californica DC. ex Lindl.	●	●	CB928
Logfia arizonica (A. Gray) J. Holub	●	●	CB857, CB557, CB1319
Logfia filaginoides (Hook. & Arn.) Morefield	●	●	CB1275, DG817, CB1006
Malacothrix coulteri Harv. & A. Gray		●	CB1393
Malacothrix glabrata (A. Gray ex D.C. Eaton) A. Gray	●	●	DG787, DG747
Malacothrix sonorae W.S. Davis & Raven	●		MM6275 [ASU]
Malacothrix stebbinsii W.S. Davis & Raven	●		DK6306
Melampodium leucanthum Torr. & A. Gray	●	●	DG820
Monoptilon bellioides (A. Gray) Hall	●	●	CB456, CB1401, DG622
*Oncosiphon pilulifer (*L. f.) Kallersjo*		●	CB1310, CB494, DG763
Pectis papposa Harv. & A. Gray	●	●	CB1060, DG861, CB1207
Pectis rusbyi Greene ex A. Gray	●	●	DG701, DG825
Perityle emoryi Torr.	●	●	CB545, CB439, DG743
Pluchea sericea (Nutt.) Coville	●	●	CB731, CB1435, CB697
Porophyllum gracile Benth.	●	●	CB983, CB735, CB1315
Pseudognaphalium canescens (DC.) Anderb.	●		DK6309
Psilostrophe cooperi (A. Gray) Greene	●	●	CB1403, CB1411, CB997
Rafinesquia californica Nutt.	●	●	CB1007, CB1042, DG720
Rafinesquia neomexicana A. Gray	●	●	DG771, CB951, CB862
Senecio lemmonii A. Gray	●	●	DG758, CB598, CB1369
Sonchus asper (L.) Hill*	●	●	CB1390, CB1265
Sonchus oleraceus L.*	●	●	CB1158, DG786, CB840
Stephanomeria pauciflora (Torr.) A. Nels.	●	●	DG634, CB638, DG667
Stephanomeria tenuifolia (Raf.) Hall		●	CB1078, DG887
Stylocline micropoides A. Gray	●	●	CB1365, CB994, DG819
Trichoptilium incisum (A. Gray) A. Gray	●	●	CB435
Trixis californica Kellogg	●	●	CB475, DG846, DG657
Uropappus lindleyi (DC.) Nutt.	●	●	CB902, CB936, CB993
Verbesina encelioides (Cav.) Benth. & Hook. f. ex A. Gray		●	DG894, CS7 [DES], CB1224
Xanthisma spinulosum (Pursh) D.R. Morgan & R.L. Hartman	●	●	CB1379, CB1000, CB1004
Xanthisma spinulosum var. gooddingii (A. Nelson) D.R. Morgan & R.L. Hartman	●	●	CB1103
BORAGINACEAE			
Amsinckia intermedia Fisch. & C.A. Mey.	●	●	DG895, CB880, CB780
Amsinckia tessellata A. Gray	●	●	DG704
Cryptantha barbigera (A. Gray) Greene	●	●	DG676, CB940, CB895
Cryptantha decipiens (M.E. Jones) Heller	●		DK4742, DK6224-a
Cryptantha juniperensis R.B. Kelley & M.G. Simpson	●		DK6212
Cryptantha maritima (Greene) Greene	●	●	CB1253, DG900, CB426
Cryptantha pterocarya (Torr.) Greene	●	●	CB1252, CB972, CB1134

Emmenanthe penduliflora Benth.	●	●	CB1316, CB1156, DG794
Eremocarya micrantha (Torr.) Greene		●	CB1467
Eucrypta chrysanthemifolia (Benth.) Greene	●	●	CB777, DG711, DG628
Eucrypta chrysanthemifolia var. bipinnatifida (Torr.) Constance	●	●	CB890, CB906
Eucrypta micrantha (Torr.) Heller	●	●	CB837
Nama hispida A. Gray	●		DK6295
Harpagonella palmeri A. Gray	●	●	CB1360, CB992, CB1241
Johnstonella angustifolia (Torr.) Hasenstab & M.G. Simpson	●	●	DG690
Pectocarya heterocarpa (I.M. Johnston) I.M. Johnston	●	●	CB718
Pectocarya platycarpa (Munz & I. M. Johnst.) Munz & I. M. Johnst.	●	●	DG623, DG753, CB816
Pectocarya recurvata I.M. Johnston	●	●	CB425, CB791, CB449
Pectocarya setosa A. Gray	●		DK6241, DK4805
Phacelia affinis A. Gray		●	DG649
Phacelia crenulata Torr. ex S. Watson	●	●	CB861, CB445, DG631
Phacelia distans Benth.	●	●	CB794, DG850, DG742
Phacelia tanacetifolia Benth.		●	CB877
Pholistoma auritum (Lindl.) Lilja	●	●	CB822, DG838, CB797
Plagiobothrys arizonicus (A. Gray) Greene ex A. Gray	●	●	CB1256, CB937, CB852
Plagiobothrys jonesii A. Gray	●	●	CB442, CB479
BRASSICACEAE			
Boechera perennans (S. Watson) W. A. Weber	●	●	CB914, CB1104
Brassica tournefortii Gouan*		●	DG705, CB431, CB876
Caulanthus lasiophyllus (Hook. & Arn.) Payson	●	●	DG804, CB453, CB1251
Descurainia pinnata (Walter) Britton	●	●	DG713, CB454, CB829
Dimorphocarpa wislizeni (Engelm.) Rollins	●		EL17637 [ASU]
Draba cuneifolia Nutt. ex Torr. & A. Gray	●	●	CB1240, CS2 [DES]
Lepidium lasiocarpum Nutt.	●	●	CB1092, CB887, CB779
Lepidium lasiocarpum var. lasiocarpum Nutt. ex Torr. & A. Gray	●	●	CB702, DG706, DG736
Lepidium virginicum L.	●		DK1968-03-30, DK6207
Matthiola parviflora (Schousb.) W.T. Aiton*		●	CB827
Physaria tenella (A. Nelson) O'Kane & Al-Shehbaz	●	●	DG750, CB809, CB843
Sisymbrium irio L.*	●	●	CB814, CB651, CB716
Thysanocarpus curvipes Hook.	●	●	DG708, CB870, CB498
BURSERACEAE			
Bursera microphylla A. Gray	●	●	CB1431, DG695
CACTACEAE			
Carnegiea gigantea (Engelm.) Britton & Rose	●	●	CB1159, CB1162, CB1164
Cylindropuntia acanthocarpa (Engelm. & Bigelow) F.M. Knuth	●	●	CB1107, DG855, CB1058
Cylindropuntia arbuscula (Engelm.) Knuth	●		DK4096, MM143 [ASU], EL4219 [ASU]
Cylindropuntia bigelovii (Engelm.) Knuth	●	●	CB1163, CB750, DG855
Cylindropuntia fulgida (Engelm.) Knuth		●	CB1038
Cylindropuntia leptocaulis (DC.) Knuth	●	●	CB950
Echinocereus engelmannii (Parry ex Engelm.) Lem.	●	●	CB1395, CB1147
Echinocereus engelmannii var. engelmannii	●	●	WH30709 [DES], WH30709 [DES]
Ferocactus cylindraceus (Engelm.) Orcutt	●	●	CB1160, CB752, CB1090
Mammillaria grahamii Engelm.	●	●	CB1246, WH30694 [DES], CB751
Opuntia chlorotica Engelm. & Bigelow	●	●	CB1084, CB1171
Opuntia engelmannii var. engelmannii Salm-Dyck ex Engelm.	●	●	RP5282 [DES]
Opuntia engelmannii var. flavispina (L. Benson) Parfitt & Pinkava	●	●	WH31136 [DES], CB1044
Peniocereus greggii (Engelm.) Britt. & Rose	●	●	CB760 [SEINet Obser.]
CAMPANULACEAE			
Triodanis perfoliata (L.) Nieuwl.	●		DK6305
CANNABACEAE			
Celtis pallida Torr.	●	●	CB677, CB1106, CB655
CARYOPHYLLACEAE			
Herniaria hirsuta L.*		●	CB1244, CB1317
Loeflingia squarrosa Nutt.		●	CB1247

Silene antirrhina L.	●	●	CB1305, CB783, DG778
Stellaria nitens Nutt.	●		DK6100
CELASTRACEAE			
Canotia holacantha Torr.	●	●	DG823, DG831
CONVOLVULACEAE			
Cuscuta indecora Choisy		●	CB1182
Cuscuta tuberculata Brandeg.	●		DK5712, DK5705, DK5696
Cuscuta umbellata Kunth	●		DK5964, DK5775, DK5778
CRASSULACEAE			
Crassula connata (Ruiz & Pav.) Berger	●	●	CB798, CB1245
Dudleya arizonica Rose	●	●	CB1022, CB692, CB1312
CROSSOSOMATACEAE			
Crossosoma bigelovii S. Watson	●	●	CB678, CB591, CB1119
CUCURBITACEAE			
Brandegea bigelovii (S. Wats.) Cogn.	●	●	CB1204, CB1225
Citrullus lanatus (Thunb.) Matsum. & Nakai*		●	CB772, CS1 [DES]
Cucurbita digitata A. Gray	●		DK5769, DP5646
Marah gilensis Greene	●	●	CB1231
CYPERACEAE			
Schoenoplectus americanus (Pers.) Volk. ex Schinz & R. Keller	●	●	CB727
EPHEDRACEAE			
Ephedra aspera Engelm. ex S. Watson	●	●	DG795, CB867, CB676
Ephedra trifurca Torr. ex S. Watson	●	●	CB1242
EUPHORBIACEAE			
Bernardia incana Morton	●		DK6180 [UNM]
Chamaesyce capitellata (Engelm.) Millsp.	●		DK6311
Chamaesyce florida (Engelm.) Millsp.	●	●	CB1205
Chamaesyce micromera (Boiss. ex Engelm.) Woot. & Standl.	●	●	DG869, CB1069
Chamaesyce revoluta (Engelm.) Small	●	●	DG833
Ditaxis lanceolata (Benth.) Pax & K. Hoffmann	●	●	DG826, CB873, CB564
Ditaxis neomexicana (Müll.Arg.) A. Heller	●	●	CB1089, DG875
Euphorbia abramsiana L.C. Wheeler	●	●	DG862, CB1064
Euphorbia arizonica Engelm.	●	●	CB1123, DG849, CB1102
Euphorbia eriantha Benth.	●	●	CB1137, DG892, CB1282
Euphorbia polycarpa Benth.	●	●	CB637, DG681, DG630
Euphorbia setiloba Engelm. ex Torr.	●		DK5742
FABACEAE			
Acmispon humistratus (Benth.) D.D. Sokoloff	●	●	CB990, CB1291, DG788
Acmispon maritimus var. brevivexillus (Ottley) Brouillet	●	●	CB944, CB443, CB785
Acmispon rigidus (Benth.) Brouillet	●	●	CB996
Acmispon strigosus (Nutt.) Brouillet	●	●	CB977, CB1359, CB899
Astragalus didymocarpus Hook. & Arn.	●	●	200PS-K121-14 [ASU]
Astragalus nuttallianus DC.	●	●	CB1388, CB788, CB801
Calliandra eriophylla Benth.	●	●	DG885, DG824, CB1020
Dalea mollis Benth.		●	CB1452
Dalea mollissima (Rydb.) Munz	●		DK5911
Lotus salsuginosus Greene	●	●	CB885, DG626, DG740
Lupinus arizonicus (S. Wats.) S. Wats.	●	●	CB713, CB448, CB917
Lupinus concinnus J. G. Agardh	●	●	CB853
Lupinus sparsiflorus Benth.	●	●	CB792, CB1254, CB1026
Lupinus succulentus Douglas ex K. Koch		●	CB918, CB434
Marina parryi (Torr. & A. Gray) Barneby	●	●	CB657, CB1085, DG800
Melilotus indicus (L.) All.*	●	●	CB1017
Olneya tesota A. Gray	●	●	CB723, CB1051, CB711
Parkinsonia florida (Benth. ex A. Gray) S. Watson	●	●	CB556
Parkinsonia microphylla Torr.	●	●	CB679, CB476, DG636
Prosopis velutina Wooton	●	●	DG756, CB684, CB1287
Senegalia greggii (A. Gray) Britton and Rose	●	●	CB1048, CB539, CB1342
Senna covesii (A. Gray) Irwin & Barneby	●	●	CB863, CB709, DG652

Trifolium willdenovii Spreng.	●	●	CB986, CB1283
Vachellia constricta (Benth.) Seigler & Ebinger	●	●	DG670, CB1057
FAGACEAE			
Quercus turbinella Greene	●	●	CB680
FOUQUIERIACEAE			
Fouquieria splendens Engelm.	●	●	CB980, DG724, CB537
GENTIANACEAE			
Zeltnera calycosa (Buckley) G. Mans.		●	CB642
GERANIACEAE			
Erodium cicutarium (L.) L'Hér. ex Aiton*	●	●	DG735, CB805, CB1378
Erodium texanum A. Gray	●	●	CB844, CB734, DG728
JUNCACEAE			
Juncus bufonius L.	●	●	CB1024, CB1303, CB1015
Juncus torreyi Coville		●	CB728
KRAMERIACEAE			
Krameria bicolor S. Watson	●	●	CB524, DG646, CB1288
Krameria erecta Willd. ex J.A. Schultes	●	●	CB1406, DG815, CB1043
LAMIACEAE			
Hedeoma nana (Torr.) Briq.	●		DK4785, DK6184
Hyptis emoryi Torr.	●	●	CB486, DG661, DG744
Salazaria mexicana Torr.	●	●	CB626, CB1056, CB687
Salvia columbariae Benth.	●	●	CB433, CB1120, CB1001
LILIACEAE			
Calochortus kennedyi Porter	●	●	CB1391, DG813, CB988
LINACEAE			
Linum grandiflorum Desf.*		●	CS3 [DES]
LOASACEAE			
Mentzelia affinis Greene	●	●	ZB2017-03-18 [SEINet Obser.]
Mentzelia involucrata S. Watson	●	●	WH30708 [DES]
Mentzelia jonesii (Urban & Gilg) H.J. Thompson & Roberts	●		DK4101
MALPIGHIACEAE			
Cottsia gracilis (A. Gray) W.R. Anderson	●	●	DG791, CB457, DG651
MALVACEAE			
Abutilon abutiloides (Jacq.) Garcke ex Britt. & Wilson		●	CB770
Abutilon incanum (Link) Sweet	●	●	CB569, DG641, CB1227
Abutilon palmeri A. Gray	●	●	CB1323, DG904
Abutilon parvulum A. Gray	●		DK4748-b
Ayenia compacta Rose		●	DS2017-April-7 [SEINet Obser.]
Ayenia filiformis S. Watson	●	●	CB573, DG852, CB634
Eremalche exilis (A. Gray) Greene	●	●	CB841
Herissantia crispa (L.) Briz.	●	●	CB567, DG782, DG692
Hibiscus coulteri Harvey ex A. Gray	●	●	CB1219
Hibiscus denudatus Benth.	●	●	CB574
Horsfordia newberryi (S. Wats.) A. Gray	●	●	CB1154, CB430, DG694
Malva neglecta Wallr.*	●	●	CB1285, CB1294
Malva parviflora L.*	●	●	DG715, CB824
Sphaeralcea ambigua A. Gray	●	●	CB541, CB1270, DG801
Sphaeralcea coulteri (S. Watson) A. Gray	●	●	CB821
Sphaeralcea emoryi Torr. ex A. Gray	●	●	CB1118, CB1257
MARTYNIACEAE			
Proboscidea altheifolia (Benth.) Decne.	●	●	CB1189
Proboscidea parviflora (Wooton) Wooton & Standl.	●		DK5788
MOLLUGINACEAE			
Mollugo cerviana (L.) Ser.	●		DK5633, DK5768, DK5693
MONTIACEAE			
Calandrinia ciliata (Ruiz & Pav.) DC.	●	●	DG726, CB830, CB889
Cistanthe monandra (Nutt.) Hershkovitz	●	●	DG759
Claytonia perfoliata Donn ex Willd.		●	CB1040
NYCTAGINACEAE			

Abronia villosa S. Watson		●	CB501
Allionia choisyi Standl.		●	DG863
Allionia incarnata L.	●	●	CB1218, CB1371, CB999
Boerhavia coccinea P. Mill.	●	●	CB1012, DG662, CB1076
Boerhavia coulteri (Hook. f.) S. Wats.	●	●	CB1499, CB1500
Boerhavia intermedia M.E.Jones	●	●	DG859, CB1065, CB759A
Boerhavia wrightii A. Gray	●		DK5641, DK5756, DK5697
Mirabilis coccinea (Torr.) Benth. & Hook. f.	●	●	CB1045
Mirabilis laevis (Benth.) Curran	●	●	CB1047, CB834, CB1372
NYMPHAEACEAE			
Nymphaea mexicana Zucc.		●	CB730
OLEACEAE			
Forestiera shrevei Standl.	●	●	CB1421
Menodora scabra A. Gray	●	●	DG901, CB985, CB621
ONAGRACEAE			
Chylismia claviformis (Torr. & Frém.) A. Heller	●	●	CB836, DG755
Eremothera boothii (Douglas) W.L. Wagner & Hoch	●	●	CB1463
Eremothera chamaenerioides (A. Gray) W.L. Wagner & Hoch	●		DK4075, DK4109, DK3044
Eulobus californicus Nutt. ex Torr. & A. Gray	●	●	CB802, DG633, DG751
Oenothera primiveris A. Gray	●	●	CB817
OROBANCHACEAE			
Castilleja exserta (Heller) Chuang & Heckard	●	●	CB1307, CB804, CB1279
Castilleja lanata A. Gray	●		DK4557, DK4195, DK4144
Orobanche cooperi (A. Gray) Heller	●	●	CB1289, CS4 [DES]
PAPAVERACEAE			
Eschscholzia californica subsp. mexicana (Greene) C. Clark	●	●	DG890, DG712, CB866
Eschscholzia minutiflora S. Watson	●	●	CS5 [DES]
PHRYMACEAE			
Erythranthe guttata (Fisch. ex DC.) G. L. Nesom	●	●	CB643, CB701, CB1306
PLANTAGINACEAE			
Keckiella antirrhinoides (Benth.) Straw	●	●	CB656, CB632, DG806
Maurandya antirrhiniflora Humb. & Bonpl. ex Willd	●		DK4222
Nuttallanthus texanus (Scheele) D. A. Sutton	●	●	CB842
Penstemon parryi (A. Gray) A. Gray		●	CB708
Penstemon subulatus M.E. Jones	●	●	CB1380, DG821
Plantago ovata Forssk.	●	●	DG725, CB849, CB446
Plantago patagonica Jacq.	●	●	DG687, CB1362, CB943
Sairocarpus nuttallianus (Benth. ex A. DC.) D.A. Sutton	●	●	CB1281, CB1009, CB1423
Stemodia durantifolia (L.) Sw.	●		DK6226
Veronica peregrina L.	●	●	CB1269
POACEAE			
Aristida adscensionis L.	●	●	DG625, CB1061, CB763
Aristida purpurea Nutt.	●	●	CB1215
Aristida purpurea var. nealleyi (Vasey) Allred	●	●	DG683, CB1340, CB562
Aristida purpurea var. parishii (A.S. Hitchc.) Allred	●		DK3170, DK5745, DK4563
Aristida ternipes Cav.	●		DK6301
Avena fatua L.*	●	●	CB653, CB1302, CB576
Bothriochloa barbinodis (Lag.) Herter	●	●	CB1348
Bouteloua aristidoides (Kunth) Griseb.	●	●	CB1067, DG881, DG867
Bouteloua barbata Lag.	●	●	CB1068, DG866
Bouteloua curtipendula (Michx.) Torr.	●	●	CB1493
Bouteloua trifida Thurb.	●		DK5736, DK3990, DK4792
Bromus arizonicus (Shear) Stebbins	●	●	CB1271, CB1032, CB810
Bromus marginatus Nees ex Steud.	●	●	CB602
Bromus rubens L.*	●	●	DG665, CB1363, DG769
Cenchrus ciliaris L.*		●	DG842, DG734, CB1381
Cenchrus setaceus (Forssk.) Morrone*		●	CB1212, CB1146, CB544
Chloris virgata Sw.	●		DK6270
Cynodon dactylon (L.) Pers.*	●	●	CB1318, CB1131, CB603

Dasyochloa pulchella (Kunth) Willd. ex Rydb.	●	●	CB500, CB1222, CB721
Digitaria californica (Benth.) Henr.	●		DK4003, DK5987, DK4014
Diplachne fusca subsp. uninervia (J. Presl) P. M. Peterson & N. Snow	●		DK6000, DK6230
Eragrostis cilianensis (All.) Vignolo ex Janch.*	●		DK5778
Eragrostis lehmanniana Nees*		●	CB1343, CB1384
Heteropogon contortus (L.) Beauv. ex Roemer & J.A. Schultes	●	●	CB1427, CB768, CB1344
Hilaria mutica (Buckley) Benth.	●	●	CB907
Hilaria rigida (Thurb.) Benth. ex Scribn.	●	●	CB577, CB673, CB485
Hordeum murinum L.*	●	●	CB1273, CB1382, DG738
Leptochloa panicea subsp. brachiata (Steudl.) N. Snow	●	●	CB762, CB1082
Melica frutescens Scribn.	●	●	CB693
Muhlenbergia microsperma (DC.) Trin.	●	●	CB766, CB1023, CB484
Muhlenbergia porteri Scribn. ex Beal	●	●	DG880, CB1234
Muhlenbergia rigens (Benth.) A.S. Hitchc.	●		DK4601
Panicum alatum var. minus (Andersson) F. Zuloaga & O. Morrone	●		DK5793
Panicum hirticaule J. Presl	●	●	CB1444
Pappostipa speciosa (Trin. & Rupr.) Romasch.	●	●	DG822, DG822
Phalaris caroliniana Walter	●		DK6304
Phalaris minor Retz.*	●	●	CB1301, CB1014, CB1433
Poa bigelovii Vasey & Scribn.	●	●	CB897, CB811, CB1243
Polypogon monspeliensis (L.) Desf.*	●	●	CB1349, CB1025, CB660
Polypogon viridis (Gouan) Breistr.*	●		DK4739
Schismus arabicus Nees*	●	●	CB1059, DG624, CB900
Schismus barbatus (Loefl. ex L.) Thellung*	●	●	CB945, CB658, CB854
Setaria leucopila (Scribn. & Merr.) K. Schum.	●		DK6302
Sporobolus airoides (Torr.) Torr.	●	●	CB1213, CB1080, CB1211
Sporobolus contractus A.S. Hitchc.	●		DK5663
Tridens muticus (Torr.) Nash	●	●	CB1217
Urochloa arizonica (Scribn. & Merr.) O. Morrone & F. Zuloaga	●	●	CB767, CB1216
Vulpia microstachys (Nutt.) Munro	●	●	CB989, CB1292
Vulpia octoflora (Walter) Rydb.	●	●	CB819
Vulpia octoflora var. hirtella (Piper) Henr.	●	●	CB904, CB978
POLEMONIACEAE			
Eriastrum diffusum (A. Gray) Mason	●	●	DG779, DG761
Eriastrum eremicum (Jepson) Mason	●	●	CB909, CB587, CB1387
Gilia flavocincta A. Nels.	●	●	CB1255, DG839, CB933
Gilia scopulorum M.E. Jones		●	CB705
Gilia stellata Heller	●	●	CB1132, CB478, CB1157
Linanthus bigelovii (A. Gray) Greene	●	●	CB908, CB831, CB832
Linanthus maricopensis J.M.Porter & R.Patt.	●	●	DK4059, GBIF[1]
POLYGALACEAE			
Polygala macradenia A. Gray	●		DK6121
POLYGONACEAE			
Chorizanthe brevicornu Torr.	●	●	CB695, CB450, CB946
Chorizanthe rigida (Torr.) Torr. & A. Gray	●	●	CB947, DG650, CB859
Eriogonum deflexum Torr.	●	●	CB733, CB756, DG702
Eriogonum fasciculatum Benth.	●	●	CB623, CB1052, DG844
Eriogonum inflatum Torr. & Frém.	●	●	CB474
Eriogonum pusillum Torr. & A. Gray		●	CB1466
Eriogonum trichopes Torr.	●	●	CB1461
Eriogonum wrightii Torr. ex Benth.	●	●	CB1238, DG902, CB1221
Pterostegia drymarioides Fisch. & C.A. Mey.	●	●	CB1399
PORTULACACEAE			
Portulaca oleracea L.	●		DK5950, DK5963
PRIMULACEAE			
Androsace occidentalis Pursh	●		DK2912, DK6217, DK3151
PTERIDACEAE			
Astrolepis cochisensis (Goodding) Benham & Windham	●	●	CB1426
Astrolepis sinuata (Lag. ex Sw.) Benham & Windham	●	●	CB1209

Myriopteris covillei (Maxon) Á.Löve & D.Löve	●	●	CB1490
Myriopteris lindheimeri (Hook.) J. Sm.	●	●	CB689
Myriopteris parryi (D. C. Eaton) Grusz & Windham	●	●	DG874, DG807, DG730
Myriopteris wrightii (Hook.) Grusz & Windham	●		DK4094, DK2906, DK6252
Notholaena californica D. C. Eaton	●		DK4024, DK3137, DK6134
Notholaena standleyi Maxon	●	●	DG870, DG792, DG697
Pellaea truncata Goodding	●	●	CB1428, CB595, CB995
Pentagramma triangularis (Kaulf.) Yatsk., Windham & E. Wollenw.	●	●	CB1127, CB1041
RANUNCULACEAE			
Anemone tuberosa Rydb.	●	●	CB905
Clematis drummondii Torr. & A. Gray	●	●	CB641
Delphinium parishii A. Gray	●	●	CB987, CB1003
Delphinium scaposum Greene	●	●	CB1008, DG784, CB1263
Myosurus cupulatus S. Wats.	●		DK6102
RESEDACEAE			
Oligomeris linifolia (Vahl) J.F. Macbr.	●		DK3165
RHAMNACEAE			
Ziziphus obtusifolia (Hook. ex Torr. & A. Gray) A. Gray	●	●	CB1398, CB670
RUBIACEAE			
Galium aparine L.	●	●	DG803, CB596, CB1432
Galium proliferum A. Gray	●	●	CB1125
Galium stellatum Kellogg	●	●	CB1142, CB622, CB489
SALICACEAE			
Populus fremontii S. Watson	●		DKsn
Salix exigua Nutt.	●		DK3988
Salix gooddingii C.R. Ball	●	●	CB1345, CB1420, CB654
SANTALACEAE			
Phoradendron californicum Nutt.	●	●	CB568, DG648, CB1101
SELAGINELLACEAE			
Selaginella arizonica Maxon	●	●	DG698, DG731
Selaginella eremophila Maxon	●		DK4088, DK2878
SIMMONDSIACEAE			
Simmondsia chinensis (Link) Schneid.	●	●	DG672, DG654, DG644
SOLANACEAE			
Datura discolor Bernh.	●	●	CB1229
Lycium andersonii A. Gray	●	●	DG643, CB881, CB523
Lycium berlandieri Dunal	●	●	DG898, DG871, DG834
Lycium exsertum A. Gray	●	●	CB1094, CB1136, DG673
Lycium fremontii A. Gray	●	●	CB1430, DG783, CB1220
Nicotiana clevelandii A. Gray		●	CB833
Nicotiana obtusifolia M. Martens & Galeotti	●	●	CB645, CB550, CB1095
Physalis crassifolia Benth.	●	●	CB1233
Physalis hederifolia A. Gray		●	CB1034
Solanum elaeagnifolium Cav.	●		DK5650
TALINACEAE			
Talinum aurantiacum Engelm.		●	CB1498
TAMARICACEAE			
Tamarix chinensis Lour.*	●	●	CB1396, CB1077, CB663
TYPHACEAE			
Typha domingensis Pers.	●	●	CB732
URTICACEAE			
Parietaria hespera Hinton	●	●	CB547, DG812, CB912
VERBENACEAE			
Aloysia wrightii Heller ex Abrams	●	●	DG830
ZYGOPHYLLACEAE			
Fagonia laevis Standl.	●	●	CB888, DG793, CB429
Kallstroemia californica (S. Watson) Vail	●		DK5766, DK5704, DK5777
Kallstroemia grandiflora Torr. ex A. Gray	●	●	CB1091
Kallstroemia parviflora J. B. S. Norton	●	●	CB1208, DG864, CB1180

Larrea tridentata (Sessé & Moc. ex DC.) Coville	●	●	CB682, CB488, DG635
Tribulus terrestris L.*	●		DK5715

*Indicates non-native status
[1]iNaturalist contributors, iNaturalist (2022). iNaturalist Research-grade Observations. INaturalist.org. Occurrence dataset https://doi.org/10.15468/ab3s5x accessed via GBIF.org on 2022-10-30. https://www.inaturalist.org/observations/5283602.

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