

## A REVISED VASCULAR FLORA OF TUMAMOC HILL, TUCSON, ARIZONA

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### ABSTRACT

Tumamoc Hill, a 352-ha preserve near Tucson, Arizona, was the site of the Desert Laboratory of the Carnegie Institution of Washington from 1903 to 1940. The present flora of Tumamoc Hill comprises 346 specific and infraspecific taxa of vascular plants compared with 238 listed in a 1909 flora of the hill. Forty-nine of the new additions to the flora are introduced species, many of which colonized disturbed habitats created on the study area after 1940. Many of the species added may have dispersed to Tumamoc Hill from the nearby Santa Cruz River floodplain as a result of artificial wetland habitats created on the hill in recent years. Two species apparently have become locally extirpated since 1909.

In 1903 the Carnegie Institution of Washington established a Desert Laboratory on Tumamoc Hill two miles west of Tucson, Arizona. The climate, geology, and vegetation of the hill and environs were first described by Spalding (1909); Thornber (1909) prepared the first flora of the hill.

The purpose of this paper is two-fold: first, to update the plant list for a site possessing considerable significance in the history of American plant ecology and, second, to assess changes in the flora over the past 75 years.

Few authors of local floras in Arizona have examined short-term floristic changes in their study areas. Arnberger (1947) listed 151 species for Walnut Canyon, and six years later Spangle (1953) added 82 species to the list. A 1976 study of the vegetation of Walnut Canyon National Monument (Joyce 1976) added another 93 species to the flora but did not speculate on floristic changes that might have occurred since 1947. Similarly, Reeves (1966) listed 687 taxa for Chiricahua National Monument with no discussion of possible losses from or additions to an earlier checklist (Clark 1940). One of the few authors to assess floristic change in local floras in Arizona was Schaack (1983). He noted previous floristic work by Little (1941) and Moore (1965) in the alpine zone of San Francisco Mountain and discussed recent additions to the flora. Another was Bowers (1984), who discussed probable local extirpation between 1909 and 1983 of at least six species in the Rincon Mountains. Her assessment of floristic change was based not on an earlier flora but on collections made in 1909 by J. C. Blumer.

## STUDY AREA

*Environment.* Tumamoc Hill, an outlier of the nearby Tucson Mountains, reaches an elevation of 948 m above sea level and rises 245 m above the surrounding plain. The hill is composed of large blocks of dark brown Tertiary basalt that have weathered to a fine clay soil, forming a matrix between the rocks.

Precipitation is biseasonal: from 1907 to 1983, 27.3% of the annual average rainfall (299 mm) fell in the winter months (December–March), and 50.8% fell in the summer (July–September). April, May, and June, called the arid foresummer by Shreve (1911), are the driest months and a time of great moisture stress for all elements of the vegetation. Temperatures frequently exceed 38°C in the summer and occasionally drop below freezing in winter. The lowest temperature recorded on Tumamoc Hill was –9.4°C in 1913 (Turnage and Hinckley 1938), but such low temperatures are rare. Freezing temperatures seldom last longer than 15–20 hours.

Vegetation of Tumamoc Hill fits into Shreve's Arizona Upland subdivision of the Sonoran Desert (Shreve 1951). Dominant species on the rocky, basaltic slopes include *Cercidium microphyllum*, *Carnegiea gigantea*, *Fouquieria splendens*, *Hyptis emoryi*, *Opuntia phaeacantha*, *Encelia farinosa*, *Lycium berlandieri*, and *Acacia constricta*. The level or gently rolling plains west of the hill are characterized by *Cercidium microphyllum*, *Carnegiea gigantea*, *Larrea divaricata*, *Ambrosia deltoidea*, *Opuntia fulgida*, *O. phaeacantha*, *O. versicolor*, *Fouquieria splendens*, and *Calliandra eriophylla*. Broad washes on the plain are dominated by *Cercidium floridum* and *Prosopis velutina* and also support *Acacia greggii*, *Celtis pallida*, *Zizyphus obtusifolia*, and other shrubs. A more detailed discussion of the vegetation of Tumamoc Hill and vegetation changes during the first part of this century can be found in Shreve (1929) and Shreve and Hinckley (1937).

*History.* Spalding (1909) regarded the "Desert Laboratory domain" to be Tumamoc Hill (his Zone I), the fenced plain west of the hill (his Zone II), and the Santa Cruz River floodplain and streambed (his Zones III and IV). Our definition of Tumamoc Hill includes the hill itself and the fenced plain to the west, that is, Spalding's Zones I and II. To the north, west, and south, our study area is bounded by Anklam Road, Greasewood Road, and 22nd Street, respectively; the eastern boundary is irregular. Our total area is 352 ha.

The U.S.D.A. Forest Service took over the laboratory buildings and land when the Desert Laboratory closed in 1940. Under Forest Service management, and later under that of the University of Arizona, various incursions took place on the property, although the

area had not been disturbed since the grounds were fenced in 1907. These incursions, which included a clay quarry, a sanitary landfill, electric powerlines, gas pipelines, access roads, and a booster pump for the city water system, have had a significant effect on the flora of Tumamoc Hill, as we will show.

#### FLORA

*Methods.* In 1968 and 1969, R. M. Turner collected plants on Tumamoc Hill to document additions and losses to the flora since 1909. Collection of Tumamoc Hill plants was resumed in 1977 and continued through 1984.

Thornber's 1909 flora comprised 429 specific and infraspecific taxa of vascular plants in 68 families and 269 genera. Of these 276 occurred in Spalding's Zones I and II, the areas we examine in this report. Problems that arose in comparing Thornber's list with our own included changes in nomenclature, misapplied names, misidentified specimens, and species listed under two or more names. Not all species listed by Thornber were documented by voucher specimens at ARIZ. We searched for vouchers for the 49 species listed by Thornber that we did not collect between 1968 and 1984, and were able to locate Thornber vouchers collected on Tumamoc Hill, "mesas, Tucson," or "mesas, Tucson Mountains," for 18 species. Of the 429 taxa listed by Thornber for the Desert Laboratory domain, we eliminated those listed only for Zones III or IV (153 in all), those listed for Zones I and II but not documented by herbarium vouchers not collected during the present study (31 in all), and those listed under two or more names (7 in all). Thus, Thornber's reconstructed flora consists of 238 taxa.

*Floristic change.* The number of taxa has apparently increased from 238 to 346 over the past 75 years. Although it is difficult to argue from negative evidence (i.e., just because Thornber did not list these "new" species does not mean they did not occur on the study area), we find meaningful patterns that suggest substantial floristic changes have occurred at Tumamoc Hill since 1909.

Many of the recent additions to the Tumamoc Hill flora resulted from changes in habitat, especially from disturbance associated with construction of roads, pipelines, a clay quarry, and a sanitary landfill on the property. Although Thornber listed 52 introduced species in all, most of these were restricted to the Santa Cruz River floodplain. In contrast, 40% of the 126 taxa we added to the flora are not native, and the majority are closely associated with disturbance. Some of the introduced species in the flora—*Lantana horrida*, *Phacelia parryi*, *Molucella laevis*, *Melia azederach*, *Opuntia lindheimeri* var. *linguiformis*, *Dimorphotheca aurantiaca*, *Pennisetum ruppelii*, *Cyperus*

*alternifolius*, and *Cupressus sempervirens*—are common in cultivation in and around Tucson. Recent development of the land surrounding Tumamoc Hill has no doubt facilitated their spread onto our study area. Not all of the introduced species collected on the Desert Laboratory domain have become established. *Bromus tectorum*, a European species common in the Great Basin, was collected on Tumamoc Hill in 1979, but has not been collected since and apparently did not become permanently established.

Changes in habitat have also been responsible for the migration of some species from the Santa Cruz River floodplain (Zones III and IV) to Tumamoc Hill (Table 1). Wetland and riparian species that formerly occupied the seasonally wet bed of the Santa Cruz River now find suitable habitat at several locations on Tumamoc Hill. Spalding (1909) noticed this process occurring with *Cynodon dactylon* as early as 1908. Currently, artificial wetland habitats on Tumamoc Hill include the seasonal ponds at the sanitary landfill and clay quarry; the overflow from a water tank southeast of the laboratory buildings and from the booster pump on Anklam Road; the septic tank installed northwest of the laboratory buildings; and a moist ditch at a broken water main near the eastern boundary of the property. A few of the apparent "migrants," such as *Poa bigelovii* and *Bromus arizonicus*, are annuals characteristic of rocky slopes and gravelly flats and may have been overlooked by Thornber. The majority, however, are recently adventive to our study area, having capitalized upon the availability of new, suitable habitat. Of the 48 species listed in Table 1, 20 are introduced. In addition to species that may have migrated to our study area from the Santa Cruz River floodplain, several other moisture-loving species not listed by Thornber are found in artificial wetland habitats on Tumamoc Hill: *Scirpus maritimus* var. *paludosus*, *Diplachne fascicularis*, *Cyperus alternifolius*, *Tamarix pentandra*, *Phalaris minor*, *Molucella laevis*, *Conyza bonariensis*, *Typha domingensis*, and *Cupressus sempervirens*.

Certain apparent additions to the flora since 1909 are not easily explained. No doubt Thornber overlooked more than a few species when preparing his flora, and this may account for the recent addition of characteristic desert species such as *Matelea parvifolia*, *Astragalus wootonii*, *Eriogonum thurberi*, *Oenothera primiveris*, *Thamnosma texana*, *Yabea microcarpum*, *Eucrypta micrantha*, *Euphorbia micromera*, *Pectocarya recurvata*, *Ambrosia dumosa*, *Filago arizonica*, *Filago depressa*, and *Tillaea erecta*. A few taxa added to the list were probably not overlooked by Thornber but are new to the flora. One of these, *Polanisia dodecandra* subsp. *trachysperma*, was first collected in a wash near Anklam Road in 1980 and apparently occurs nowhere else on the study area.



TABLE 1. PLANTS OF TUMAMOC HILL LISTED BY THORNBUR (1909) ONLY FOR THE SANTA CRUZ RIVER OR ITS FLOODPLAIN. \* = introduced.

<i>Amaranthus palmeri</i>	<i>Teucrium cubense</i>
<i>Sarcostemma cynanchoides</i> var. <i>cynanchoides</i>	* <i>Malva parviflora</i>
<i>Aster subulatus</i> var. <i>ligulatus</i>	<i>Sphaeralcea coulteri</i>
<i>Baccharis salicifolia</i>	<i>Boerhaavia coccinea</i>
* <i>Centaurea melitensis</i>	* <i>Avena fatua</i>
<i>Conyza canadensis</i>	<i>Bromus arizonicus</i>
<i>Erigeron divergens</i>	* <i>Bromus rubens</i>
<i>Gutierrezia microcephala</i>	* <i>Bromus willdenowii</i>
<i>Heterotheca psammophila</i>	* <i>Cynodon dactylon</i>
<i>Hymenoxis wislizenii</i>	* <i>Echinochloa colonum</i>
* <i>Matricaria matricarioides</i>	* <i>Eragrostis cilianensis</i>
* <i>Sonchus oleraceus</i>	<i>Eriochloa lemmonii</i> var. <i>gracilis</i>
<i>Verbesina encelioides</i>	* <i>Hordeum murinum</i>
* <i>Matthiola bicornis</i>	<i>Hordeum pusillum</i>
<i>Sambucus mexicana</i>	<i>Poa bigelovii</i>
<i>Atriplex canescens</i>	* <i>Polypogon monspeliensis</i>
<i>Chenopodium fremontii</i>	<i>Setaria macrostachya</i>
* <i>Chenopodium murale</i>	* <i>Sorghum halepense</i>
* <i>Medicago polymorpha</i> var. <i>vulgaris</i>	<i>Androsace occidentalis</i>
* <i>Melilotus indicus</i>	<i>Clematis drummondii</i>
<i>Corydalis aurea</i>	<i>Maurandya antirrhiniflora</i>
* <i>Erodium cicutarium</i>	* <i>Nicotiana glauca</i>
<i>Nama hispidum</i>	<i>Physalis acutifolia</i>
<i>Koelerlinia spinosa</i>	* <i>Tribulus terrestris</i>

Forty-nine species listed by Thornber for Zones I or II were not collected by us. Eighteen of these are documented by ARIZ voucher specimens collected on Tumamoc Hill, on "mesas, Tucson," or on "mesas, Tucson Mountains." The remaining 31 species were not documented by voucher specimens at ARIZ, and we did not include them in our reconstruction of Thornber's list. It is likely that some of these species still occur on the study area but were overlooked. Two species, *Olneya tesota* and *Simmondsia chinensis*, are of more interest, because they may have been locally extirpated. (*Forestiera shrevei* might be included here, since Thornber collected it on Tumamoc Hill and we did not; however, it still occurs within one-quarter mile of the boundary of our study area.) Although we may have overlooked these species, both are large, woody plants that are not easily missed. Spalding noted that the *Olneya* growing near the east edge of his permanent plot #12 was the only individual known to occur on the Desert Laboratory grounds (Spalding, unpubl. notes, 1906). This individual was shown on maps of permanent plot #12 made by Shreve in 1929 and 1936, but had disappeared by 1948 when the plot was mapped again. *Olneya* is frost-sensitive, and the

single individual on Tumamoc Hill may have died following a severe freeze such as the one that occurred in 1937. Alternatively, it may have died after senescence. *Simmondsia chinensis* was collected on Tumamoc Hill in 1905 (Thornber 2576), and although it is common in the Tucson Mountains, it has failed to reoccupy the hill. Perhaps individuals of *Simmondsia* were so few that the level of reproduction fell below that necessary to maintain the population. If the few remaining individuals in the population were all of one sex, reproduction would have been impossible, and the population would have died out eventually. Although adults are hardy, seedlings are susceptible to freezing, drought, and predation by rodents (Sherbrooke 1977).

*Annotated checklist.* The annotated checklist includes 346 specific and infraspecific taxa, in 67 families and 241 genera, known either to occur presently on the Tumamoc Hill property or to have occurred historically and for which vouchers exist. Habitat, local distribution, and relative abundance are noted for most. Species not listed by Thornber for Zones I and II are denoted by an asterisk. Species collected by Thornber and others for which vouchers exist, but which we did not collect, are denoted by a dagger. Names applied by Thornber are listed in brackets where appropriate. Nomenclature follows Lehr (1978) and Lehr and Pinkava (1980, 1982). Nomenclature for cultivated species not listed in Lehr or Lehr and Pinkava follows Bailey and Bailey (1976). A full set of our vouchers has been deposited at ARIZ. Additional vouchers have been deposited at ASU, BRI, ENCB, HUF, LIL, MEXU, MICH and MNA.

## VASCULAR PLANTS OF TUMAMOC HILL<sup>1</sup>

### PTEROPHYTA

#### Adiantaceae

*Cheilanthes wootonii* Maxon. Rocky slopes; under trees; rare.

*Cheilanthes wrightii* Hook. Rocky, north-facing slopes; rare.

*Notholaena cochisensis* Goodding. Rocky, north-facing slopes; occasional.

*Notholaena standleyi* Maxon. Rocky slopes; occasional to common.

*Pellaea truncata* Goodding [*Pellaea wrightiana* Hook.]. Rocky, north-facing slopes; occasional.

<sup>1</sup> See text for explanation of symbols.

## CONIFEROPHYTA

## Cupressaceae

- \**Cupressus sempervirens* L. Local, along moist ditch; tree commonly cultivated in Tucson, probably spreading onto our area from nearby housing developments.

## Ephedraceae

- Ephedra trifurca* Torr. Gravelly flats and along washes; occasional to common.

## ANTHOPHYTA—DICOTYLEDONEAE

## Acanthaceae

- Anisacanthus thurberi* (Torr.) Gray. Along washes; common; usually flowering in the spring.  
*Carlowrightia arizonica* Gray. Rocky slopes; occasional.  
*Ruellia nudiflora* (Engelm. & Gray) Urban. Banks of washes, in shade of trees; locally common.  
*Siphonoglossa longiflora* (Torr.) Gray. Rocky slopes, often in shade of trees; common.

## Aizoaceae

- Trianthema portulacastrum* L. Disturbed sites, abundant on sanitary landfill; introduced.

## Amaranthaceae

- Amaranthus fimbriatus* (Torr.) Benth. Washes and sandy flats; occasional summer annual.  
 \**Amaranthus palmeri* Wats. Washes and roadsides; common summer annual.  
*Tidestromia lanuginosa* (Nutt.) Standl. Gravelly slopes; locally common summer annual.

## Anacardiaceae

- \**Rhus lancea* L. f. Moist soil, local, ditch at broken water main; an ornamental common in cultivation in Tucson; probably spreading to our area from nearby housing developments.

## Apiaceae

- Bowlesia incana* Ruiz & Pav. Rocky slopes and gravelly flats, often under shrubs, trees or rocks; common spring annual.

*Daucus pusillus* Michx. Rocky slopes or gravelly flats, often under shrubs, trees, or rocks; common spring annual.

*Spermolepis echinata* (Nutt.) Heller. Rocky slopes and gravelly flats; common spring annual.

\**Yabea microcarpum* (Hook. & Arn.) K.-Pol. Rocky slopes; common spring annual.

#### Apocynaceae

*Haplophyton crooksii* L. Rocky slopes, flowering in spring; common.

#### Aristolochiaceae

*Aristolochia watsonii* Woot. & Standl. Disturbed sites on flats; apparently uncommon.

#### Asclepiadaceae

\**Asclepias nyctaginifolia* Gray. Along washes; apparently uncommon.

†*Cynanchum arizonicum* (Gray) Shinnery. *Thornber 4855, 8989.*

\**Matelea parvifolia* (Torr.) Woods. Climbing on cacti, trees, and shrubs; gravelly flats; rare.

\**Sarcostemma cynanchoides* Decne. var. *cynanchoides*. Along washes; climbing on shrubs; apparently rare.

\**Sarcostemma cynanchoides* Decne. var. *hartwegii* (Vail) Shinnery. Along washes; climbing on trees and shrubs; common.

#### Asteraceae

*Acourtia nana* (Gray) Reveal & King. Gravelly flats, often under shrubs; flowering in spring.

*Acourtia wrightii* (Gray) Reveal & King. Banks of washes and rocky slopes; common.

*Ambrosia confertiflora* DC. Washes and dirt roads, often in disturbed areas; locally common.

*Ambrosia deltoidea* (Torr.) Payne. Rocky slopes and gravelly flats; a common dominant.

\**Ambrosia dumosa* (Gray) Payne. Gravelly flats and rocky slopes; near clay quarry and on south slopes of hill; locally common; probably overlooked by Thornber.

\**Aster subulatus* Michx. var. *ligulatus* Shinnery. Moist soil; local, near pond at sanitary landfill and along ditch below water tank; apparently recently adventive to our study area.

*Baccharis brachyphylla* Gray [*Baccharis wrightii* Gray]. Gravelly flats; local; occasional.



- \**Baccharis salicifolia* (Ruiz & Pav.) Pers. Low-lying, disturbed sites; apparently recently adventive to our study area.
- Baccharis sarothroides* Gray [*Baccharis emoryi* Gray]. Washes and disturbed sites; locally common.
- Bahia absinthifolia* Benth. Rocky slopes and gravelly flats; common on edges of old roadways and on soils containing caliche.
- Baileya multiradiata* Harv. & Gray. Along washes and on sandy flats; common; flowering sporadically throughout the year.
- Bebbia juncea* (Benth.) Greene. Gravelly flats, often along washes; occasional.
- \**Brickellia californica* (Torr. & Gray) Gray. Rocky flats, in shade of trees; rare.
- Brickellia coulteri* Gray. Along washes and on rocky slopes, often under trees; common; flowering sporadically throughout the year.
- Calycoseris wrightii* Gray. Gravelly flats and rocky slopes; a common and showy spring annual.
- \**Centaurea melitensis* L. Disturbed sites; common on sanitary landfill; introduced; apparently recently adventive to our study area.
- Chaenactis stevioides* Hook. & Arn. Gravelly flats and rocky slopes, often under shrubs and trees; a common and showy spring annual.
- \**Cirsium neomexicanum* Gray. Rocky slopes; rare.
- \**Conyza bonariensis* (L.) Cronq. Moist soil; local, along moist ditch at broken water main.
- \**Conyza canadensis* (L.) Cronq. Disturbed sites; local along moist ditches and other damp spots; perhaps recently adventive to our study area.
- Conyza coulteri* Gray. Moist soil; local, near pond in sanitary landfill and at moist ditch at broken water main.
- \**Dimorphotheca aurantiaca* DC. Gravelly flats and along washes; occasional; apparently adventive from nearby housing developments; an introduced ornamental common in cultivation in and around Tucson.
- Dyssodia pentachaeta* (DC.) Robins. Rocky flats; common on soils containing caliche and on disturbed sites such as dirt roads and scraped ground.
- Dyssodia porophylloides* Gray. Rocky slopes and gravelly flats; uncommon.
- Encelia farinosa* Gray. Rocky slopes; a common dominant; flowering in late winter and early spring.
- Ericameria laricifolia* (Gray) Shinn. Rocky slopes; rare; only a few individuals known from the study area; a marginal population at the lower limit of its range.

- \**Erigeron divergens* Torr. & Gray. Rocky slopes and gravelly flats; common; flowering sporadically throughout the year.
- Eriophyllum lanosum* Gray. Rocky slopes and gravelly or rocky flats; common spring annual.
- Evax multicaulis* DC. Gravelly or rocky flats; locally common spring annual.
- \**Filago arizonica* Gray. Rocky slopes and gravelly or rocky flats; common spring annual.
- Filago californica* Nutt. Rocky slopes; common spring annual.
- \**Filago depressa* Gray. Gravelly flats, often under shrubs; rare.
- Gaillardia arizonica* Gray. Sandy flats and washes; locally common; flowering in late spring.
- Gutierrezia arizonica* (Gray) Lane. Gravelly flats; rare; flowering in late spring.
- \**Gutierrezia microcephala* (DC.) Gray. Rocky slopes; rare; perhaps recently adventive to our study area.
- \**Heterotheca psammophila* Wagenkn. Disturbed sites and low-lying areas; locally common; perhaps recently adventive to our study area.
- \**Hymenothrix wislizenii* Gray. Often on disturbed sites, common along roads; perhaps recently adventive to our study area.
- Isocoma tenuisecta* Greene. Gravelly flats, often on disturbed sites; common on scraped ground and along roads.
- \**Lactuca serriola* L. Along washes; usually under shrubs; occasional; introduced.
- †*Lasthenia californica* DC. ex Lindl. *Thornber 5307*.
- †*Machaeranthera gracilis* (Nutt.) Shinnery. *Thornber 2028*.
- Machaeranthera pinnatifida* (Hook.) Shinnery. Gravelly flats, often on disturbed sites; common.
- \**Machaeranthera tagetina* Greene. Disturbed sites; along roads and near buildings; locally common.
- Malacothrix californica* DC. var. *glabrata* Eaton. Gravelly flats; apparently rare; showy spring annual.
- Malacothrix clevelandii* Gray. Rocky slopes, under trees and shrubs; rare spring annual.
- †*Malacothrix coulteri* Gray. *Thornber 387, 4621*.
- \**Matricaria matricarioides* (Less.) Porter. Disturbed sites; introduced; perhaps recently adventive to our study area; *Schoenwetter T-28*.
- Microseris linearifolia* (DC.) Schultz-Bip. Rocky slopes; common spring-flowering annual.
- Monoptilon bellioides* (Gray) H. M. Hall. Rocky or gravelly flats; common spring annual.
- Parthenium incanum* H.B.K. Rocky slopes and gravelly flats; locally common.

- Pectis papposa* Harv. & Gray. Gravelly flats, often in low-lying areas; locally common summer annual.
- Porophyllum gracile* Benth. Rocky slopes and gravelly flats; locally common.
- Psilostrophe cooperi* (Gray) Greene. Gravelly flats; abundant; flowering after winter and summer rains.
- Rafinesquia neomexicana* Gray. Rocky slopes; a common and showy spring annual.
- \**Senecio douglasii* DC. var. *douglasii*. Often along washes; common spring-flowering annual.
- Senecio lemmonii* Gray. Rocky slopes; common spring annual, rarely flowering in late fall.
- \**Sonchus oleraceus* L. Rocky slopes and gravelly flats; locally common in moist areas; introduced. Apparently recently adventive to our study area.
- Stephanomeria pauciflora* (Torr.) A. Nels. Along washes, also on rocky slopes; occasional.
- \**Stylocline gnaphaloides* Nutt. Gravelly flats, perhaps rare, but easily overlooked.
- Stylocline micropoides* Gray. Rocky slopes and gravelly or rocky flats; common spring annual.
- Trixis californica* Kellogg. Rocky slopes; common.
- \**Verbesina encelioides* (Cav.) Benth. & Hook. Locally common in low-lying areas; perhaps recently adventive to our study area.
- Zinnia acerosa* (DC.) Gray [*Zinnia grandiflora* Nutt.]. Gravelly flats; locally common; often on soils containing caliche.

#### Boraginaceae

- Amsinckia intermedia* Fisch. & Mey. Rocky slopes and gravelly flats; a common spring annual.
- Amsinckia tessellata* Gray. Disturbed sites; apparently only locally common.
- Cryptantha angustifolia* (Torr.) Greene. Gravelly or sandy flats; an uncommon spring annual.
- Cryptantha barbiger*a (Gray) Greene. Rocky slopes and sandy or gravelly flats; a common spring annual.
- Cryptantha micrantha* (Torr.) Johnst. Sandy washes; apparently rare.
- Cryptantha nevadensis* Nels. & Kenn. [*Cryptantha intermedia* (Gray) Greene]. Rocky slopes; common spring annual.
- Cryptantha pterocarya* (Torr.) Greene. Rocky and gravelly slopes and flats, often under shrubs; a common spring annual.
- Harpagonella palmeri* Gray. Rocky slopes and flats; typically sprawling over and between rocks; a common spring annual.

- Lappula redowskii* (Hornem.) Greene var. *redowskii*. Gravelly flats, often in disturbed areas; common spring annual.
- Lappula redowskii* (Hornem.) Greene var. *cupulatum* (Gray) Jones. Gravelly flats; rare.
- Pectocarya heterocarpa* Johnst. Gravelly flats; often growing with the next two species; common.
- Pectocarya platycarpa* Munz & Johnst. Gravelly flats; occasional.
- \**Pectocarya recurvata* Johnst. Rocky and gravelly flats; locally abundant.
- Plagiobothrys arizonicus* (Gray) Greene. Gravelly flats; an uncommon spring annual.
- †*Plagiobothrys pringlei* Greene. *Thornber 533, 2206*.
- Tiquilia canescens* (DC.) A. Richardson. Gravelly flats and dirt roads; especially common on soils containing caliche.

#### Brassicaceae

- Arabis perennans* Wats. Rocky, north-facing slopes; local and uncommon.
- \**Brassica tournefortii* Gouan. Disturbed ground; locally common along roads; introduced.
- Caulanthus lasiophyllus* (Hook. & Arn.) Payson. Rocky slopes and gravelly flats, often under shrubs and trees; common spring annual.
- Descurainia pinnata* (Walt.) Britt. Rocky slopes and gravelly flats; common spring annual.
- Draba cuneifolia* Nutt. Gravelly and rocky flats, often under trees; common; flowering early in the spring.
- \**Dryopetalon runcinatum* Gray. Rocky, north-facing slopes; uncommon.
- Lepidium lasiocarpum* Nutt. Rocky slopes and gravelly flats; common spring annual.
- \**Lepidium oblongum* Small. Disturbed sites; common on sanitary landfill; introduced.
- Lesquerella gordonii* (Gray) Wats. Rocky slopes and gravelly or rocky flats; common spring annual.
- \**Matthiola bicornis* (Sibth. & Smith) DC. Disturbed sites; common on and near sanitary landfill; introduced; perhaps recently adventive to our study area.
- \**Sisymbrium altissimum* L. Along washes; apparently uncommon; introduced. *Turner 78-11* is unusual in its soft pubescence and rather wide leaf segments.
- \**Sisymbrium irio* L. Rocky slopes and gravelly flats, often on disturbed sites; introduced.
- Streptanthus arizonicus* Wats. Rocky slopes and gravelly or rocky flats; common spring annual.



*Thysanocarpus curvipes* Hook. Rocky slopes, often under shrubs and trees; common spring annual.

### Cactaceae

*Carnegiea gigantea* (Engelm.) Britt. & Rose. Rocky slopes and gravelly flats; a common dominant.

\**Echinocereus fasciculatus* (Engelm.) L. Benson. Gravelly flats; occasional.

*Echinocereus fendleri* Engelm. Gravelly flats; common.

*Ferocactus wislizenii* (Engelm.) Britt. & Rose. Rocky slopes and gravelly flats; occasional; flowering in August.

*Mammillaria microcarpa* Engelm. [*Cactus grahamii* (Engelm.) Kuntze]. Gravelly flats, often under trees, shrubs, and large cacti; common.

\**Opuntia ficus-indica* (L.) Mill. Gravelly flats; common in cultivation in and around Tucson; apparently spreading to our study area from nearby housing developments.

*Opuntia fulgida* Engelm. Gravelly flats west of hill; locally abundant.

\**Opuntia kleiniae* DC. var. *tetracantha* (Toumey) Marshall. Rocky flats; widely scattered; locally common. Possibly of hybrid origin between *O. leptocaulis* and *O. versicolor*.

*Opuntia leptocaulis* DC. Rocky slopes and gravelly flats; sometimes forming impenetrable thickets.

\**Opuntia lindheimeri* Engelm. var. *linguiformis* (Griffiths) L. Benson. Gravelly flats; common in cultivation in and around Tucson; apparently spreading to our area from nearby housing developments.

*Opuntia phaeacantha* Engelm. var. *discata* (Griffiths) Benson & Walkington. Rocky slopes and gravelly flats; common; intergrading with *O. p.* var. *major*.

*Opuntia phaeacantha* Engelm. var. *major* Engelm. Rocky slopes and gravelly flats; common; intergrading with *O. p.* var. *discata*.

*Opuntia spinosior* (Engelm.) Toumey. Gravelly flats; uncommon.

*Opuntia versicolor* Engelm. Rocky slopes and gravelly flats; common.

*Peniocereus greggii* (Engelm.) Britt. & Rose. Gravelly flats, usually under trees; occasional.

### Campanulaceae

*Nemacladus glanduliferus* Jeps. var. *orientalis* McVaugh [*Nemacladus ramosissimus* Nutt.]. Rocky slopes and gravelly flats; uncommon spring annual.

## Caprifoliaceae

- \**Sambucus mexicana* Presl. Local, wet area by septic system near laboratory buildings; apparently recently adventive to our study area.

## Caryophyllaceae

- \**Herniaria cinerea* DC. Gravelly flats; rare; introduced.  
*Loeflingia squarrosa* Nutt. Gravelly flats; an uncommon spring annual.  
*Silene antirrhina* L. Rocky slopes and gravelly and rocky flats; common spring annual.

## Chenopodiaceae

- \**Atriplex canescens* (Pursh) Nutt. Along washes and on rocky slopes; occasional.  
*Atriplex elegans* (Moq.) D. Dietr. Disturbed sites; common on sanitary landfill.  
 \**Chenopodium fremontii* Wats. Gravelly flats and rocky slopes; often under trees; common spring annual.  
 \**Chenopodium murale* L. Disturbed site near laboratory buildings; introduced.  
 †*Monolepis nuttalliana* (Schult.) Greene. Gravelly flats and washes; occasional spring annual; *P. S. Martin 1053*.  
 \**Salsola iberica* Sennen & Pau. Disturbed sites; abundant on sanitary landfill; introduced.

## Cleomaceae

- \**Polanisia dodecandra* (L.) DC. var. *trachysperma* (Torr. & Gray) Iltis. Washes and roadsides; localized in somewhat disturbed sites; apparently recently adventive to our study area.

## Convolvulaceae

- \**Ipomoea barbatisepala* Gray. Climbing on shrubs and trees in rocky slopes, often in shallow ravines.

## Crassulaceae

- \**Tillaea erecta* Hook. & Arn. Gravelly flats; perhaps local, but easily overlooked.

## Cucurbitaceae

- †*Apodanthera undulata* Gray. *Thornber 5259*.  
*Cucurbita digitata* Gray. Gravelly flats and low-lying spots; uncommon.

*Tumamoca madougalii* Rose [*Maximowiczia tripartita* Cogn. var. *tenuisecta* Wats.]. Gravelly flats, climbing on shrubs and trees; occasional on our study area, but rare in Arizona. Described in 1912 from specimens collected on Tumamoc Hill.

#### Euphorbiaceae

*Argythamnia neomexicana* Muell.-Arg. Rocky slopes and gravelly flats; occasional; flowering after summer rains.

*Euphorbia capitellata* Engelm. Rocky slopes; common; flowering sporadically throughout the year.

*Euphorbia florida* Engelm. Gravelly flats and shallow, sandy washes; common summer annual.

\**Euphorbia heterophylla* L. Along washes and in low-lying areas; locally common summer annual.

\**Euphorbia hyssopifolia* L. Gravelly flats and shallow, sandy washes; common summer annual.

\**Euphorbia micromera* Boiss. Gravelly flats and sandy washes; common summer annual.

*Euphorbia pediculifera* Engelm. Gravelly flats and sandy washes; common; flowering in summer.

*Euphorbia setiloba* Engelm. Gravelly and rocky flats; flowering after winter and summer rains; occasional.

†*Euphorbia serrula* Engelm. *Thornber 47, 8948.*

*Jatropha cardiophylla* (Torr.) Muell.-Arg. Rocky slopes; occasional.

\**Tragia nepetaefolia* Cav. Rocky slopes; uncommon.

#### Fabaceae

*Acacia constricta* Benth. Gravelly flats, rocky slopes, and along washes; common.

*Acacia greggii* Gray var. *arizonica* Isely. Washes, gravelly flats, and rocky slopes; common.

*Astragalus nuttallianus* DC. Rocky slopes and gravelly flats; common spring annual.

\**Astragalus wootonii* Sheldon. Gravelly flats; occasional.

*Calliandra eriophylla* Benth. Gravelly flats and rocky slopes; common.

*Cercidium floridum* Benth. Along the larger washes; a common dominant.

*Cercidium microphyllum* (Torr.) Rose & Johnst. Gravelly flats and rocky slopes; a common dominant.

†*Hoffmanseggia glauca* (Ort.) Eifort. *Thornber s.n. (1904).*

*Lotus humistratus* Greene. Gravelly flats; common spring annual.

*Lotus tomentellus* Greene [*Hosackia humilis* Greene]. Gravelly flats; occasional spring annual.

- Lupinus concinnus* Agardh. Along washes and on gravelly flats; occasional spring annual.
- Lupinus sparsiflorus* Benth. Rocky slopes; common spring annual.
- Marina parryi* (Torr. & Gray) Barn. Rocky slopes, often along paved roads; locally common.
- \**Medicago polymorpha* L. var. *vulgaris* (Benth.) Shinnars. Local, moist site near buildings; introduced; apparently recently adventive to our study area.
- \**Melilotus indicus* (L.) All. Pond at sanitary landfill; locally common; introduced; apparently recently adventive to our study area.
- Nissolia schottii* (Torr.) Gray. Rocky slopes; climbing on trees and shrubs; occasional.
- †*Olneya tesota* Gray. *Spalding* (1909).
- \**Parkinsonia aculeata* L. Disturbed sites; along roads and on sanitary landfill; an introduced ornamental common in cultivation in and around Tucson.
- Prosopis velutina* Woot. Gravelly flats and along washes; a common dominant.
- †*Senna bahinioides* (Gray) Irwin & Barneby. *Thornber s.n.* (1903).
- Senna covesii* (Gray) Irwin & Barneby. Gravelly flats and rocky slopes; common; flowering after summer rains.
- \**Sphinctospermum constrictum* (Wats.) Rose. Rocky slopes; rare summer annual; not listed by Thornber, although collected by him (*Thornber 4851*) on Tumamoc Hill in August 1906.
- Vicia ludoviciana* Nutt. Rocky slopes, climbing on shrubs and annuals; common spring annual.

#### Fouquieriaceae

- Fouquieria splendens* Engelm. Gravelly flats and rocky slopes; a common dominant.

#### Fumariaceae

- \**Corydalis aurea* Willd. Along washes; rare spring annual.

#### Geraniaceae

- \**Erodium cicutarium* (L.) L'Her. Rocky slopes and gravelly flats; locally common spring annual; introduced. Listed by Thornber only for the Santa Cruz River floodplain, but occurring on Tumamoc Hill according to *Spalding* (1909).
- Erodium texanum* Gray. Gravelly and rocky flats; locally common spring annual.



## Hydrophyllaceae

- Eucrypta chrysanthemifolia* (Benth.) Greene. Rocky slopes, often under trees; occasional spring annual.
- \**Eucrypta micrantha* (Torr.) Heller. Rocky slopes and gravelly flats, often under trees and shrubs; common spring annual.
- \**Nama hispidum* Gray. Along washes; occasional spring annual.
- \**Phacelia affinis* Gray. Along washes; rare spring annual.
- †*Phacelia arizonica* Gray. *Thornber 4013*.
- Phacelia crenulata* Torr. Rocky slopes and gravelly flats; common spring annual.
- Phacelia distans* Benth. Rocky slopes and gravelly flats; often reclining on shrubs and other annuals; common spring annual.
- \**Phacelia parryi* Torr. Gravelly flats; local. An exotic species in Arizona, native to California, cultivated nearby at St. Mary's Hospital and adventive to our study area.

## Koeberliniaceae

- \**Koeberlinia spinosa* Zucc. Gravelly flats and banks of washes; locally common.

## Krameriaceae

- Krameria grayi* Rose & Painter. Gravelly flats and rocky slopes; occasional.
- Krameria parvifolia* Benth. Gravelly flats and rocky slopes; occasional.

## Lamiaceae

- Hyptis emoryi* Torr. Rocky slopes; common.
- \**Molucella laevis* L. Disturbed sites, low-lying areas; locally common; an introduced ornamental cultivated in and around Tucson.
- Salvia columbariae* Benth. Gravelly flats and along washes; occasional spring annual.
- \**Teucrium cubense* Jacq. Along washes; locally common; perhaps recently adventive to our study area.

## Linaceae

- Linum lewisii* Pursh. Rocky slopes and gravelly flats; uncommon. Although *L. lewisii* is described by Kearney and Peebles (1960) as a perennial herb, it is an annual on Tumamoc Hill and on other desert mountain ranges in southern Arizona. It can be distinguished from *L. usitatissimum* (cultivated flax), which is

also an annual, by its capitate stigmas and ovate sepals. *L. usitatissimum* has longitudinal stigmas and acuminate, ciliate sepals.

#### Loasaceae

*Mentzelia albicaulis* Dougl. Rocky slopes and gravelly flats; occasional spring annual.

*Mentzelia multiflora* (Nutt.) Gray. Rocky slopes; occasional.

#### Loranthaceae

*Phoradendron californicum* Nutt. Gravelly flats and along washes; parasitic on a variety of trees and shrubs; common.

#### Malpighiaceae

*Janusia gracilis* Gray. Rocky slopes and gravelly flats; common.

#### Malvaceae

*Abutilon incanum* (Link.) Sweet subsp. *pringlei* (Hochr.) Felger & Lowe. Rocky slopes; occasional.

*Anoda pentaschista* Gray. Rocky slopes; rare; flowering in the summer.

†*Eremalche exilis* (Gray) Greene. *Thornber 4884, 5326.*

*Herissantia crispa* (L.) Brizicky. Rocky slopes; common.

*Hibiscus coulteri* Harv. Rocky slopes; often among shrubs; occasional.

*Hibiscus denudatus* Benth. Rocky slopes and gravelly flats; locally common.

\**Malva parviflora* L. Disturbed sites, low-lying areas; locally common; introduced; apparently recently adventive to our study area.

*Rhynchosida physocalyx* (Gray) Fryxell. Disturbed sites and on banks of washes; locally common.

*Sida procumbens* Swartz. Sandy or gravelly flats; occasional summer-flowering perennial herb.

*Sphaeralcea angustifolia* (Cav.) G. Don. var. *cuspidata* Gray. Disturbed sites and along washes; local and uncommon.

\**Sphaeralcea coulteri* (Wats.) Gray. Gravelly flats; uncommon spring annual.

\**Sphaeralcea emoryi* Torr. var. *californica* (Parish) Shinners. Rocky, north-facing slopes; rare and local.

*Sphaeralcea laxa* Woot. & Standl. [*Sphaeralcea pedata* Torr.]. Rocky slopes and gravelly flats; common.

## Martyniaceae

- Proboscidea altheaeifolia* (Benth.) Decne. Gravelly flats and sandy washes; occasional; flowering in summer.  
 \**Proboscidea parviflora* (Woot.) Woot. & Standl. Disturbed sites; apparently local, near sanitary landfill.

## Meliaceae

- \**Melia azedarach* L. Disturbed sites; local, at sanitary landfill; an ornamental commonly cultivated in and around Tucson.

## Nyctaginaceae

- Allionia incarnata* L. Gravelly flats, rocky slopes and along washes; common; flowering sporadically throughout the year.  
 \**Boerhaavia coccinea* Mill. Banks of washes; locally common.  
*Boerhaavia coulteri* (Hook. f.) Wats. Sandy flats; occasional summer annual.  
*Boerhaavia intermedia* Jones. Rocky slopes, low-lying areas, often on disturbed sites; common.  
 †*Boerhaavia megaptera* Standl. *Thornber 161, 4863.*  
 †*Boerhaavia spicata* Choisy. Rocky slopes and washes; uncommon summer annual; *B. Fink s.n.*  
 \**Boerhaavia wrightii* Gray. Disturbed sites; locally common on roadbanks; not listed by Thornber, although collected by him (*Thornber 2617*) on Tumamoc Hill in September 1903.  
*Commicarpus scandens* L. Along washes, scandent on trees and shrubs; occasional.

## Oleaceae

- †*Forestiera shrevei* Standl. *Thornber s.n. (1906).*  
*Menodora scabra* Gray. Rocky slopes and gravelly flats; common; flowering after spring and summer rains.

## Onagraceae

- Camissonia californica* (Nutt. ex Torr. & Gray) Raven. Rocky slopes and flats; common spring annual.  
*Camissonia chamaenerioides* (Gray) Raven. Gravelly flats; occasional spring annual.  
*Camissonia clavaeformis* (Torr. & Frem.) Raven. Gravelly or sandy flats; locally common spring annual.  
 †*Oenothera caespitosa* Nutt. *Shreve s.n. (1931).*  
 \**Oenothera primiveris* Gray. Gravelly flats and rocky slopes; occasional spring annual.

## Orobanchaceae

- \**Orobanche cooperi* (Gray) Heller. Rocky slopes and disturbed sites, particularly favoring berms along dirt roads; uncommon.

## Papaveraceae

- Argemone pleicantha* Greene subsp. *pleicantha*. Gravelly flats, often in disturbed areas; occasional.  
*Eschscholzia californica* Cham. subsp. *mexicana* (Greene) C. Clark. Rocky slopes; locally common spring annual.

## Plantaginaceae

- Plantago insularis* Eastw. Gravelly flats and rocky slopes; common; flowering early in spring.  
*Plantago patagonica* Jacq. Rocky slopes and gravelly flats; common spring annual.  
*Plantago rhodosperma* Decne. [*Plantago virginica* L.]. Moist soil on rocky slopes; local.

## Polemoniaceae

- Eriastrum diffusum* (Gray) Mason [*Gilia floccosa* Gray]. Rocky slopes and gravelly flats; common spring annual.  
*Gilia stellata* Heller [*Gilia glutinosa* Benth.; *Gilia inconspicua* (Small) Dougl. var. *sinuata* Gray]. Rocky slopes and gravelly flats; occasional spring annual.  
 †*Ipomopsis longiflora* (Torr.) V. Grant. *Thorner* 4439, 4988.  
*Linanthus bigelovii* (Gray) Greene. Rocky slopes; occasional spring annual.

## Polygalaceae

- Polygala macradenia* Gray. Rocky slopes and gravelly flats, often on soil containing caliche; occasional.

## Polygonaceae

- Chorizanthe brevicornu* Torr. Gravelly flats; common spring annual.  
*Chorizanthe rigida* (Torr.) Torr. & Gray. Gravelly flats; locally common spring annual.  
*Eriogonum abertianum* Torr. Gravelly flats, disturbed sites; locally common.  
*Eriogonum deflexum* Torr. Along washes; common summer annual.  
*Eriogonum maculatum* Heller. Gravelly flats; occasional spring annual.



- \**Eriogonum polycladon* Benth. Along washes; locally common.  
 \**Eriogonum thurberi* Torr. Gravelly flats; occasional.  
*Eriogonum trichopes* Torr. Gravelly flats and sandy washes; common.

#### Portulacaceae

- Calyptridium monandrum* Nutt. Sandy flats; locally common.

#### Primulaceae

- \**Androsace occidentalis* Pursh. Rocky, north-facing slopes; uncommon spring annual.

#### Ranunculaceae

- Anemone tuberosa* Rydb. Rocky slopes; common; flowering in spring.  
 \**Clematis drummondii* Torr. & Gray [*Clematis ligusticifolia* Nutt.]. Along washes, climbing on trees and shrubs; occasional.  
*Delphinium scaposum* Greene. Rocky slopes and gravelly flats; common.

#### Resedaceae

- Oligomeris linifolia* (Vahl) Macbr. Gravelly flats, often in dirt roads; locally common.

#### Rhamnaceae

- Condalia warnockii* M. C. Johnst. var. *kearneyana* M. C. Johnst. Gravelly flats and borders of washes; occasional.  
*Zizyphus obtusifolia* (Hook. ex Torr. & Gray) Gray var. *canescens* (Gray) M. C. Johnst. Gravelly flats and along washes; occasional.

#### Rubiaceae

- Galium proliferum* Gray. Rocky slopes; locally common spring annual.  
*Galium stellatum* Kellogg. Rocky slopes; rare.

#### Rutaceae

- \**Thamnosma texana* (Gray) Torr. Gravelly flats, often on banks of washes and under trees; locally common.

## Scrophulariaceae

- \**Maurandya antirrhiniflora* Humb. & Bonpl. Along washes, climbing on trees; occasional to common.
- Orthocarpus purpurascens* Benth. Rocky slopes; locally abundant spring annual.
- Penstemon parryi* Gray [*Penstemon wrightii* Hook.]. Gravelly flats, rocky slopes and along washes; occasional; flowering in spring.

## Simmondsiaceae

- †*Simmondsia chinensis* (Link.) Schneid. *Thornber 2576*.

## Solanaceae

- \**Datura discolor* Bernh. Sandy flats, disturbed sites; locally common.
- Lycium berlandieri* Dunal. Rocky slopes; common dominant.
- Lycium exsertum* Gray. Rocky slopes and along washes; occasional.
- \**Nicotiana glauca* Graham. Rocky slopes and along moist ditch; locally common; introduced; apparently recently adventive to our study area.
- Nicotiana trigonophylla* Dunal. Rocky slopes; occasional.
- \**Physalis acutifolia* (Miers) Sandw. Rocky slopes, moist soil; rare; perhaps recently adventive to our study area.
- Physalis crassifolia* Benth. Gravelly flats and rocky slopes; uncommon; flowering mostly in summer.
- Quincula lobata* (Torr.) Raf. Gravelly and sandy flats, occasionally in washes; locally common; flowering after spring and summer rains.
- Solanum elaeagnifolium* Cav. Disturbed sites, near buildings and along roads; occasional.

## Sterculiaceae

- \**Ayenia compacta* L. Rocky slopes and flats, often under shrubs and trees; locally common. Not listed by Thornber although collected by him (*Thornber 2561*) on Tumamoc Hill in March 1905.
- Ayenia microphylla* Gray. Rocky slopes and gravelly flats, often under trees; occasional.
- †*Hermannia pauciflora* Wats. *Thornber 2281*.

## Tamaricaceae

- \**Tamarix pentandra* Pall. Disturbed sites, moist soil; common near ponds at sanitary landfill and clay quarry; introduced.

## Ulmaceae

*Celtis pallida* Torr. Rocky slopes and along washes; common.

## Urticaceae

*Parietaria hespera* Hinton [*Parietaria debilis* Forst. f.]. Rocky slopes, usually in recesses under rocks and boulders; common spring annual.

## Verbenaceae

*Aloysia wrightii* (Gray) Heller. Rocky, north-facing slopes and along washes; locally common.

*Glandularia gooddingii* (Briq.) Solbrig [*Verbena ciliata* Benth.]. Rocky slopes; common; flowering sporadically throughout the year.

\**Lantana horrida* H.B.K. Disturbed sites; occasional; an ornamental commonly cultivated in and around Tucson.

*Tetradlea coulteri* Gray. Disturbed sites, often in low-lying areas; locally common.

## Zygophyllaceae

*Kallstroemia grandiflora* Torr. Rocky and gravelly flats and along washes; occasional summer annual.

\**Kallstroemia hirsutissima* Vail. Disturbed sites and along roads; occasional.

*Larrea divaricata* Cav. subsp. *tridentata* (Sesse & Moc. ex DC.) Felger & Lowe. Gravelly flats and rocky slopes; common dominant; flowering sporadically throughout the year.

\**Tribulus terrestris* L. Disturbed sites; occasional; introduced; apparently recently adventive to our study area.

## ANTHOPHYTA—MONOCOTYLEDONEAE

## Agavaceae

\**Agave americana* L. Perhaps local; under tree along wash; an ornamental commonly cultivated in and around Tucson, probably spreading onto our area from nearby housing developments.

*Yucca elata* Engelm. Gravelly flats; rare; only one individual known from the study area. Spalding (1909) also found only one plant; this was not the same individual currently found on the study area.

## Cyperaceae

- \**Cyperus alternifolius* L. Moist soil; local; along ditch near broken water main; an ornamental commonly cultivated in and around Tucson.
- \**Scirpus maritimus* L. var. *paludosus* (A. Nels.) Kukenthal. Moist soil; local; in pond at sanitary landfill.

## Liliaceae

- Allium macropetalum* Rydb. Gravelly flats; not uncommon locally; flowering in the spring.
- Calochortus kennedyi* Porter. Rocky slopes; occasional; flowering in the spring.
- Dichelostemma pulchellum* (Salisb.) Heller. Rocky slopes and gravelly flats; common; flowering in the spring.

## Poaceae

- Aristida adscensionis* L. Rocky slopes; common along roads; flowering in spring and summer.
- \**Aristida parishii* Hitchc. Rocky slopes; occasional.
- Aristida purpurea* Nutt. var. *glauca* (Nees) A. Holmgren & N. Holmgren. Rocky slopes; common along paved road.
- Aristida ternipes* Cav. [*Aristida scheidiana* Trin. & Rupr.]. Rocky slopes and gravelly flats; common.
- \**Avena fatua* L. Along washes, in shade of trees; occasional; introduced; probably recently adventive to our study area.
- Bothriochloa barbinodis* (Lag.) Herter. Rocky slopes and gravelly flats; locally common; flowering after summer rains.
- Bouteloua aristidoides* (H.B.K.) Griseb. Gravelly flats and shallow, sandy washes; locally abundant summer annual.
- Bouteloua barbata* Lag. var. *barbata*. Gravelly flats; common on disturbed sites; summer-flowering annual.
- Bouteloua barbata* Lag. var. *rothrockii* (Vasey) Gould. Gravelly flats; rare; flowering after summer rains.
- Bouteloua curtispindula* (Michx.) Torr. Rocky slopes; locally common; flowering after summer rains.
- Bouteloua repens* (H.B.K.) Scribn. & Merr. [*Bouteloua bromoides* (H.B.K.) Lag.]. Rocky slopes; common along paved road.
- Bouteloua trifida* Thurber. Gravelly flats; probably occasional.
- \**Bromus arizonicus* (Shear) Stebbins. Rocky slopes and gravelly flats, also banks of washes, usually under trees and shrubs; common spring annual.
- \**Bromus rubens* L. Rocky slopes and gravelly flats, often on disturbed sites; common; introduced; apparently recently adventive to our study area.

- \**Bromus willdenowii* Kunth. Disturbed sites; local and rare; introduced; probably recently adventive to our study area.
- Chloris virgata* Swartz. Gravelly flats; occasional summer annual.
- \**Cortaderia selloana* (Schult. & Schult.) Asch. & Graebn. Moist soil; local; ditch near broken water main; an ornamental common in cultivation in Tucson; recently adventive to our study area.
- Cottea pappophoroides* Kunth. Rocky slopes; locally common; flowering after summer rains.
- \**Cynodon dactylon* L. Banks of washes; occasional; introduced. Listed by Thornber only for the Santa Cruz River floodplain, but noted by Spalding (1909) to occur near buildings on the hill.
- \**Diplachne fascicularis* (Lam.) Beauv. Moist soil; local, around ponds at clay quarry and sanitary landfill.
- \**Echinochloa colonum* (L.) Link. Disturbed sites; local, moist soil below water tank; introduced; probably recently adventive to our study area.
- Enneapogon desvauxii* Beauv. Gravelly flats and rocky slopes; occasional; flowering after summer rains.
- \**Eragrostis barrelieri* Daveau. Disturbed sites; local and uncommon; introduced; summer annual.
- \**Eragrostis cilianensis* (All.) Mosher. Disturbed sites and sandy flats; locally common summer annual; introduced; probably recently adventive to our study area.
- \**Eragrostis echinochloidea* Stapf. Moist soil; local, below water tank; introduced.
- \**Eragrostis lehmanniana* Nees. Gravelly flats and disturbed sites; locally common; introduced.
- \**Eragrostis pectinacea* (Michx.) Nees. Along washes and in moist soil; occasional; summer annual.
- \**Eriochloa lemmonii* Vasey & Scribn. var. *gracilis* (Fourn.) Gould. Moist soil; rare; apparently recently adventive to our study area.
- Erioneuron pulchellum* (H.B.K.) Tateoka. Gravelly flats and rocky slopes; common.
- Heteropogon contortus* (L.) Beauv. Rocky slopes, ravines and roadways; common.
- Hilaria belangeri* (Steud.) Nash. Rocky, north-facing slopes and gravelly flats; occasional.
- Hilaria mutica* (Buckl.) Benth. Sandy flats and rocky slopes; locally common.
- \**Hordeum murinum* L. Disturbed sites, gravelly flats, and rocky slopes; common; introduced. Listed by Thornber only for the Santa Cruz River floodplain, but noted by Spalding (1909) to occur on Tumamoc Hill.



- \**Hordeum pusillum* Nutt. Gravelly flats, low-lying areas; locally common.
- Leptochloa filiformis* (Lam.) Beauv. Along washes, on rocky slopes and in moist soil at disturbed sites; common summer annual.
- Muhlenbergia microsperma* (DC.) Kunth. Rocky slopes and along washes; locally common spring annual.
- Muhlenbergia porteri* Scribn. Gravelly flats, typically growing among shrubs; common.
- Panicum arizonicum* Scribn. & Merr. Sandy flats and shallow washes; occasional; flowering in the summer.
- Panicum hirticaule* Presl. Disturbed sites; along roads and near buildings.
- Pappophorum vaginatum* Buckl. Along washes and on gravelly flats; locally common.
- \**Pennisetum ciliare* (L.) Link. Rocky slopes and disturbed sites, along roads and on sanitary landfill; locally common; introduced.
- \**Pennisetum setaceum* (Forssk.) Chiov. Disturbed sites, near buildings; an introduced ornamental common in cultivation in and around Tucson.
- \**Phalaris minor* Retz. Moist soil; local, at pond in sanitary landfill; introduced.
- \**Phragmites australis* (Cav.) Trin. ex Steud. Moist soil; rare; local, near booster pump on Anklam Road; apparently recently adventive to our study area.
- \**Poa bigelovii* Vasey & Scribn. Rocky slopes and gravelly flats; common spring annual.
- \**Polypogon monspeliensis* (L.) Desf. Moist soil; local, at pond in sanitary landfill; introduced; apparently recently adventive to our study area.
- \**Schismus arabicus* Nees. Rocky slopes and gravelly flats; common spring annual; introduced.
- \**Schismus barbatus* (L.) Thell. Rocky slopes and gravelly flats; common spring annual; introduced.
- \**Setaria liebmannii* Fourn. Rocky slopes; occasional; summer-flowering annual.
- \**Setaria macrostachya* H.B.K. Rocky slopes; occasional.
- \**Sitanion hystrix* (Nutt.) J. G. Smith. Rocky slopes; occasional.
- \**Sorghum halepense* (L.) Pers. Disturbed sites, moist soil; locally common; introduced; apparently recently adventive to our study area.
- \**Sporobolus airoides* Torr. var. *wrightii* (Munro ex Scribn.) Gould. Along washes; locally common; listed by Thornber only for the Santa Cruz River floodplain, but collected by F. Shreve in 1908 "near wash northwest of Desert Laboratory."

- \**Sporobolus contractus* Hitchc. Gravelly or sandy flats and rocky slopes; occasional.
- Sporobolus cryptandrus* (Torr.) Gray. Gravelly flats, low-lying areas; occasional.
- Trichachne californica* (Benth.) Chase. Rocky slopes and gravelly flats; common; flowering after summer rains.
- Tridens muticus* (Torr.) Nash. Rocky slopes; occasional.
- \**Trisetum interruptum* Buckl. Moist soil and at roadsides; uncommon.
- Vulpia octoflora* (Walt.) Rydb. Rocky slopes and gravelly flats; common spring annual.

### Typhaceae

- \**Typha domingensis* Pers. Moist soil; locally common along wet ditch, pond at clay quarry and below water tank.

### ACKNOWLEDGMENTS

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## ANNOUNCEMENT

Additional authors are sought for the revision of JEPSON'S MANUAL OF CALIFORNIA PLANTS. If you have expertise or particular interest in any of the groups listed below and are willing to contribute to this project, or know of those we might invite to participate, or would like more information, please write or call James C. Hickman, Botany Dept., Univ. of California, Berkeley, CA 94720, (415)642-2465.

Groups available: Apocynaceae; Aristolochiaceae; Asclepiadaceae; Asteraceae (some genera); Betulaceae; Boraginaceae (esp. *Cryptantha*, *Hackelia*, *Plagiobothrys*); Cactaceae; Callitrichaceae; Capparidaceae; Caprifoliaceae; Convolvulaceae; Crassulaceae (esp. *Sedum*); Elatinaceae; Garryaceae; Gentianaceae; Haloragaceae; Hydrophyllaceae (esp. *Phacelia*); Hypericaceae; Lamiaceae (esp. *Monardella*, *Scutellaria*, *Stachys*); Polygalaceae; Portulacaceae (esp. *Calyptridium*, *Lewisia*); Resedaceae; Rhamnaceae (esp. *Ceanothus*, *Rhamnus*); Salicaceae (*Populus*); Sterculiaceae; Urticaceae; Verbenaceae; Violaceae; Vitaceae; Liliaceae (esp. *Brodiaea* [+*Dichelostemma*, *Triteleia*], *Erythronium*, *Fritillaria*, *Lilium*, *Yucca*, *Zigadenus*); Poaceae (some genera).