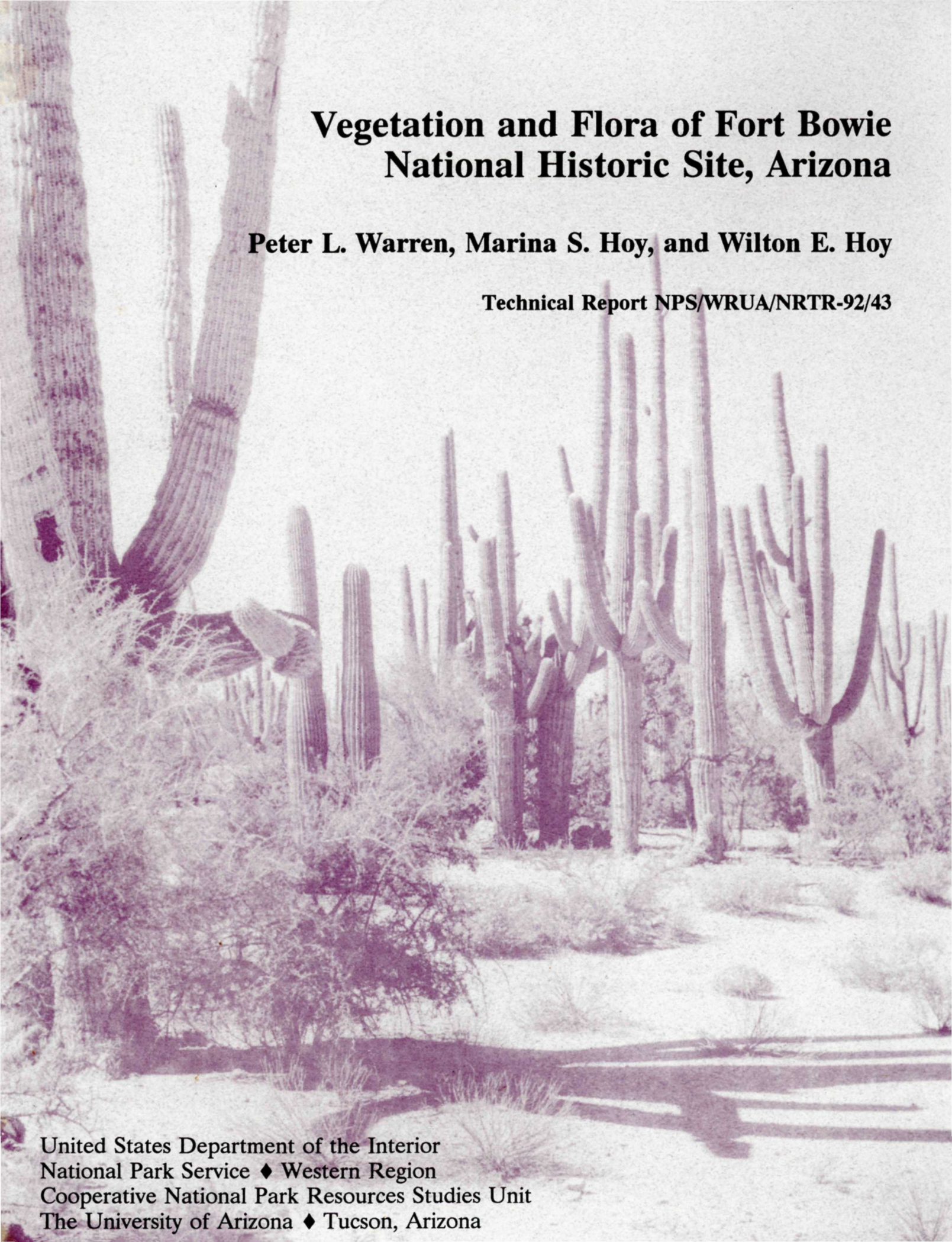


Vegetation and Flora of Fort Bowie National Historic Site, Arizona

Peter L. Warren, Marina S. Hoy, and Wilton E. Hoy

Technical Report NPS/WRUA/NRTR-92/43

United States Department of the Interior
National Park Service ♦ Western Region
Cooperative National Park Resources Studies Unit
The University of Arizona ♦ Tucson, Arizona



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March 1992

National Park Service
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ABSTRACT

The variety of plant species and vegetation associations found at Fort Bowie National Historic Site is influenced by the complex geology of the area. Eleven vegetation associations, ranging from desertscrub to oak woodland, are found in the area, with associations characteristic of the Apachean floristic region on granite and associations of Chihuahuan affinities on limestone. A total of 470 species and subspecies of plants representing 277 genera and 76 families have been identified in the area. This is approximately 50% more species than would be expected in an area of this topographic relief. The relatively high species diversity can be attributed to the geology, and to the presence of mesic riparian habitat with perennial water at springs.

INTRODUCTION

Fort Bowie National Historic Site (FOBO) was authorized as a unit of the National Park Service (NPS) on August 30, 1964, and formally established on July 28, 1972, for the protection and interpretation of fort ruins. The historic site was established also to commemorate the Butterfield Overland Trail and Stage Station, the fort's soldiers, and the Chiricahua Apache Indians. The Fort Bowie Master Plan (NPS 1975) provides a brief summary of the development policy:

> Fort Bowie National Historic Site provides a matchless opportunity to interpret the genesis, growth and eventual decline of a southwestern frontier settlement during the last half of the 1800s. A classic western military outpost situated in the heartland of the Chiricahua Apaches, Fort Bowie bore witness to the tragic clash of cultures that characterized America's western expansion.
>
> Much of the land surrounding the site of this early outpost remains as it appeared during the height of the fort's historic period a century ago. The surviving natural and historic resources lend themselves to preservation in a primitive state—not to modern restoration or reconstruction.

The historic site, consisting of 405 ha (1,000 a), is located in Apache Pass, between the Chiricahua Mountains to the south and the Dos Cabezas Mountains to the north (Fig. 1). Apache Pass also separates the San Simon Valley to the northeast from the Sulphur Springs Valley to the southwest. Elevations within the historic site range from 1,400 m (4,550 ft) in lower Siphon Canyon to 1,600 m (5,250 ft) in upper Apache Pass southwest of the cemetery.

The purpose of this study was to describe and map the vegetation of FOBO and to catalogue the vascular flora of the historic site. Fort Bowie National Historic Site is located at the northwestern edge, and at the upper elevational extremes, of the Chihuahuan Desert. The historic site is located in a region of complex intermingling of floristic elements from the Chihuahuan Desert, Madrean evergreen woodlands, and semi-desert grassland. Desert species such as creosote-bush (*Larrea tridentata*) and velvet mesquite (*Prosopis velutina*) are found at the lower, warmer elevations, but in many locations they are found in mixed stands codominant with various grasses including sideoats grama (*Bouteloua curtipendula*), hairy grama (*B. hirsuta*), and tanglehead (*Heteropogon contorta*). The higher slopes support a mixture of chaparral and woodland characterized by shrubs such as point-leaf manzanita (*Arctostaphylos pungens*), alder-leaf mountain-mahogany (*Cercocarpus montanus*), and scrub oak (*Quercus turbinella*), and trees such as oaks (*Quercus* spp.), Mexican pinyon pines (*Pinus discolor*), and junipers (*Juniperus* spp.). The canyon bottoms support a riparian woodland characterized by velvet ash (*Fraxinus velutina*) and netleaf hackberry (*Celtis reticulata*). This mix of vegetation types provides habitat for an equally diverse wildlife fauna (Cockrum et al. 1976).

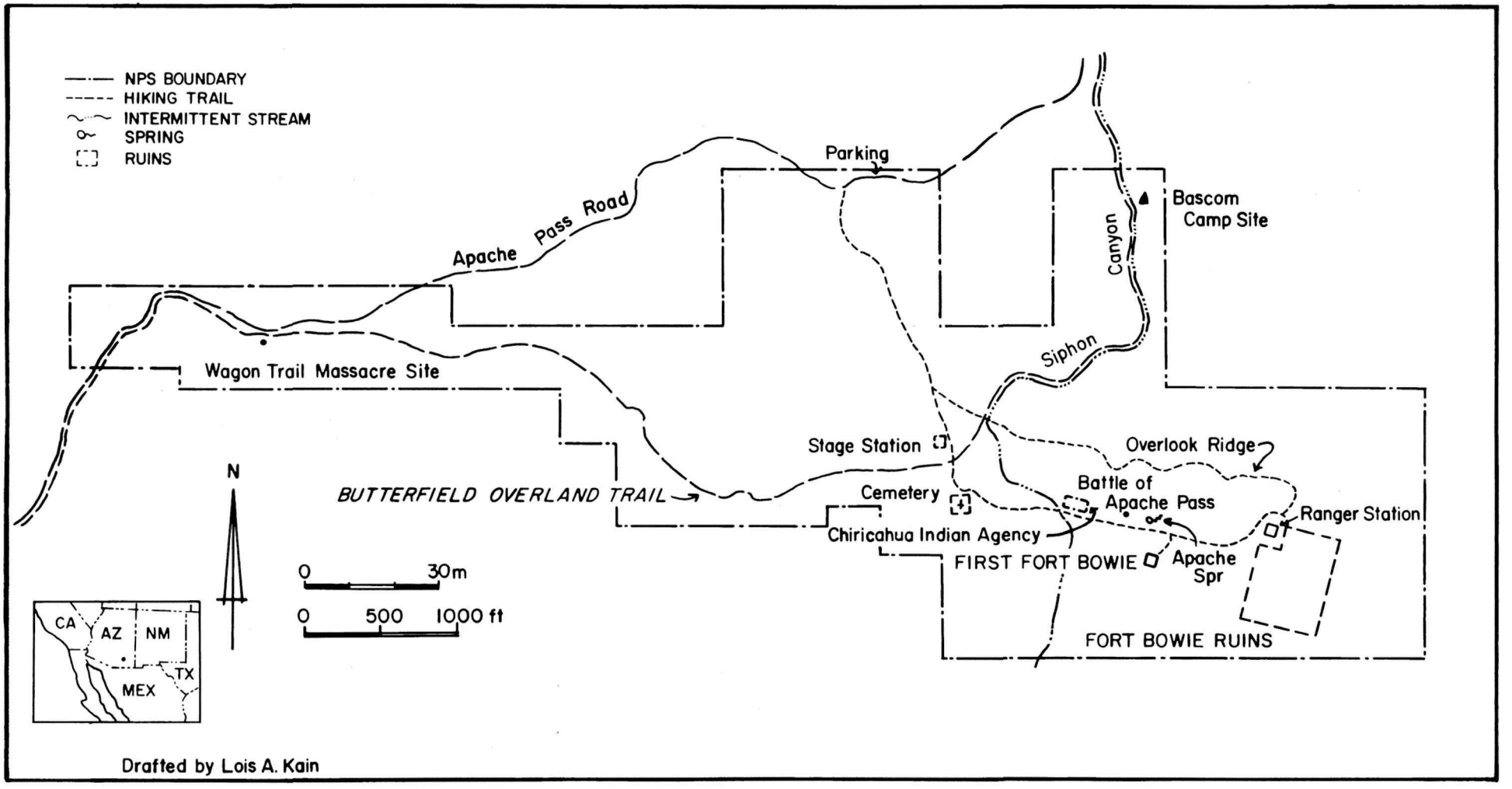


Figure 1. Map of Fort Bowie National Historic Site, Arizona, and its location.

APACHE PASS AND FORT BOWIE: THE HUMAN STORY

> We followed the bed of a dry arroya where there was scarcely room for the wagon wheels, let alone room for the driver. The road was overshadowed by handsome trees among which I noticed the pecans, ash, willow, etc. (Robert Eccleston, immigrant in Apache Pass, 1849).

It was the rich natural setting of a mountain corridor called Apache Pass and the nearby water source, Apache Spring, that attracted a procession of inhabitants and passersby: Indian, Mexican, and American. With the American acquisition of the Gadsden Purchase from Mexico in 1853-1854, Apache Pass began to serve as a crossroad for emigrants, miners, surveyors, and soldiers. In 1858, the Butterfield Overland Mail established a station at Apache Pass and improved the Apache Pass road, but antagonism between Americans and Chiricahua Apaches interfered with "civilizing" the area (Murray 1951). In August 1862, atop a hill near Apache Spring, a small fort named Fort Bowie after regimental commander George Washington Bowie was established.

From 1861 to 1872 the "Cochise War" against the Apaches raged. During 1868-1870, the American soldiers abandoned the original location and established a new, enlarged fort at its present site. In the 1870s, Fort Bowie's mission was expanded to fighting Indians throughout southeastern Arizona, southwestern New Mexico, and northern Chihuahua and Sonora, Mexico. Although a peace agreement was reached in 1872 and the Chiricahua Apaches were given a reservation, outbreaks of fighting and war continued. Cochise died in 1874, but other Chiricahuas continued the resistance. The final campaign of the Apache War, that against the Geronimo band, operated largely out of Fort Bowie (Bourke 1891). The Geronimo band of 38 men, women and children surrendered in 1886, ending 25 years of war between the Chiricahua Apache Indians and American soldiers (Debo 1976). In 1894, Fort Bowie was abandoned.

After Fort Bowie

During and after the Fort Bowie years, solitary miners and prospectors sporadically picked at claims within the pass, such as those in Willow Canyon and the Bowie Peak-Helen's Dome massif. In 1911, the 15.5-km^2 (6-mi^2) military reservation was auctioned to ranchers. After the fort closed, the grasslands and water resources of Apache Pass were used as open rangeland, a less intensive use than the area experienced during the period of military occupation.

In 1964, Congress authorized FOBO as a unit of NPS to commemorate the two forts, the American soldiers, the Chiricahua Apache Indians, and the Butterfield Overland Trail and stage station. The development theme is characterized by "abandonment and wildness." Visitor access to the ruins is by a 2.4-km (1.5-mi) foot trail, and no public vehicular access is available or presently contemplated.

Pursuant to legislative commitment, public land grazing has been allowed to continue since establishment of FOBO. Grazing is managed by NPS and administered by the Bureau of Land Management. Since 1967, fences around the first and second forts and the cemetery have excluded cattle from the fragile ruins and headstones.

Historic Impacts

Historic photographs show evidence of disturbance and changes in the natural vegetation of FOBO since its origin as a fort (Fig. 2). Although the once dusty fort grounds and old roads are scarcely visible today, old stumps of juniper up to 1.2 m (4 ft) in diameter, as well as oak and pinyon pine are conspicuous on Bowie Peak and other hills. The effects of woodcutting in the Fort Bowie area were probably similar to those experienced by other parts of southeast Arizona in the late 1800s (Bahre and Hutchinson 1985). Old photographs show stacks of wood and hay bales. Horses and cattle have been grazed in the vicinity for more than 125 years. In early photographs, grasses and small shrubs appear to have provided more or less continuous ground cover on rocky, lower slopes. The woody vegetation of the foothills, as it appears in these photographs, formed savanna-like stands on gentle slopes, and a mixture of woodland and chaparral along draws and steep north-facing slopes.

CLIMATE

> Climate mild, generally warm during summer months; and occasional fall of snow during the winter; average temperature 62.27 degrees thermometer; 55.39 degrees hygrometer (Capt. Ruben Bernard, Fort Bowie Commander, 1872).

The climate of the Apache Pass region is mild; the average annual temperature is 15.6°C (60°F). The highest recorded temperature at FOBO was 41.1°C (106°F) in June 1974. The lowest recorded temperature was -15°C (5°F) taken in February 1971. July is usually the warmest month, with an average temperature of 25.6°C (78°F), and January is the coldest, averaging 7.0°C (44.6°F). Weather records were kept during the period of military occupation in the 1800s; recent weather records began in 1970.

Precipitation occurs in two distinct seasons. Winter rains, typically bringing gentle precipitation from the Pacific Ocean, usually arrive in December or early January and continue sporadically into March. Summer convectional rains, consisting of brief, local, intense showers accompanied by thunder and lighting, come from the Gulf of Mexico. These summer showers usually begin in early July and continue into September and comprise the highest percentage of yearly precipitation. Average annual rainfall at FOBO, based on records from 1970-1977, is 312 mm (12.3 in). The wettest year on record was 1971 with 579 mm (22.8 in.), and the driest year was 1973 with 197 mm (7.76 in.) of precipitation.

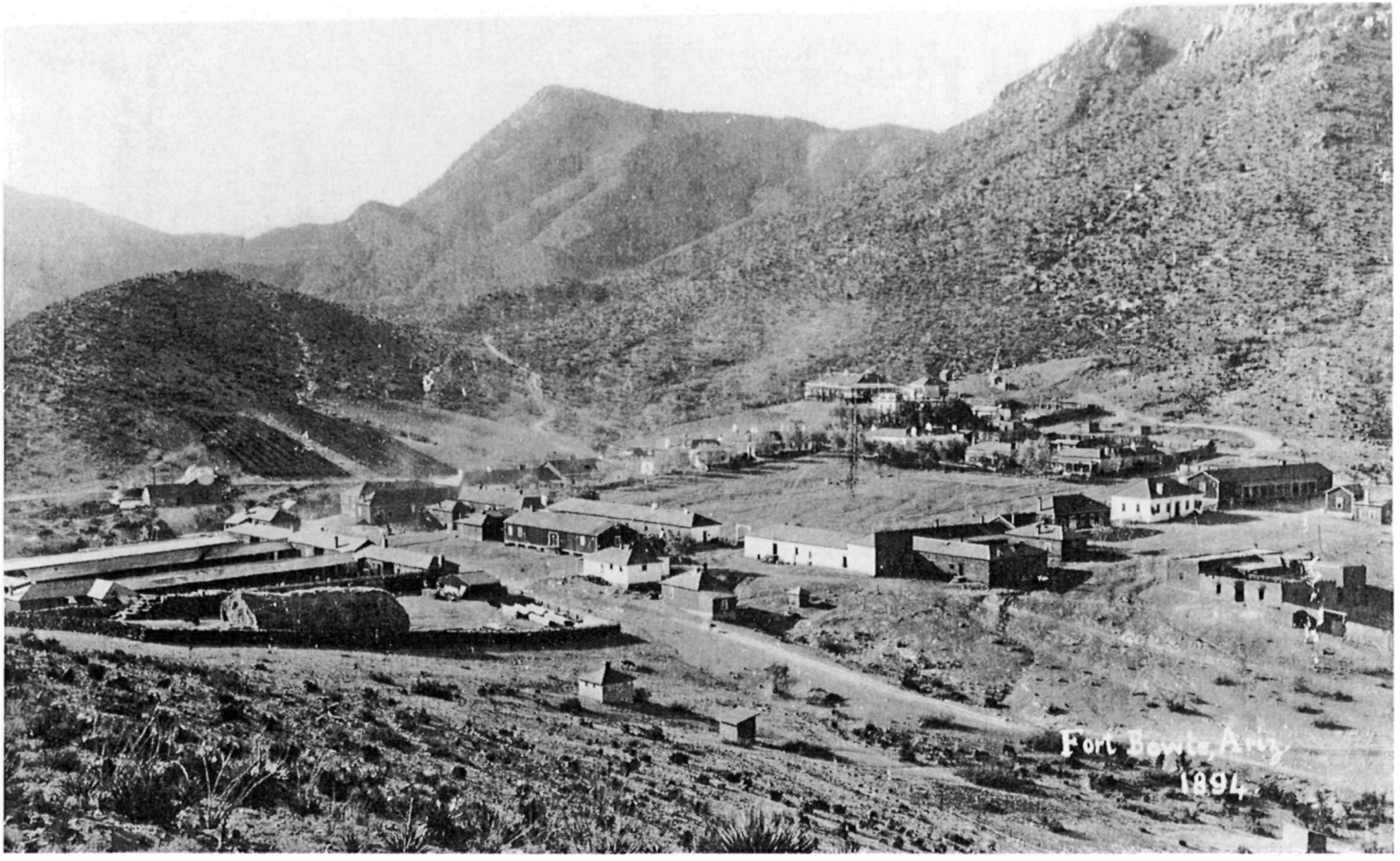


Figure 2. Looking from Overlook Ridge to the southeast across Fort Bowie, Arizona Territory, 1894. Note the large piles of cordwood to the left rear.

Table 1 is a comparison of weather records from Fort Bowie during 1870-1874 and 1970-1974. Maximum and minimum temperatures remained relatively similar, but precipitation was slightly higher in the 1870s compared to a similar period 100 years later.

Table 1. Average monthly temperature in degrees Fahrenheit and precipitation in inches from 1870-1874 and 1970-1974 at Fort Bowie National Historic Site (FOBO), Arizona. (Records from FOBO files.)

	Temperature (F)				Precipitation (in.)	
	1870-74		1970-74			
	Max.	Min.	Max.	Min.	1870-74	1970-74
Jul	96.5	67.2	98.2	56.7	3.64	2.26
Aug	94.7	64.5	96.2	54.2	4.35	3.54
Sep	94.2	59.7	93.2	46.2	0.69	0.93
Oct	89.5	39.5	88.7	34.7	0.18	1.70
Nov	76.5	34.0	78.5	27.2	0.31	0.44
Dec	72.0	26.2	70.7	19.0	1.24	1.00
Jan	67.0	18.2	72.0	16.2	0.58	0.85
Feb	68.5	28.0	73.5	16.0	1.64	0.69
Mar	79.5	33.5	81.2	27.7	0.93	0.76
Apr	84.7	33.0	84.7	32.7	0.15	0.00
May	96.5	52.0	91.7	41.5	0.36	0.46
Jun	100.7	64.2	101.7	52.5	0.44	0.24
Annual	85.0	43.3	85.9	35.4	14.51	12.87

GEOLOGY

> The Fort Bowie ruins are on a northwest-trending overthrust block of Horquilla Limestone that was folded after being overthrust. The folded thrust is separated from the Rattlesnake Point Granite of Sabins (1957) to the southwest by the Apache Pass fault. . . (E. S. Davidson 1965, U.S. Geological Survey unpubl. report to NPS, on file at FOBO.)

The Chiricahua and Dos Cabezas mountains are located within the Mexican Highland portion of the Basin and Range Province. The 5-km (3-mi) corridor of Apache Pass

divides the two ranges. However, because the ranges on either side of the pass are geologically similar (Sabins 1957a), this is a separation in name only.

The vegetation patterns seen at FOBO are strongly influenced by geology in general respects. The major geologic feature of the area is Apache Pass Fault, which runs from southeast to northwest through the historic site. This fault provides the fissure that brings the water of Apache Spring and Siphon Spring to the surface, creating the rich riparian vegetation along Siphon Canyon. Vegetation associations are also determined by the type of bedrock on which they are found. Two major types of rock are found in the area. These are granite, on which are found vegetation types characteristic of the Apachean province (McLaughlin 1986), and limestone, on which vegetation with Chihuahuan Desert affinities prevail.

The western section of the historic site consists of coarse, nonfoliated Rattlesnake Point granite of Precambrian age (Sabins 1957b). East of Apache Spring and east of Apache Pass Fault, on which the spring lies, the geology within the ruins area consists of Pennsylvanian-age Horquilla Limestone, which contains chert and a variety of fossils. East of the second fort are exposed strata of the middle and upper Bisbee Group consisting of reddish-purple siltstone.

WATER SOURCES

No perennially flowing streams exist within Apache Pass; however, during heavy summer rains, ephemeral streams may carry substantial runoff for a brief time. Three major springs flow within the Apache Pass area: Apache Spring, located 0.4 km (0.25 mi) west of the second fort ruins; Goodwin Spring, in Goodwin Canyon on the north side of the pass; and Bear Spring, in Bear Canyon, southeast of the fort ruins. Four or five small intermittent springs are also present in the pass area. Apache Spring is located on Apache Pass Fault, which separates Rattlesnake Point Granite from the overthrust plate of Horquilla Limestone (Sabins 1957b).

During the occupation of the fort, Bear Spring supplied the garrison water at 80,000 l/day (21,103 gal/day). During the drought of 1892-1893 the water supply dwindled, forcing the garrison to find and utilize a different water source. At present, the spring is intermittent.

METHODS

The classification of vegetation into associations was made based on a series of 36 reconnaissance site samples. Sample locations were selected to represent uniform stands of characteristic vegetation associations observed in the field. They were also selected to include a representative sample from all of the major geologic and topographic settings on the historic site. At each sample location a complete species list was made of perennial plants within the stand. Each sample included approximately 0.4 ha (1 a).

A modified Braun-Blanquet (Westhoff and Van der Maarel 1973) method was used in which all species were assigned a prominence rank at the site ranging from 1 to 5 ("1" is the rarest and "5" is the most abundant). A rank of 5 indicates a single dominant where one species is clearly the most abundant in a stand and no other species shares codominance. A rank of 4 indicates those species that share codominance at a site and which are distributed commonly and uniformly throughout the stand. A rank of 3 indicates species that are characteristic, widespread, and uniformly scattered throughout a stand. A rank of 2 indicates species that are uncommon, and are represented by only a few individuals at a site. A rank of 1 indicates a species that is rare at a site and may be represented by a single individual in the sample area (Warren et al. 1982).

Site data were sorted manually into groups that were judged to be floristically similar based on shared dominant species and that shared landform distribution characteristics (Van der Muelen et al. 1978). In some associations, some species may be locally dominant but have a distribution that is patchy, especially in the case of some perennial grasses such as black grama (*Bouteloua eripoda*) that spread vegetatively to form clumps. In some mixed grass/shrub associations such clumping is commonly observed within the type, so the type description is based in large part on the more consistent distribution of associated species, rather than on species that may be abundant at a few sites, but unpredictable throughout the association.

FLORA

The following checklist of vascular plants of FOBO is based primarily upon 5 years of field work by Marina and Bill Hoy between 1972 and 1977, with some additional observations of species distribution made during field work for preparation of the vegetation map in 1987. Collection numbers, indicated by parentheses in the checklist, refer to specimens collected by M. Hoy during her residence at FOBO and that are deposited at FOBO with duplicates of selected species at The University of Arizona.

The historic site has a relatively rich flora for an area of its small size and limited topographical relief. A total of 471 species and subspecies in 274 genera, representing 75 families of vascular plants, has been identified in the area. Based on the correlation developed by Bowers and McLaughlin (1982) between plant species diversity and site variables, the observed flora is approximately 50% larger than the roughly 330 species that would be expected based on the elevation range and collecting history for the area. The historic site covers an area of approximately 4.4 km (2.75 mi) long by an average of less than 0.8 km (0.5 mi) wide, totalling approximately 405 ha (1000 a). The elevational span at the historic site is just 210 m (700 ft), extending from 1,390 m (4,550 ft) up to 1,600 m (5,250 ft) elevation.

There are 3 major reasons for the diverse flora at FOBO. Most important is the variety of geologic substrates including limestone, granitic, and metamorphic rock. Second, the presence of permanent water and a mesic riparian canyon provides habitat for several species that would not otherwise occur there. And finally, as Bowers and McLaughlin (1982) pointed out, local floras derived from the Madrean biogeographic region are intrinsically more floristically diverse than are those from other regions of Arizona.

Fort Bowie National Historic Site is centrally located in the Apachean floristic region described by McLaughlin (1986). The FOBO flora is similar to other local floras studied in the mountains of southeastern Arizona and adjacent New Mexico that fall within this region (Reeves 1976; Moir 1979; Wentworth 1982). For example, the FOBO flora shares 80% of its plant species with the Rincon Mountain flora (Bowers and McLaughlin 1987) which is located 3 mountain ranges and 80 mi to the west. This suggests a fairly high degree of floristic similarity among widely separated sites within the Apachean region.

Although the geographic affinities of the FOBO flora are clearly with the Apachean region, a number of species represent the Chihuahuan and Great Plains regions as well. Among the 20% of the FOBO flora that is not found in the Rincon Mountains, many of the species have affinities with these two regions. Species with primarily Chihuahuan distribution, particularly those found on limestone at FOBO, include groundsel-tree (*Baccharis bigelovii*), tar-bush (*Flourensia cernua*), stick-seed (*Lappula redowskii*), desert sumac (*Rhus microphylla*), milk-wort (*Polygala racemosa*), globe mallow (*Sphaeralcea subhastata*), *Salvia henryi*, and *Sanvitalia abertii*.

Several plants found at FOBO are of special interest due to their limited distribution. *Plummera floribunda* is a composite whose original type specimen was collected at Apache Pass by J. G. Lemmon in 1881. It is known only from 3 mountain ranges in southeastern Arizona. Two other species known only from the mountains of southeastern Arizona, although both have ranges larger than the *Plummera*, are Leding hedgehog (*Echinocereus ledingii*) and groundsel (*Senecio quercetorum*).

We found 24 introduced plant species at FOBO, comprising approximately 5% of the flora. This is a somewhat low percentage for introduced species than has been found in other floras in Arizona (Felger et al. 1992). Introduced plants have been found to contribute from 2 to 16% of the flora in parts of the Sonoran Desert region, averaging approximately 10%. Very likely, the low proportion of non-native plants at FOBO can be attributed to the fact that FOBO's occupation occurred before many non-native species that are now common were introduced to the Southwest.

The nomenclature used for the checklist follows Kartesz and Kartesz (1980). Where appropriate, synonyms are provided for names used by more readily available Arizona references such as Kearney and Peebles (1960), Lehr (1978), Benson (1974) and Gould (1981). Common names largely follow Lehr (1978). The checklist of plants is arranged alphabetically by family, genus, and species. The annotation provided for each species includes scientific name and synonymy, common name(s) if any, and brief notes about the abundance and distribution of each species. The notes generally include 3 parts separated by a semicolon. First, is abundance described as common, occasional, uncommon or rare; second, the microhabitat(s) where the species is found; and third, the broader distribution of each species indicated by the plant association(s) in which it is most commonly found. If a species is found in all of the associations on the historic site, its distribution is described as widespread.

VEGETATION

Survey of the vegetation of FOBO has revealed the presence of 11 associations (Table 2). Most of these associations (or types) represent transitional conditions between more widely distributed vegetation communities. For example, 4 of the types are a mixture of chaparral and woodland species, and 5 of the types are various combinations of desertscrub and grassland elements. Figure 3 is the map of plant associations for FOBO.

The complex geology and long history of human disturbance in the area contribute to the difficulty of interpreting vegetation associations at FOBO. In many of the vegetation types, the dominant species are weedy invasive species such as velvet mesquite and burro-weed (*Isocoma tenuisecta*). Disturbance is particularly noticeable on level locations with good soil development where high grass cover would be expected at this altitude. Instead, perennial grasses may be quite sparse, the dominants are weedy shrubs, and erosion of the soil surface is evident.

It is no coincidence that the historic site is located in an area of geologic complexity. The fault running through FOBO is the source of the spring that has been the focus of human activity there for many decades. In several locations plant associations change abruptly across the fault as the transition is made from granitic rocks on the west side to limestone rocks on the east. The variety of vegetation associations at FOBO is emphasized by comparison with Coronado National Memorial (CORO) (Ruffner and Johnson 1991). At CORO, which spans 1,900 ha (4,750 a) and 825 m (2,680 ft) in elevation, 4 associations were identified, compared to 11 associations at FOBO in an area of 405 ha (1,000 a) and 210 m (700 ft) elevation relief.

Table 2. Plant associations of Fort Bowie National Historic Site (FOBO), Arizona, with numerical classification following Brown et al. (1979; see also Brown 1982).

Fort Bowie National Historic Site Vegetation associations	Brown et al. 1982 Classification no.
Riparian Associations:	
1. Arizona Walnut—Netleaf Hackberry—Gum Bumelia (*Juglans major—Celtis reticulata—Bumelia lanuginosa*)	223.225
Woodland/Chaparral Associations:	
2. Emory Oak—Point-leaf Manzanita—Beargrass (*Quercus emoryi—Arctostaphylos pungens—Nolina microcarpa*)	123.313[a]
3. Emory Oak—Turpentine-bush—Grama Grass (*Quercus emoryi—Ericameria laricifolia—Bouteloua* spp.)	123.313[a]
4. Scrub Oak—Beargrass—One-seed Juniper (*Quercus turbinella—Nolina microcarpa—Juniperus monosperma*)	133.314
5. Desert Deerbrush—Alder-leaf Mountain-mahogany—Desert Sumac (*Ceanothus greggii—Cercocarpus montanus—Rhus microphylla*)	133.332
Shrub/Grassland Associations:	
6. Velvet Mesquite—Turpentine-bush—Burro-weed (*Prosopis velutina—Ericameria laricifolia—Isocoma tenuisecta*)	143.165
7. Turpentine-bush—Fairy Duster—Ocotillo (*Ericameria laricifolia—Calliandra eriophylla—Fouquieria splendens*)	143.155
8. Ocotillo—Mariola—Grama Grass (*Fouquieria splendens—Parthenium incanum—Bouteloua* spp.)	143.154[a]
9. Velvet Mesquite—Desert Sumac—Snakeweed (*Prosopis velutina—Rhus microphylla—Gutierrezia sarothrae*)	143.154[a]
10. Russian Thistle—Snakeweed—Mixed Grass (*Salsola iberica—Gutierrezia sarothrae*—Mixed Grass)	143.165
Desertscrub Associations:	
11. Creosote-bush—Velvet Mesquite—Mariola (*Larrea tridentata—Prosopis velutina—Parthenium incanum*)	153.212

[a] These types described at FOBO fall floristically into the same Brown et al. association categories, and so could be considered sub-associations.

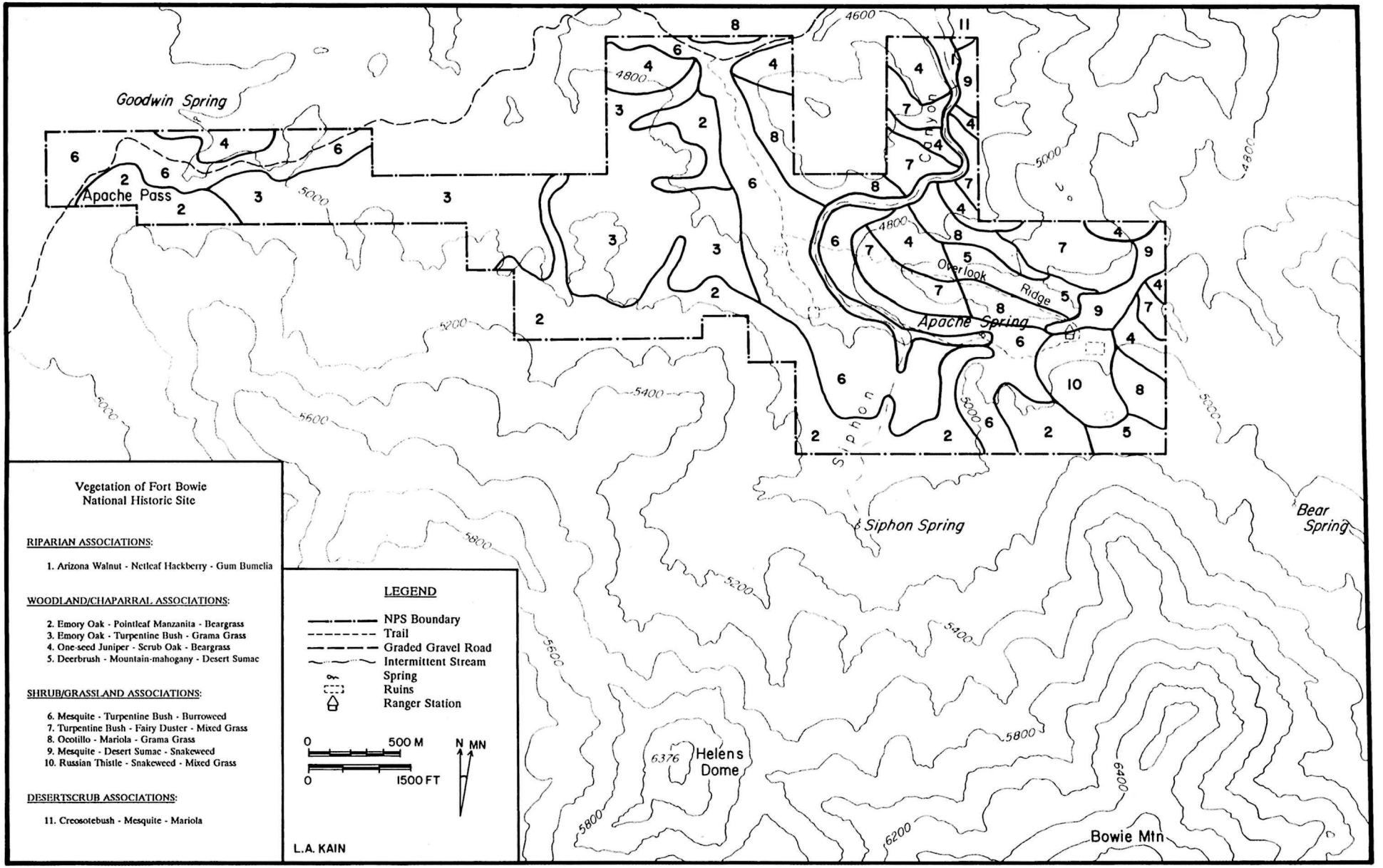


Figure 3. Map of the vegetation of Fort Bowie National Historic Site, Arizona.

PLANT ASSOCIATION DESCRIPTIONS

1. Arizona Walnut—Netleaf Hackberry—Gum Bumelia Association

   (*Juglans major—Celtis reticulata—Bumelia lanuginosa*)

Description: This type is a mixed-broadleaf deciduous woodland with a more-or-less continuous closed canopy that occurs in linear corridors along intermittent stream courses (Figs. 4 and 5). The canopy is generally 9.1 to 12.2 m (30 to 40 ft) in height, with an overstory of deciduous trees of varying sizes and a shrub understory. Canyon grape is a codominant whose tangled vines occasionally bind the trees and shrubs together into dense thickets. Distribution of the common species is patchy, with the dominants shifting from site to site along the stream corridor. In the upper, more open portions of Siphon Canyon, the tree canopy is more open and broken than in the narrower lower portions where tree cover is relatively continuous.

Floristics: (3 sample sites)

Dominants and codominants:

Arizona Walnut	*Juglans major*
Netleaf Hackberry	*Celtis reticulata*
Gum Bumelia	*Bumelia lanuginosa*
Velvet Ash	*Fraxinus velutina*
Canyon Grape	*Vitis arizonica*
Desert-willow	*Chilopsis linearis*

Other Common Associates:

Velvet Mesquite	*Prosopis velutina*
Desert Sumac	*Rhus microphylla*
Soapberry	*Sapindus drummondii*
Seep-willow	*Baccharis salicifolia*
Turpentine-bush	*Ericameria laricifolia*
Catclaw Mimosa	*Mimosa biuncifera*
One-seed Juniper	*Juniperus erythrocarpa*
Clammy-weed	*Polanisia dodecandra*

Distinguishing features: This association differs from other mixed-broadleaf riparian forests by the presence of gum bumelia, a tree that has limited distribution in Arizona, and the absence of Arizona sycamore, a tree that is common in most similar types.

Distribution: This type is found along Siphon Canyon from Siphon Spring, at 1,490 m (4,900 ft) down to the FOBO boundary at 1,400 m (4,600 ft). It occurs on sandy alluvium of the canyon bottom.



Figure 4. Riparian woodland at Apache Spring, Fort Bowie National Historic Site, Arizona. Perennial subsurface water supports the dense growth of velvet ash (*Fraxinus velutina*) and Arizona walnut (*Juglans major*).

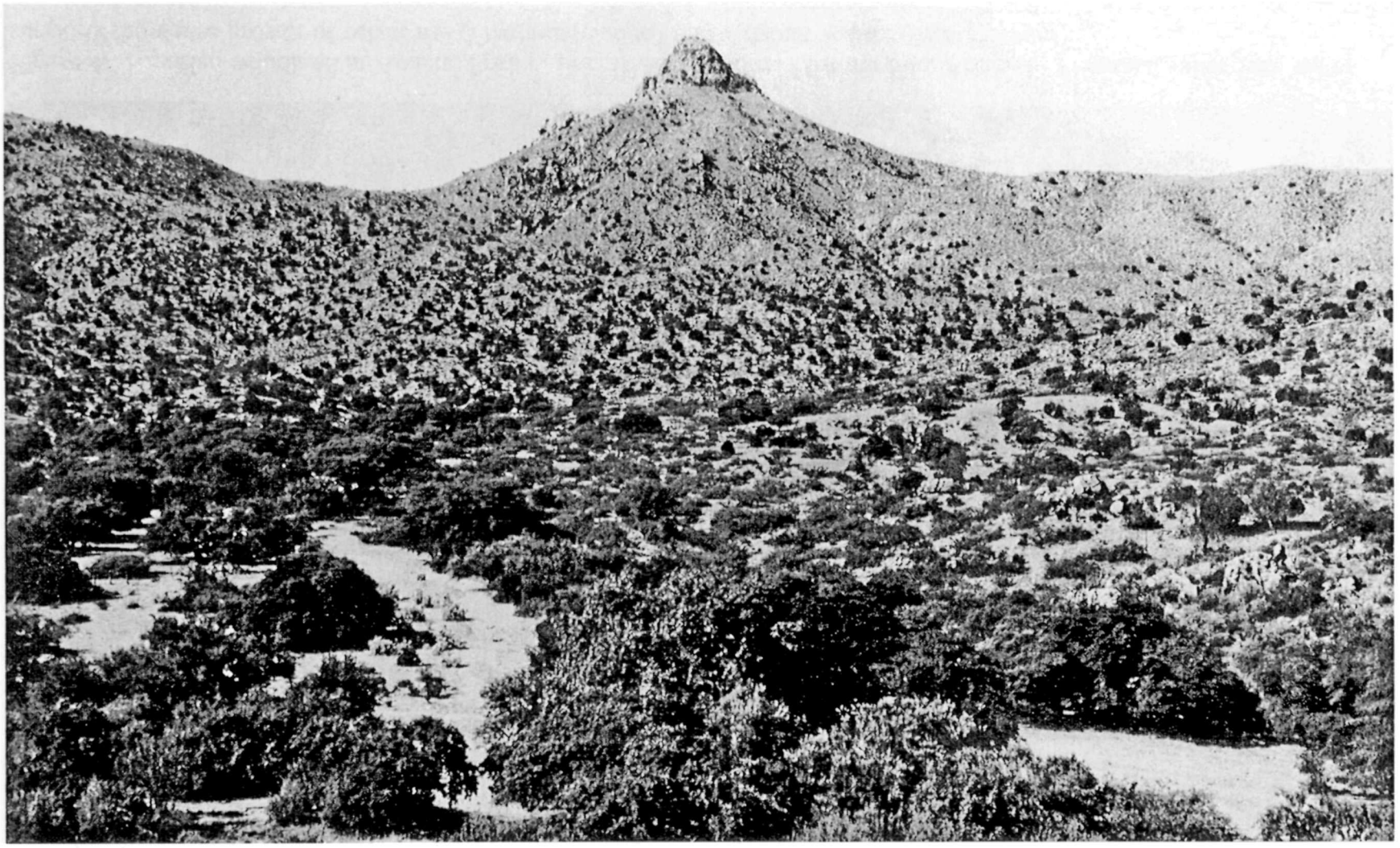


Figure 5. Looking south across Siphon Canyon to Helen's Dome, Fort Bowie National Historic Site, Arizona. The Arizona Walnut–Netleaf Hackberry–Gum Bumelia (*Juglans major–Celtis reticulata–Bumelia lanuginosa*) riparian woodland occurs as a narrow corridor along the drainage bottom. This is one of the few sites in Arizona where gum bumelia occurs as a codominant in riparian woodlands.

2. Emory Oak—Point-leaf Manzanita—Beargrass Association

(*Quercus emoryi—Arctostaphylos pungens—Nolina microcarpa*)

Description: This type has an open overstory of small evergreen trees whose cover may range from 10 to 20% and a relatively dense understory of evergreen sclerophyllous shrubs that may have 20 to 40% cover (Fig. 6). Height of the shrubs is 0.9 to 1.8 m (3 to 6 ft) and of the trees is 3 to 6 m (10 to 20 ft). The herbaceous component of the understory is variable, but may be abundant in some areas with numerous beargrass and bullgrass. This type is equivalent to the *Quercus emoryi/Arctostaphylos pungens* type (6W) identified by the U.S. Forest Service (USFS) (1987).

Floristics: (6 sample sites)

Dominants and Codominants:

Emory Oak	*Quercus emoryi*
Point-leaf Manzanita	*Arctostaphylos pungens*
Beargrass	*Nolina microcarpa*
Scrub Oak	*Quercus turbinella*
One-seed Juniper	*Juniperus erythrocarpa*

Other Common Associates:

Banana Yucca	*Yucca baccata*
Silk Tassel	*Garrya wrightii*
Turpentine-bush	*Ericameria laricifolia*
Cane Cholla	*Opuntia spinosior*
Bullgrass	*Muhlenbergia emersleyi*
Wild Buckwheat	*Eriogonum wrightii*
Hairy Grama	*Bouteloua hirsuta*
Sotol	*Dasylirion wheeleri*
Catclaw Mimosa	*Mimosa biuncifera*
Palmer Agave	*Agave palmeri*

Distinguishing Features: This type shares many species with other similar woodland/ chaparral associations in the area. It differs from the Emory Oak—Turpentine-bush—Grama Grass savanna association by the higher total cover of woody species, greater shrub diversity and lower grass abundance. It differs from the Scrub Oak—Beargrass—One-seed Juniper association in the abundance of point-leaf manzanita and Emory oak, and the relative absence of desert deerbrush.

Distribution: This type is found on moderately steep north-facing slopes above 1,520 m (5,000 ft) elevation, although it rarely extends down to 1,460 m (4,800 ft). The substrate on which it occurs is generally igneous or metamorphic rock with very shallow, rocky soil. This is the most mesic upland association on the historic site, and it occurs up to the highest point at FOBO.



Figure 6. Emory Oak–Point-leaf Manzanita–Beargrass (*Quercus emoryi–Arctostaphylos pungens–Nolina microcarpa*) woodland, characteristic of steep north-facing slopes with granitic soils at Fort Bowie National Historic Site, Arizona. Some of the characteristic species visible include banana yucca (*Yucca baccata*), beargrass (*Nolina microcarpa*), and Palmer agave (*Agave palmeri*). The bright, feathery flowering stalks of bullgrass (*Muhlenbergia emersleyi*), a common perennial bunchgrass, can be seen scattered across the hillside.

3.Emory Oak—Turpentine-bush—Grama Grass Association

(*Quercus emoryi—Ericameria laricifolia—Bouteloua* spp.)

Description: This type is an open savanna with cover of scattered trees and shrubs totalling 10 to 20% cover and a diverse herbaceous stratum dominated by perennial grasses with 20 to 40% cover (Figs. 7 and 8). Cacti, especially *Opuntia*, are common. Within this type, in swales and drainages, sclerophyllous chaparral shrubs may be locally more common. This type is equivalent to the *Quercus emoryi/Dasilirion wheeleri* type (8W) identified by USFS (1987).

Floristics: (1 sample site)

Dominants and Codominants:

Emory Oak	*Quercus emoryi*
Turpentine-bush	*Ericameria laricifolia*
Beargrass	*Nolina microcarpa*
Hairy Grama	*Bouteloua hirsuta*
Tanglehead	*Heteropogon contortus*
Bullgrass	*Muhlenbergia emersleyi*
Alligator Juniper	*Juniperus deppeana*

Other Common Associates:

Sideoats Grama	*Bouteloua curtipendula*
Spruce-top Grama	*B. chondrosioides*
Black Grama	*B. eriopoda*
Engelmann Prickly-pear	*Opuntia phaeacantha*
Cane Cholla	*Opuntia spinosior*
Wild Buckwheat	*Eriogonum wrightii*
Sotol	*Dasylirion wheeleri*
Rainbow Cactus	*Echinocereus pectinatus*
Point-leaf Manzanita	*Arctostaphylos pungens*

Distinguishing Features: This type is an open savanna woodland with relatively low shrub diversity and a well developed herbaceous stratum. It differs from the shrub/grass associations by the presence of an open tree stratum, and from the woodland types by its sparse woody cover and relatively high perennial grass cover.

Distribution: Throughout the western and central parts of the historic site between 1,430 m (4,700 ft) and 1,550 m (5,100 ft) elevation on gently rolling terrain with slopes up to 30%. The substrate is very rocky, usually with igneous or metamorphic parent rock.

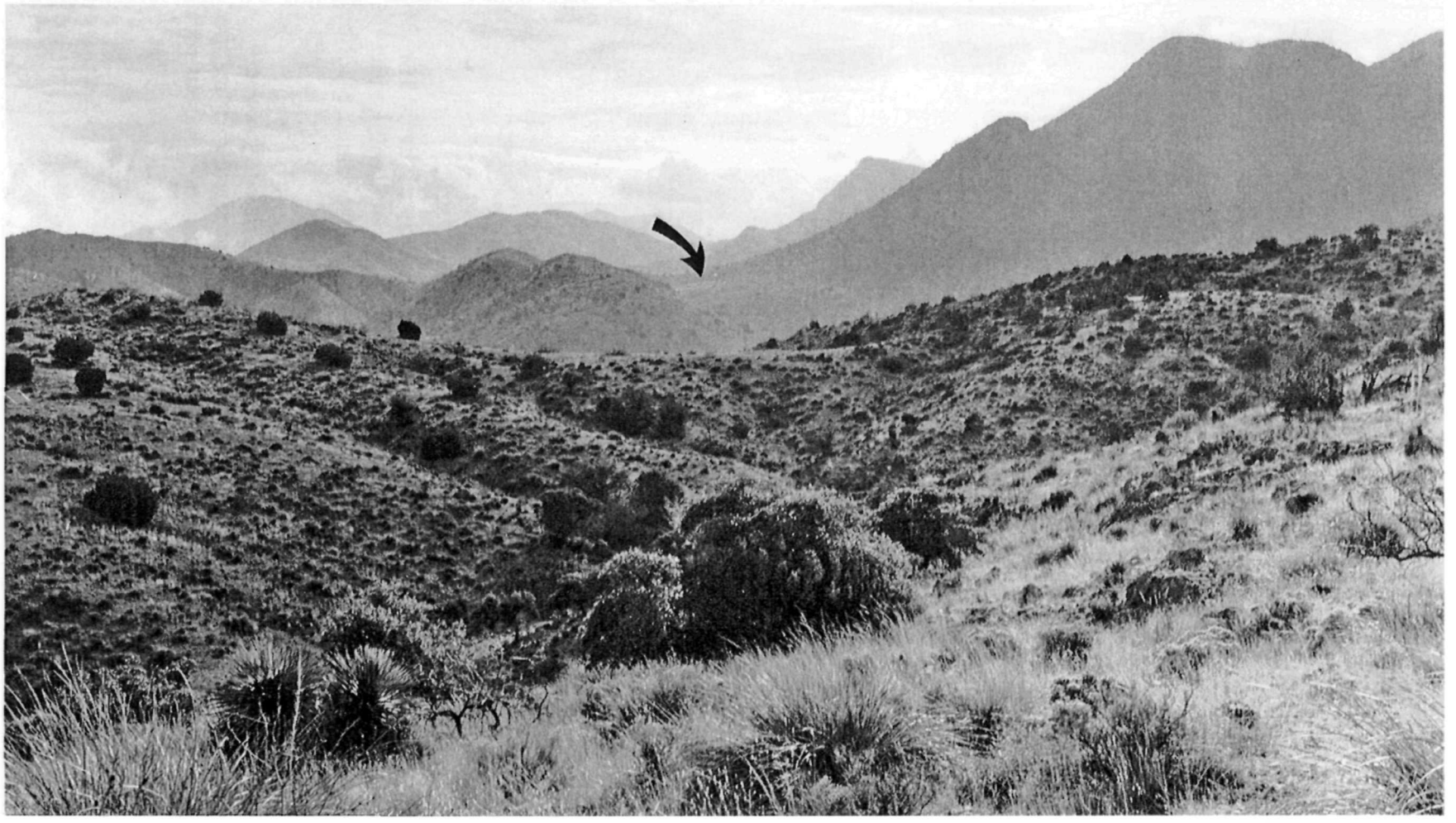


Figure 7. Looking east from the Butterfield Trail toward the site of Fort Bowie (Fort Bowie National Historic Site, Arizona), which can be seen as a faint bare patch in the saddle in the center rear of the photo (indicated by arrow). Vegetation in the foreground is Emory Oak–Turpentine-bush–Gramma Grass (*Quercus emoryi–Ericameria laricifolia–Bouteloua* spp.) savanna, one of the most open, grassy types on the historic site.

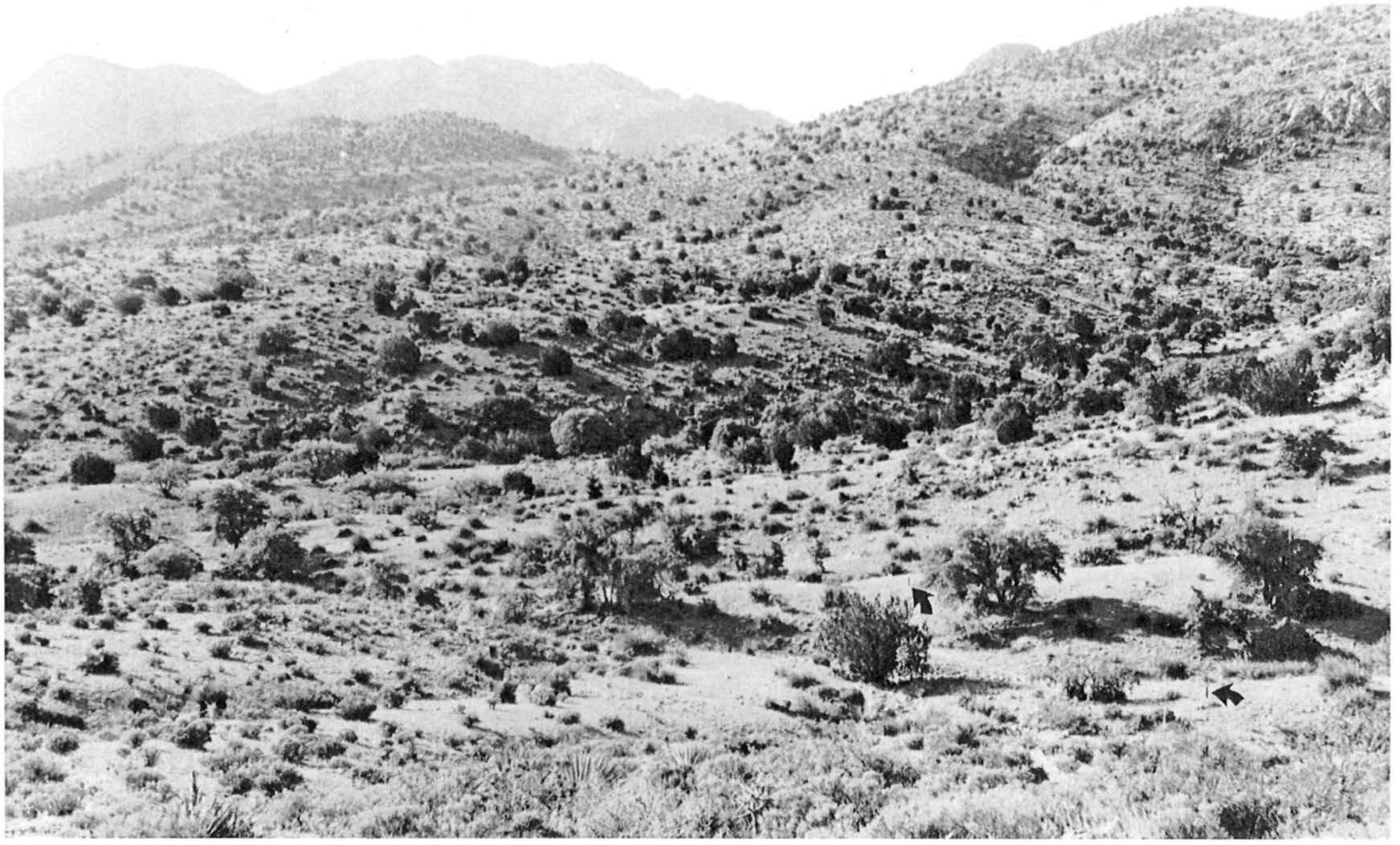


Figure 8. Looking southeast from the Butterfield Trail pull-out, Fort Bowie National Historic Site, Arizona. Two posts marking the historic trail can be seen in the lower right (indicated by arrows), and Helen's Dome is peaking above the ridge on the skyline. The Velvet Mesquite—Turpentine-bush—Burro-weed (*Prosopis velutina—Ericameria laricifolia—Isocoma tenuisecta*) association in the foreground gives way to Emory Oak-Turpentine-bush-Gramma Grass (*Quercus emoryi—Ericameria laricifolia—Bouteloua* spp.) association on the far hillside. The arroyo in the middle of the photo is upper Willow Gulch.

4. Scrub Oak—Beargrass—One-seed Juniper Association

(*Quercus turbinella—Nolina microcarpa—Juniperus monosperma*)

Description: This type is dominated by a relatively dense shrub canopy of chaparral species, including evergreen and deciduous species, with an open overstory of evergreen trees. Total woody cover generally ranges from 30 to 40%. There is frequently a diverse but patchy herbaceous understory of a number of bunchgrasses and perennial herbs. Herbaceous cover is variable and may range from 5 to 20%. This type is equivalent to the *Juniperus erythrocarpus/Quercus turbinella* type (36W) identified by USFS (1987).

Floristics: (6 sample sites)

Dominants and Codominants:

Scrub Oak	*Quercus turbinella*
Beargrass	*Nolina microcarpa*
One-seed Juniper	*Juniperus erythrocarpa*
Desert Deerbrush	*Ceanothus greggii*
Banana Yucca	*Yucca baccata*
Hairy Grama	*Bouteloua hirsuta*

Other Common Associates:

Point-leaf Manzanita	*Arctostaphylos pungens*
Wild Buckwheat	*Eriogonum wrightii*
Sideoats Grama	*Bouteloua curtipendula*
Silk Tassel	*Garrya wrightii*
Oreganillo	*Aloysia wrightii*
Turpentine-bush	*Ericameria laricifolia*
Bullgrass	*Muhlenbergia emersleyi*
Engelmann Prickly-pear	*Opuntia phaeacantha*
Cane Cholla	*Opuntia spinosior*
Sotol	*Dasylirion wheeleri*

Distinguishing Features: This type is floristically very similar to the Desert Deerbrush—Alder-leaf Mountain-mahogany—Desert Sumac association, but differs in its greater abundance of scrub oak, presence of a tree overstory, and generally higher woody cover. The shrub stratum in this type is also similar to the Emory oak—Point-leaf Manzanita—Beargrass association, but it lacks Emory oak, and point-leaf manzanita is much less abundant.

Distribution: Generally on steep north-facing slopes with very rocky soil. The parent rock is usually igneous or metamorphic. This type is found on the drier slopes of the north half of the historic site between 1,400 m (4,600 ft) and 1,520 m (5,000 ft) elevation.

5. Desert Deerbrush—Alder-leaf Mountain-mahogany—Desert Sumac Association

(*Ceanothus greggii—Cercocarpus montanus—Rhus microphylla*)

Description: This type is dominated by evergreen shrubs 1.2 to 1.8 m (4 to 6 ft) tall, most of which are characteristic of chaparral habitats, but also including several of Chihuahuan affinities such as desert sumac and indigo-bush (Fig. 9). A few evergreen trees occur in low abundance. Total woody cover is typically 30 to 50%. The patchy herbaceous understory includes perennial grasses and a variety of herbs such as *Astragalus*, *Hedeoma*, *Castilleja*, *Erigeron*, and *Dyssodia*, and ferns such as lip fern (*Cheilanthes wootonii)* and cloak fern (*Notholaena sinuata*).

Floristics: (3 sample sites)

Dominants and Codominants:	
Desert Deerbrush	*Ceanothus greggii*
Alder-leaf Mountain-mahogany	*Cercocarpus montanus*
Desert Sumac	*Rhus microphylla*
Snakeweed	*Gutierrezia sarothrae*
Oreganillo	*Aloysia wrightii*
Banana Yucca	*Yucca baccata*

Other Common Associates:	
Indigo-bush	*Dalea formosa*
Sideoats Grama	*Bouteloua curtipendula*
Hairy Grama	*Bouteloua hirsuta*
Palmer Agave	*Agave palmeri*
Engelmann Prickly-pear	*Opuntia phaeacantha*
Beargrass	*Nolina microcarpa*
Bricklebush	*Brickellia* spp.
One-seed Juniper	*Juniperus erythrocarpa*
Mexican Pinyon Pine	*Pinus discolor*
Sotol	*Dasylirion wheeleri*

Distinguishing Features: This type is similar to the other mixed chaparral woodland types, but it has a somewhat more xeric aspect with more Chihuahuan desertscrub species, fewer trees, and fewer sclerophyllous shrubs such as point-leaf manzanita and silk tassel.

Distribution: This type is found on moderate to steep north-facing slopes between 1,460 m (4,800 ft) and 1,550 m (5,100 ft) with very shallow, rocky soil. The factor that likely contributes to the floristic differences between this and other similar types is that it is generally found on limestone. It is restricted to the eastern end of the historic site where limestone is found.

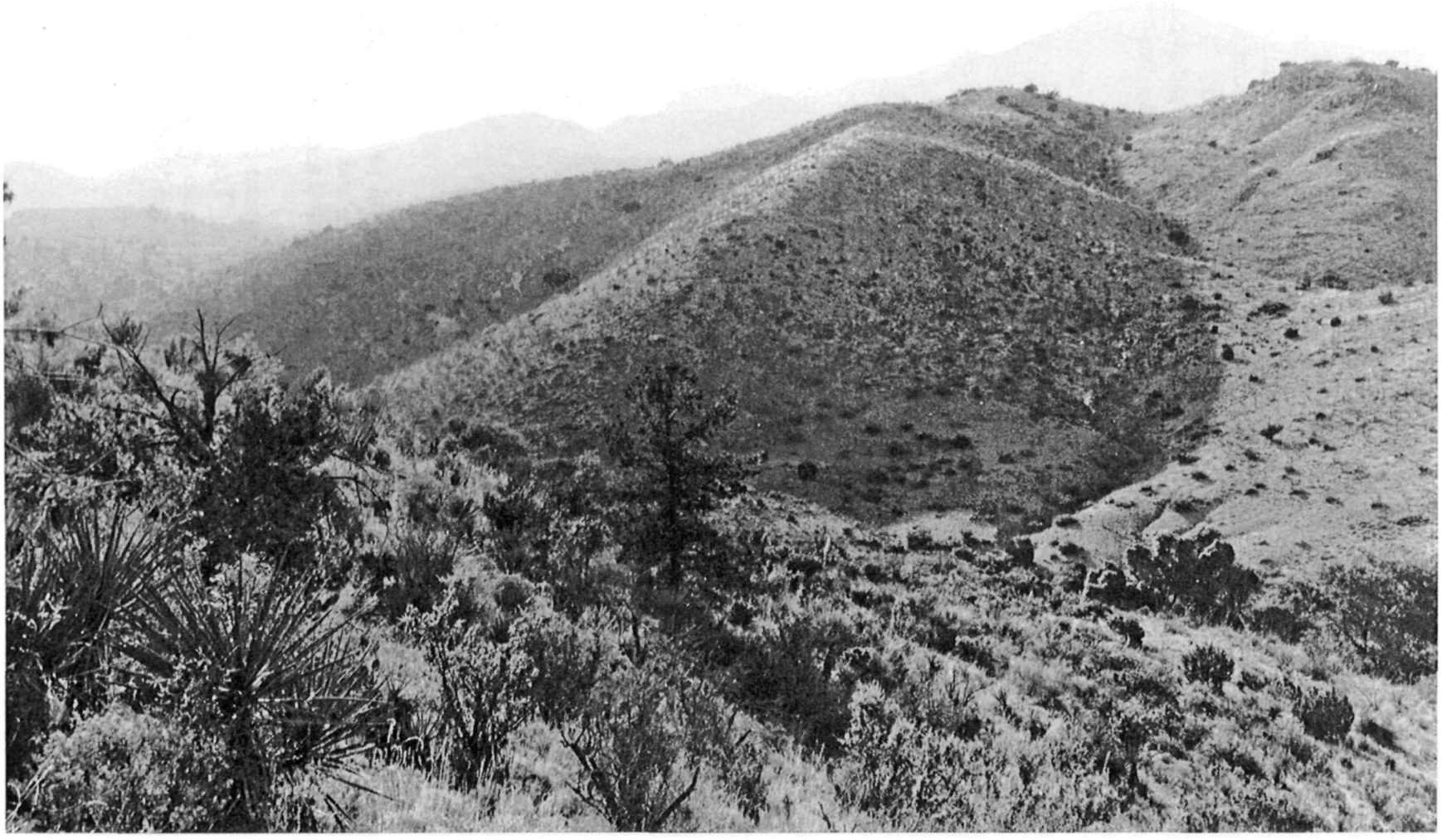


Figure 9. Looking northwest from Overlook Ridge across Siphon Canyon, Fort Bowie National Historic Site, Arizona. A lone Fremont cottonwood (*Populus fremontii*) along Siphon Canyon can be seen in the lower right. The Desert Deerbrush—Alder-leaf Mountain-mahogany—Desert Sumac (*Ceanothus greggii—Cercocarpus montanus—Rhus microphylla*) association in the foreground has the densest cover of all non-riparian associations on the historic site.

6. Velvet Mesquite—Turpentine-bush—Burro-weed Association

(*Prosopis velutina—Ericameria laricifolia—Isocoma tenuisecta*)

Description: This type is apparently a shrub-dominated disclimax of what was previously a grassland (Fig. 10). All of the dominant shrubs are invasive weedy species that typically invade following intense livestock grazing and resultant destruction of grass cover. Vegetative cover in this type is patchy, apparently reflecting past use patterns, and is dissected with foot trails and ruins.

Floristics: (7 sample sites)

Dominants and Codominants:

Velvet Mesquite	*Prosopis velutina*
Turpentine-bush	*Ericameria laricifolia*
Burro-weed	*Isocoma tenuisecta*
Snakeweed	*Gutierrezia sarothrae*
Hairy Grama	*Bouteloua hirsuta*

Other Common Associates:

Banana Yucca	*Yucca baccata*
Sideoats Grama	*Bouteloua curtipendula*
Black Grama	*B. eriopoda*
Palmer Agave	*Agave palmeri*
Engelmann Prickly-pear	*Opuntia phaeacantha*
Cane Cholla	*O. spinosior*
Catclaw Mimosa	*Mimosa biuncifera*
Emory Oak	*Quercus emoryi*
Beargrass	*Nolina microcarpa*
Desert Sumac	*Rhus microphylla*
Wild Buckwheat	*Eriogonum wrightii*
Plains Lovegrass	*Eragrostis intermedia*

Distinguishing Features: This type differs from most of the other associations of the historic site because the low-diversity shrub stratum is composed entirely of invasive weedy species, and the herbaceous understory is very depauperate.

Distribution: This type generally occurs on the most level terrain of the historic site in areas where the soil, though gravelly, is relatively deep and well developed. The substrate is often alluvium, and slopes typically vary from level up to 10%. This type is best represented in the broad valley that forms the divide between upper Siphon Canyon and Cutoff Canyon through which the trail runs. This area at one time was likely a preferred pasture for the fort and the stage station.

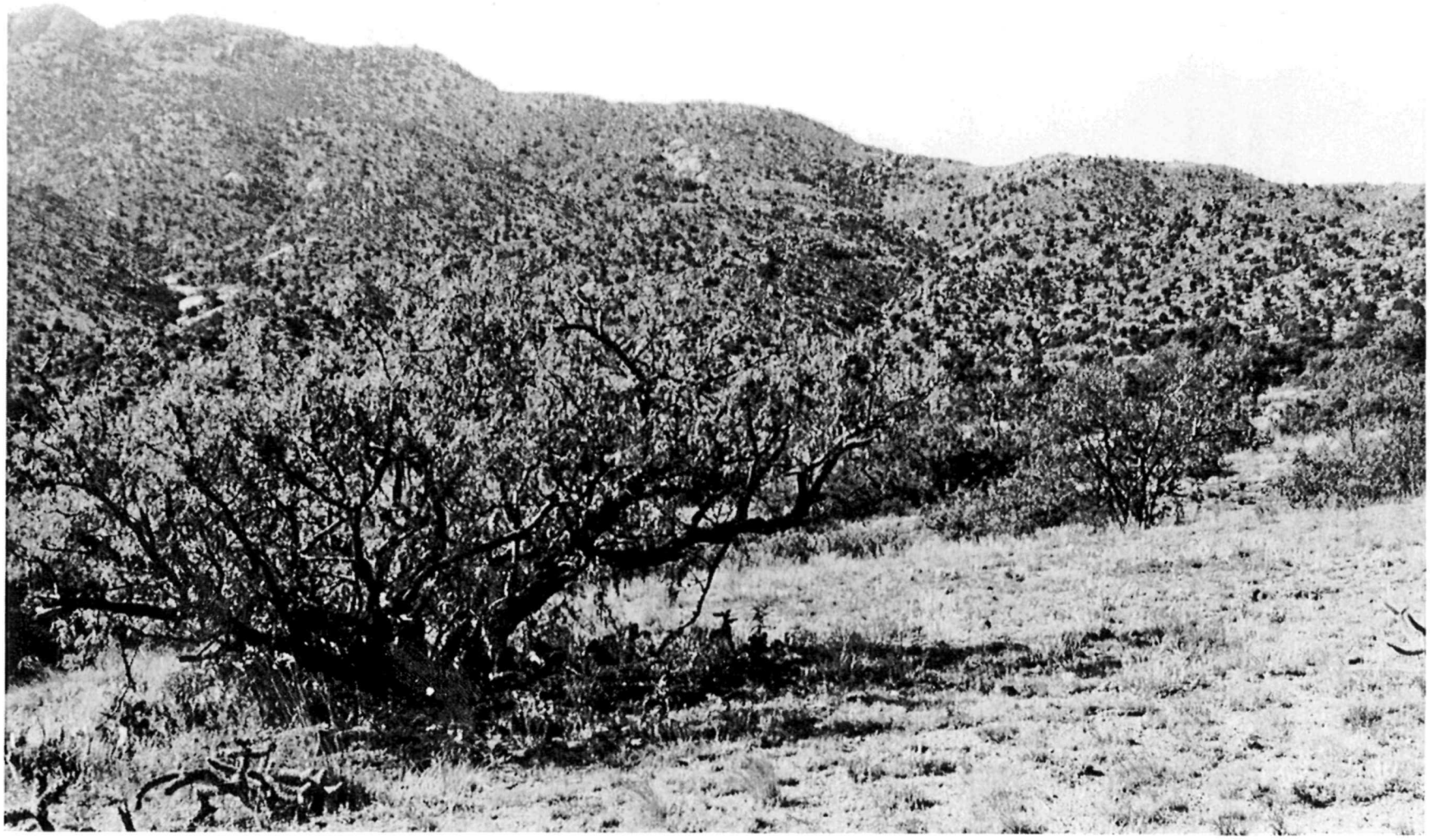


Figure 10. Near Butterfield Stage Station ruin, Fort Bowie National Historic Site, Arizona. The Velvet Mesquite—Turpentine-bush—Burro-weed (*Prosopis velutina— Ericameria laricifolia—Isocoma tenuisecta*) association here is a disclimax from what was historically a grassland before heavy livestock use.

7. Turpentine-bush—Fairy Duster—Ocotillo Association

(*Ericameria laricifolia—Calliandra eriophylla—Fouquieria splendens*)

Description: This type is a mixed shrub/grassland in which shrub and grass species often share dominance (Fig. 11). The shrub stratum, which may vary from 10 to 40% cover, is often composed of relatively small species that are 0.3 to 0.9 m (1 to 3 ft) tall (with the exception of ocotillo). Herbaceous cover, consisting mostly of perennial grasses, is usually 20 to 40%.

Floristics: (4 sample sites)

Dominants and Codominants:

Turpentine-bush	*Ericameria laricifolia*
Fairy Duster	*Calliandra eriophylla*
Ocotillo	*Fouquieria splendens*
Hairy Grama	*Bouteloua hirsuta*
Sideoats Grama	*Bouteloua curtipendula*
Engelmann Prickly-pear	*Opuntia phaeacantha*
Snakeweed	*Gutierrezia sarothrae*

Other Common Associates:

Black Grama	*Bouteloua eriopoda*
Palmer Agave	*Agave palmeri*
Velvet Mesquite	*Prosopis velutina*
Cane Cholla	*Opuntia spinosior*
Tanglehead	*Heteropogon contortus*
Leather Weed	*Croton pottsii*
Catclaw Acacia	*Acacia greggii*

Distinguishing Features: This type has the best developed perennial grass stratum of any type on the historic site. The open overstory of small shrubs, combined with good grass cover, gives this type one of the most open aspects of any on the historic site.

Distribution: This type is found on south-facing slopes with shallow, rocky soil between 1,400 m (4,600 ft) and 1,550 m (5,100 ft). The soil is derived from granitic or metamorphic rock.

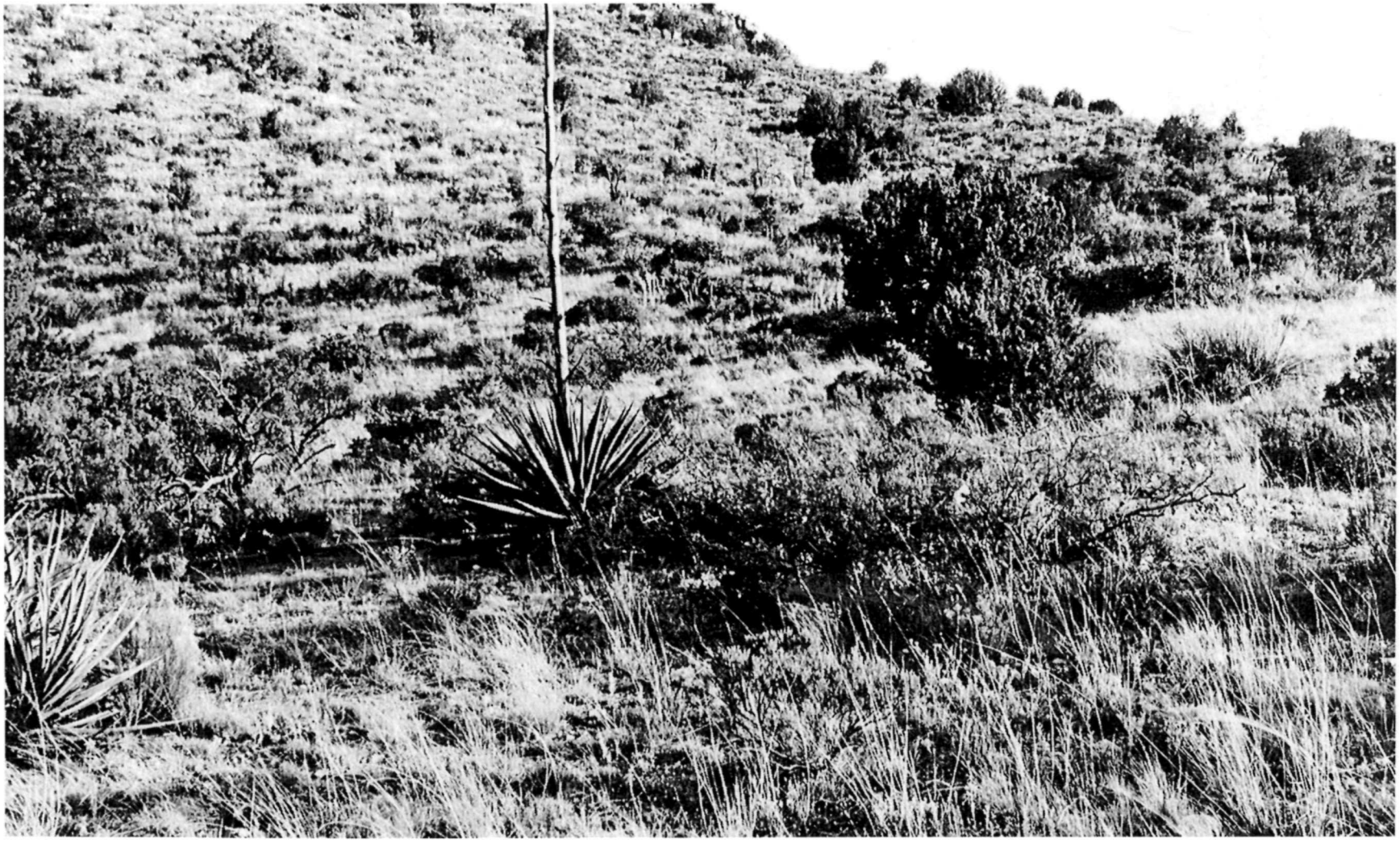


Figure 11. On a south-facing slope northeast of Overlook Ridge, Fort Bowie National Historic Site, Arizona. This Turpentine-bush—Fairy Duster—Ocotillo (*Ericameria laricifolia—Calliandra eriophylla—Fouquieria splendens*) association has the greatest variety of perennial grasses of the associations on the historic site.

7. Turpentine-bush—Fairy Duster—Ocotillo Association

(*Ericameria laricifolia—Calliandra eriophylla—Fouquieria splendens*)

Description: This type is a mixed shrub/grassland in which shrub and grass species often share dominance (Fig. 11). The shrub stratum, which may vary from 10 to 40% cover, is often composed of relatively small species that are 0.3 to 0.9 m (1 to 3 ft) tall (with the exception of ocotillo). Herbaceous cover, consisting mostly of perennial grasses, is usually 20 to 40%.

Floristics: (4 sample sites)

Dominants and Codominants:

Turpentine-bush	*Ericameria laricifolia*
Fairy Duster	*Calliandra eriophylla*
Ocotillo	*Fouquieria splendens*
Hairy Grama	*Bouteloua hirsuta*
Sideoats Grama	*Bouteloua curtipendula*
Engelmann Prickly-pear	*Opuntia phaeacantha*
Snakeweed	*Gutierrezia sarothrae*

Other Common Associates:

Black Grama	*Bouteloua eriopoda*
Palmer Agave	*Agave palmeri*
Velvet Mesquite	*Prosopis velutina*
Cane Cholla	*Opuntia spinosior*
Tanglehead	*Heteropogon contortus*
Leather Weed	*Croton pottsii*
Catclaw Acacia	*Acacia greggii*

Distinguishing Features: This type has the best developed perennial grass stratum of any type on the historic site. The open overstory of small shrubs, combined with good grass cover, gives this type one of the most open aspects of any on the historic site.

Distribution: This type is found on south-facing slopes with shallow, rocky soil between 1,400 m (4,600 ft) and 1,550 m (5,100 ft). The soil is derived from granitic or metamorphic rock.

8. Ocotillo—Mariola—Grama Grass Association

(*Fouquieria splendens—Parthenium incanum—Bouteloua* spp.)

Description: This is a shrub-dominated association with good representation of Chihuahuan species such as ocotillo, mariola, desert sumac, and feather-plume dalea (*Dalea formosa*) (Fig. 12). The shrub canopy is composed of species generally 0.6 to 1.2 m (2 to 4 ft) tall, with the exception of ocotillo that commonly grows 3 to 3.7 m (10 to 12 ft) tall. The herbaceous understory is dominated by several species of grama grass plus a few other perennial grasses. Total woody cover is usually between 20 and 40%, and total herbaceous cover is usually 10 to 20%.

Floristics: (3 sample sites)

Dominants and Codominants:

Ocotillo	*Fouquieria splendens*
Mariola	*Parthenium incanum*
Hairy Grama	*Bouteloua hirsuta*
Sideoats Grama	*B. curtipendula*
Black Grama	*B. eriopoda*
Snakeweed	*Gutierrezia sarothrae*

Other Common Associates:

Fairy Duster	*Calliandra eriophylla*
Engelmann Prickly-pear	*Opuntia phaeacantha*
Palmer Agave	*Agave palmeri*
Velvet Mesquite	*Prosopis velutina*
Cane Cholla	*Opuntia spinosior*
Tanglehead	*Heteropogon contortum*
Wolftail	*Lycurus phleoides*
Desert Sumac	*Rhus microphylla*

Distinguishing Features: The aspect of this type differs from all others on the historic site due to the dominance of ocotillo, whose tall spindly stems tower above the short shrub stratum. This type is perhaps the most typical Chihuahuan desertscrub association on the historic site, although a number of chaparral species are found scattered through the association as well.

Distribution: This type is found on south-facing limestone slopes between 1,430 m (4,700 ft) and 1,550 m (5,100 ft) elevation. The soils are quite shallow and rocky with frequent bedrock outcrops. It is generally restricted to the east end of the historic site on limestone east of the fault zone.



Figure 12. Looking from Overlook Ridge to the southwest (Helen's Dome is just out of the picture to the left), Fort Bowie National Historic Site, Arizona. The Ocotillo—Mariola—Gramma Grass (*Fouquieria splendens—Parthenium incanum—Bouteloua* spp.) association in the foreground is characteristic of limestone substrates.

9. Velvet Mesquite—Desert Sumac—Snakeweed Association

(*Prosopis velutina—Rhus microphylla—Gutierrezia sarothrae*)

Description: This type is dominated by an overstory of mixed deciduous and evergreen shrubs 1.2 to 1.8 m (4 to 6 ft) tall with a second shrub stratum composed of species 0.3 to 0.9 m (1 to 3 ft) tall. Total shrub cover is variable and can be relatively dense, ranging from 25 to 50%. The patchy herbaceous understory consists of a diverse combination of perennial grasses and other herbaceous species.

Floristics: (3 sample sites)

Dominants and Codominants:

Velvet Mesquite	*Prosopis velutina*
Desert Sumac	*Rhus microphylla*
Snakeweed	*Gutierrezia sarothrae*
Mariola	*Parthenium incanum*

Other Common Associates:

Fairy Duster	*Calliandra eriophylla*
Engelmann Prickly-pear	*Opuntia phaeacantha*
Hairy Grama	*Bouteloua hirsuta*
Black Grama	*B. eriopoda*
Palmer Agave	*Agave palmeri*
Sotol	*Dasilirion wheeleri*
Ocotillo	*Fouquieria splendens*
Curly Mesquite	*Hilaria belangeri*
Tanglehead	*Heteropogon contortus*
Feather-plume Dalea	*Dalea formosa*
Gum Bumelia	*Bumelia lanuginosa*

Distinguishing Features: This type is floristically similar to the Ocotillo—Mariola—Grama Grass association, but differs substantially in aspect due to the dominance of larger shrubs such as mesquite and desert sumac. This is the only association on the historic site in which Desert Sumac is a codominant, and its dark, dense, evergreen canopy stands out in contrast to all other Chihuahuan desertscrub species.

Distribution: This type is found on gentle to moderate south-facing slopes with very rocky soil from 1,400 m (4,600 ft) up to 1,520 m (5,000 ft) elevation. The parent rock is generally metamorphic, but occasionally limestone. It is restricted to the northeast portion of the historic site.

10. Russian Thistle—Snakeweed—Mixed Grass Association

(*Salsola iberica—Gutierrezia sarothrae*—Mixed Grass)

Description: This type occupies a heavily disturbed area, dominated by weedy species, that is located in the immediate vicinity of the old Fort Bowie site. It consists predominantly of herbaceous species, but many shrubs, such as burro-weed and velvet mesquite, are becoming well established. This area was almost totally stripped of plant cover at the time of occupation of the fort.

Floristics: (1 sample site)

Dominants and Codominants:

Russian Thistle	*Salsola iberica*
Snakeweed	*Gutierrezia sarothrae*
Burro-weed	*Isocoma tenuisecta*
Three-awn	*Aristida* spp.

Other Common Associates:

Velvet Mesquite	*Prosopis velutina*
Turpentine-bush	*Ericameria laricifolia*
Spiny Haplopappus	*Machaeranthera pinnatifida*
Horehound	*Marrubium vulgare*
Sideoats Grama	*Bouteloua curtipendula*
Hairy Grama	*Bouteloua hirsuta*
Cane Cholla	*Opuntia spinosior*
Plains Lovegrass	*Eragrostis intermedia*

Distinguishing Features: This type is historically the most heavily disturbed of all the vegetation associations on the historic site, and, consequently, has the greatest proportion of invasive herbaceous and woody species. It still sustains the heaviest disturbance in the area, although this now consists of foot traffic instead of livestock.

Distribution: This type is found only in the immediate vicinity of the old Fort Bowie site, and in scattered smaller patches along recent road and pipeline clearings that were not mapped.

11. Creosote-bush—Velvet Mesquite—Mariola Association

(*Larrea tridentata—Prosopis velutina—Parthenium incanum*)

Description: This desertscrub type is dominated by shrubs 0.6 to 1.2 m (2 to 4 ft) tall and has a poorly developed herbaceous understory. Woody cover is 30 to 40%. Perennial grasses are sparse and total herbaceous cover is less than 10%.

Floristics: (1 sample site)

Dominants and Codominants:	
Creosote-bush	*Larrea tridentata*
Velvet Mesquite	*Prosopis velutina*
Mariola	*Parthenium incanum*
Desert Sumac	*Rhus microphylla*

Other Common Associates:	
Black Grama	*Bouteloua eriopoda*
Snakeweed	*Gutierrezia sarothrae*
Wolfberry	*Lycium* sp.
Bush Muhly	*Muhlenbergia porteri*
Oreganillo	*Aloysia wrightii*
Engelmann Prickly-pear	*Opuntia phaeacantha*

Distinguishing Features: This is the only type on the historic site in which creosote-bush is a prominent member. It is one of only two types on the historic site that is a true desertscrub association without a prominent grass understory.

Distribution: This type is found only at the lowest elevations at FOBO in lower Siphon Canyon at 1,400 m (4,600 ft). It occurs on rocky southwest-facing slopes. The landform on which it occurs is a remnant alluvial terrace with gravelly soil.

ANNOTATED CHECKLIST OF VASCULAR PLANTS

FERNS
PTERIDOPHYTA

ADIANTACEAE

Bommeria hispida (Mett.) Underw. Hairy Bommeria
Uncommon; rocky slopes, shaded places; widespread. (63).

Cheilanthes eatonii Baker. Lip Fern
Uncommon; rocky slopes, crevices; widespread. (58).

Cheilanthes lindheimeri Hook. Lip Fern
Common; rocky slopes, crevices, canyons; widespread. (55).

Cheilanthes wootonii Maxon. Lip Fern
Common; rocky slopes, among rocks, canyons and cliffs; widespread. (57).

Cheilanthes wrightii Hook. Lip Fern
Rare; rocky slopes and ledges; widespread. (62).

Notholaena limitanea Maxon. Cloak Fern
(*Pellaea l.* [Maxon] Morton.) Rare; north-facing rocky slopes; widespread. (61, 336).

Notholaena sinuata (Lag. ex Swartz) Kaulf. Cloak Fern
Common; rocky slopes, crevices, canyons, usually on limestone; widespread. (59, 454).

Notholaena standleyi Maxon. Cloak Fern
Rare; among rocks and cliffs; oak woodland. (399).

Pellaea truncata Goodding. Cliff Brake
(*P. longimucronata* Hook.) Common, rocky slopes, canyons, drainages, among rocks and cliffs; widespread. (61).

ASPLENIACEAE

Woodsia mexicana Fée. Rock Fern
Rare; crevices, rocky slopes; oak woodland. (411).

CONE-BEARING PLANTS
GYMNOSPERMAE

CUPRESSACEAE

Juniperus deppeana Steud. Alligator Juniper
Uncommon; slopes, washes, canyons; widespread. (10).

Juniperus erythrocarpa Cory. One-seed Juniper
(*J. monosperma* [Englem.] Sarg.) Common; slopes, washes, canyons; widespread. (54).

EPHEDRACEAE

Ephedra trifurca Torr. Mormon Tea, Joint-fir
Rare; foothills, grasslands; mesquite savanna. (148).

PINACEAE

Pinus discolor Bailey. Mexican Pinyon Pine
(*P. cembroides* Zucc. var. *bicolor* Little) Uncommon; slopes, washes, canyons; widespread. (1).

Pinus edulis Emgelm. Colorado Pinyon Pine
Occasional; northern slopes; oak woodland and savanna. (249).

Pinus monophylla Torr. & Frem. One-needle Pinyon Pine
(*P. edulis* Engelm. var. *fallax* Little) Rare; wash northeastern base of Helen's Dome and oak woodland. This is one of the few locations in the Southwest where these three pinyons occur together. (209).

FLOWERING PLANTS
ANGIOSPERMAE

ACANTHACEAE

Anisacanthus thurberi (Torr.) Gray. Chuparosa, Desert Honeysuckle.
Occasional; sandy washes and canyons; widespread. (194).

Carlowrightia arizonica Gray
Rare; rocky hills; grassland and oak savanna. (171).

AGAVACEAE

Agave palmeri Engelm. Mountain Agave, Palmer Agave
Common; rocky slopes and hills, plains, sandy soils, canyons; widespread. (329).

Agave parryi Engelm. Parry Agave
Rare; higher elevations, Bowie Mountain. (253).

Dasylirion wheeleri Wats. Sotol, Desert Spoon
Common; slopes, rocky hills, canyons; widespread. (256).

Nolina microcarpa Wats. Sacahuista, Beargrass
Common; rocky hills, slopes, canyons; widespread. (324).

Yucca baccata Torr. Banana Yucca, Blue Yucca
Common; rocky soils, washes, canyons, slopes; widespread. (195).

Yucca elata Engelm. Soaptree Yucca, Palmilla
Rare; sandy soils, canyons, plains; widespread. (326).

AIZOACEAE

Trianthema portulacastrum L. Horse Purslane
Very rare; sandy soils, washes; oak woodland. Introduced. (547).

AMARANTHACEAE

Amaranthus palmeri Wats. Careless-weed, Quelite
Common; distributed areas, washes; widespread. (288, 347).

Froelichia arizonica Thornber ex Standl. Snake Cotton
Uncommon; rocky slopes and foothills, grassy plains; widespread. (273).

Gomphrena caespitosa Torr. Ball Clover
Common; rocky hills and slopes, grassy plains; widespread. (89).

Guilleminea densa (Willd.) Moq. Cottonflower
(*Brayulinea d.* [Humb. & Bonpl.] Small) Uncommon; rocky slopes. (230).

AMARYLLIDACEAE

Zephyranthes longifolia Hemsl. Zephyr Lily
Rare; sandy soils, washes; oak woodland. (542).

ANACARDIACEAE

Rhus microphylla Engelm. ex Gray. Little-leaf Sumac, Desert Sumac
Common; canyons, washes, slopes; widespread. (202).

Rhus trilobata (Nutt.) Gray var. **pilosissima** Engelm. Skunk-bush Sumac
Common; localized areas, washes, canyons, slopes; oak woodland, riparian woodland and oak savanna. (201).

Rhus virens Lindheimer ex Gray ssp. **choriophylla** (Wooton & Standl.) Young. Mearn Sumac. (*R. c.* Wooton & Standl.) Rare, rocky and gravelly slopes; oak woodland and savanna. (114).

Toxicodendron radicans (L.) Kuntze. Poison Ivy
(*Rhus r.* L.) Rare; canyons among rocks, moist places; oak woodland. (161).

APIACEAE (UMBELLIFERAE)

Cymopterus multinervatus (Coult. & Rose) Tidestrom
Uncommon; rocky slopes and hills; widespread. (3).

Daucus pusillus Michx. Carrot
Occasional; rocky hills and slopes; widespread. (409).

Lomatium nevadense (Wats.) Coult. & Rose
Uncommon; rocky hills, slopes; widespread. (76, 338).

Pseudocymopterus montanus (Gray) Coult. & Rose. Mountain Parsley
Rare; rocky slopes and hills; shrub-grassland. (565).

Spermolepis echinata (Nutt.) Heller. Wild Carrot
Uncommon; sandy soils, rocky slopes; widespread. (359).

APOCYNACEAE

Macrosiphonia brachysiphon (Torr.) Gray
Rare; rocky drainages; shrub-grassland. (36, 489).

ARISTOLOCHIACEAE

Aristolochia watsonii Wooton & Standl. Indian Root, Pipevine
Rare; sandy soils, washes, canyons; riparian woodlands. (402).

ASCLEPIADACEAE

Asclepias asperula (Dcne.) Woods. Antelope-horn Milk-weed
(*A. capricornu* Woods). Rare; slopes, drainages; oak woodland and savanna. (254).

Asclepias engelmanniana Woods. Milk-weed
Rare; plains; mesquite savanna. (566).

Asclepias macrotis Torr. Milk-weed
Rare; canyons, sandy soils; oak woodland and riparian woodland. (567).

Asclepias nyctaginifolia Gray. Milk-weed
Occasional; sandy soils, washes; widespread. (322).

Sarcostemma crispum Benth. Climbing Milk-weed
(*Funastrum c.* [Benth.] Schechter.) Occasional; rocky hills, gravelly ground; widespread. (457).

Sarcostemma cynanchoides Dcne. ssp. **hartwegii** (Vail) Holm. Climbing Milk-weed
(*Funastrum heterophyllum* [Engelm.] Standl.) Rare; sandy soils, washes. (568).

ASTERACEAE (COMPOSITAE)

Acourtia nana (Gray) Reveal & King. Desert Holly
(*Perezia n.* Gray) Rare; forming patches, plains, slopes; mesquite savanna. (199).

Acourtia wrightii (Gray) Reveal & King. Arizona Holly
(*Perezia w.* Gray) Rare; rocky hills, slopes; widespread. (401).

Ambrosia confertiflora DC. Ragweed
(*Franseria c.* [DC.] Rydb.) Common; disturbed areas, plains, slopes, foothills; widespread. (44).

Artemisia dracunculoides Pursh. False Tarragon
(*A. glauca* Pall.) Occasional; rocky hills, slopes; oak woodland and chaparral. (298).

Artemisia ludoviciana Nutt. Western Mugwort, White Sage
Common; disturbed areas, slopes, plains; widespread. (43).

Baccharis bigelovii Gray. Groundsel-tree
Uncommon; rocky slopes; widespread. (49).

Baccharis pteronioides DC. Yerba del Pasmo
Occasional; gravelly and rocky slopes; widespread. (196).

Baccharis salicifolia (Ruiz & Pavon) Pers. Seep-willow, Batamote
(*B. glutinosa* Pers.) Common; localized areas, sandy washes; oak woodland. (149).

Baccharis sarothroides Gray. Broom Baccharis, Desert Broom
Occasional; gravelly and rocky soils, slopes; widespread. (50).

Baccharis wrightii Gray
Rare; sandy washes; riparian woodland. (589).

Bahia absinthifolia Benth.
Uncommon; rocky hills and slopes, gravelly soils; widespread. (450).

Baileya multiradiata Harv. & Gray ex Torr. Desert Marigold
Common; slopes, washes, plains, roadsides; widespread. (95, 140).

Baileya pauciradiata Harv. & Gray. Desert Marigold
Occasional; rocky hills, plains; widespread. (140).

Berlandiera lyrata Benth. Green-eyes, Lyreleaf
Occasional; gravelly soils, plains, slopes; widespread. (205).

Bidens leptocephala Sherff. Spanish-needles
Uncommon; sandy washes, moist canyons; widespread. (307).

Brickellia californica (Torr. & Gray) Gray. Pachaba, Bricklebush
Common; sandy soils, washes, slopes; widespread. (600).

Brickellia chlorolepis (Wooton & Standl.) Shinners. False Boneset, Bricklebush
(*Kuhnia rosmarinifolia* Vent.) Occasional; sandy washes, slopes; widespread. (302, 433).

Brickellia venosa (Wooton & Standl.) Robins. Bricklebush
Occasional; rocky slopes; widespread. (41, 509).

Carphochaete bigelovii Gray
Rare; rocky slopes; oak woodland. (71).

Chaenactis stevioides Hook. & Arn.
Very rare; sandy washes; riparian woodland. (590).

Chrysothamnus nauseosus (Pall.) Britton. Rabbit-brush
Common; localized areas, sandy washes; oak woodland and riparian woodland. (601).

Cirsium neomexicanum Gray. New Mexico Thistle
Uncommon; roadsides, slopes, plains; widespread. (241).

Cirsium ochrocentrum Gray. Yellow Spine Thistle
Rare; roadsides; oak woodland and savanna. (591).

Conyza canadensis (L.) Cronq. Horse-weed
(*Erigeron c.* L.) Uncommon; washes, disturbed areas; widespread. (278).

Conyza coulteri Gray
Rare; disturbed areas, gravelly soils. (602).

Dyssodia acerosa DC. Fetid Marigold
Occasional; sandy washes, rocky slopes; oak savanna and riparian woodland. (153).

Dyssodia pentachaeta (DC.) Robins. Fetid Marigold, Parralena
Rare; rocky hills, slopes, especially on limestone; Ocotillo—Mariola—Grama Grass and Desert Deerbrush—Alder-leaf Mountain-mahogany—Desert Sumac associations. (385).

Ericameria laricifolia (Gray) Shinners. Turpentine-bush
(*Haplopappus l.* Gray.). Common; rocky hills, slopes, plains, canyons; widespread. (588).

Erigeron divergens Torr. & Gray. Wild Daisy, Fleabane
Occasional; disturbed areas, rocky slopes. (599).

Erigeron divergens Torr & Gray var. **cinereus** Gray. Sprawling Daisy
(*E. nudiflorus* Buckl.). Common; plains, slopes, rocky hills; widespread. (73).

Erigeron oreophilus Greenm. Wild Daisy, Fleabane
Rare; rocky and sandy slopes; oak savanna. (496).

Flourensia cernua DC. Tar-bush
Uncommon; higher elevations, Bowie Mountain. (592).

Gaillardia pulchella Foug. Blanket Flower
Occasional; disturbed areas. (170).

Gnaphalium wrightii Gray. Cud-weed
Occasional; sandy washes; oak woodland and riparian woodland. (598).

Gutierrezia microcephala (DC.) Gray. Snakeweed
(*Xanthocephalum m.* [DC.] Shinners) Common; rocky slopes, foothills, plains, washes; widespread. (602).

Gutierrezia sarothrae (Pursh) Britt. & Rusby. Snakeweed, Broomweed
(*Xanthocephalum s.* [Pursh] Shinners) Rare; disturbed areas, sandy washes; riparian woodland. (588).

Helianthus annuus L. Sunflower
Rare; disturbed areas, roadsides; oak woodland and mesquite savanna. (348).

Heterosperma pinnatum Cav.
Rare; roadsides, gravelly slopes; savanna. (520).

Hymenoclea monogyra Torr. & Gray ex Gray. Burro-brush
Common; localized areas, sandy washes; mesquite savanna. (521).

Hymenothrix wislizenii Gray
Occasional; rocky slopes, sandy washes; widespread. (440).

Isocoma tenuisecta Greene. Burro-weed
(*Haplopappus t.* [Greene] Blake.) Common; localized areas, gravelly soils, disturbed areas, roadsides; oak woodland and mesquite savanna. (317).

Iva ambrosiaefolia Gray. Marsh Elder
Rare; sandy washes; oak woodland. (510).

Iva dealbata Gray. Marsh Elder
Rare; disturbed areas. (342).

Lactuca serriola L. Prickly Lettuce
Occasional; sandy washes, gravelly soils; widespread. (417).

Leucelene ericoides (Torr.) Greene. White Aster, Rose Heath
(*Aster hirtifolius* Blake, *Aster arenosus* [Heller] Blake) Uncommon; rocky slopes; widespread. (69).

Machaeranthera pinnatifida (Hook.) Shinners. Spiny Haplopappus
(*Haplopappus spinulosus* [Pursh] DC.) Common; sandy soils, washes, slopes; widespread. (105).

Machaeranthera tagetina Greene. Aster
(*Aster t.* [Greene] Blake) Uncommon; plains, washes, slopes; widespread. (316).

Machaeranthera tephrodes (Gray) Greene. Aster
(*Aster t.* [Gray] Blake) Rare; sandy washes, alluvial soils; riparian woodland. (511).

Malacothrix fendleri Gray. Desert Dandelion
Common; sandy soils, rocky slopes; widespread. (392).

Microseris gracilis (Hook.) Greene
Rare; rocky slopes; shrub-grassland. (603).

Microseris lindleyi (DC.) Gray. Silver Puff
(*M. linearifolia* [DC.] Sch.) Occasional; rocky and gravelly slopes; riparian woodland. (390).

Parthenium incanum H.B.K. Mariola
Common; rocky hills, slopes, plains; widespread. (250).

Pectis filipes Harv. & Gray. Fetid Marigold
Common; sandy soils, washes, drainages; widespread. (314).

Pectis longipes Gray. Fetid Marigold
Uncommon; rocky and gravelly soils, slopes, foothills; oak woodland and savanna. (198).

Pectis prostrata Cav. Fetid Marigold
Rare; sandy washes, gravelly slopes; widespread. (522).

Plummera floribunda Gray
Occasional; rocky slopes and hills; oak woodland and savanna. Apache Pass is the locality of the type collection for this species, made by J. G. Lemmon in 1881. (429).

Psilostrophe sparsiflora (Gray). A. Nels. Paperflower
Uncommon; rocky hills, slopes; widespread. (513).

Psilostrophe tagetina (Nutt.) Greene. Paperflower
Uncommon; rocky hills, slopes, plains; widespread. (38).

Rafinesquia neomexicana Gray. Desert Chicory
Rare; sandy soils, plains; mesquite savanna. (593).

Ratibida columnifera (Nutt.) Wooton & Standl. Coneflower
(*R. columnaris* [Sims] D. Don.) Very rare; disturbed areas. (225).

Sanvitalia abertii Gray
Occasional; sandy soils, plains, foothills. (299).

Senecio douglasii DC. var. **longilobus** (Benth.) L. Benson. Thread-leaf Groundsel
Uncommon; washes, plains slopes; widespread. (46, 146).

Senecio douglasii var. **monoensis** (Greene) Jepson. Groundsel
(*S. m.* Greene) Rare; sandy soils, disturbed areas; oak woodland. (594).

Senecio multicapitatus Greenm. Groundsel
Very rare; sandy soils, disturbed areas. (595).

Senecio neomexicanus Gray. New Mexico Senecio
Uncommon; sandy and gravelly soils, slopes, washes, hills; widespread. (115).

Senecio quercetorum Greene. Groundsel
Rare; rocky slopes and hills; oak woodland. (378).

Solidago sparsiflora Gray. Golden Rod
Rare; roadsides, gravelly soils; oak savanna. (466).

Sonchus oleraceus L. Sow-thistle
Rare; sandy soils; riparian woodland. (596).

Stephanomeria pauciflora (Torr.) Nutt. Wire-lettuce
Uncommon; slopes, foothills, plains; widespread. (182).

Thelesperma longipes Gray. Navajo Tea
Occasional; limestone, slopes, hills; widespread. (37).

Thelesperma megapotamicum (Spreng.) Kuntze. Green Thread
Rare; sandy and gravelly soils; mesquite savanna and riparian woodland. (197).

Trixis californica Kellogg.
Occasional; gravelly soils, plains slopes; widespread. (434, 525).

Verbesina encelioides (Cav.) Benth. & Hook. f. ex Gray. Golden Crown-beard
Common; washes, plains, sandy soils; widespread. (186).

Verbesina rothrockii Robins. & Greenm. Crown-beard
Uncommon; slopes, canyons; widespread. (300).

Viguiera deltoidea Gray. Golden-eye, Resin-weed
Very rare; sandy washes; riparian woodland. (597).

Viguiera dentata (Cav.) Spreng. Golden-eye
Rare; sandy washes; riparian woodland. (476).

Viguiera multiflora (Nutt.) Blake.
Rare; sandy washes; riparian woodland. (526).

Zinnia acerosa (DC.) Gray. Wild Zinnia
(*Z. pumila* Gray) Occasional; washes, plains, foothills; widespread. (320).

Zinnia grandiflora Nutt. Rocky Mountain Zinnia
Uncommon; plains, slopes washes; widespread. (296).

BIGNONIACEAE

Chilopsis linearis (Cav.) Sweet. Desert-willow
Common; localized areas, sandy washes; riparian woodlands. (226).

BORAGINACEAE

Amsinckia intermedia Fisch. & Meyer. Coast Fiddle-neck
Rare; rocky hills; grassland. (574).

Cryptantha crassisepala (Torr. & Gray) Greene. Nievitas
Uncommon; plains, slopes, washes, sandy soils; widespread. (96).

Cryptantha micrantha (Torr.) Johnst. Forget-me-not
Occasional; plains, sandy soils, disturbed areas. (575).

Lappula redowskii (Hornem.) Greene var. **redowskii.** Stick-seed
Rare; sandy washes; oak woodland. (576).

Lappula redowskii (Hornem.) Greene var. **texana** (Scheele) Brand. Stick-seed
Occasional; rocky slopes and hills; grassland and savanna. (125).

Lithospermum cobrense Greene. Gromwell, Puccoon
Rare; sandy washes; ash-walnut woodlands. (577).

Pectocarya recurvata Johnst.
Rare; sandy soils, washes; riparian woodland. (578).

Plagiobothrys arizonicus (Gray) Greene ex Gray. Blood-weed
Rare; sandy soils, washes, slopes; mesquite savanna. (354).

Tiguilia canescens (DC.) Richards. Shrubby Coldenia, Oreja de Perro
(*Coldenia c.* DC.) Rare; slopes, rocky ground; oak woodland and savanna. (144, 424).

BRASSICACEAE (CRUCIFERAE)

Arabis perennans Wats. Rocky-cress
Uncommon; slopes, foothills; widespread. (68, 136, 337).

Descurainia pinnata (Walt.) Britton. Tansymustard
Uncommon; disturbed areas, washes, slopes; widespread. (85).

Descurainia sophia (L). Webb ex Prantl. Tansymustard
Uncommon; disturbed areas, sandy soils; widespread. Introduced. (363).

Draba cuneifolia Nutt. ex Torr. & Gray
Uncommon; rocky slopes, hills, plains; widespread. (339).

Lepidium lasiocarpum Nutt. Pepper-grass
Common; disturbed areas, sandy soils; widespread. (79).

Lepidium thurberi Wooton. Pepper-grass
Common; disturbed areas, washes, roadsides, sandy soils; widespread. (257).

Lepidium virginicum L. var. **medium** (Greene) Hitchc. Pepper-grass
(*L. m.* Greene) Very rare; rocky hills; Shrub-grassland. (550).

Lesquerella fendleri (Gray) Wats. Bladder-pod
Uncommon; rocky slopes, sandy soils; widespread. (362).

Lesquerella gordonii (Gray) Wats. Gordon Bladder-pod
Common; slopes, foothills, disturbed areas; widespread. (66, 361).

Pennellia longifolia (Benth.) Rollins.
(*Thelypodium l.* [Benth.] Wats.) Rare, rocky slopes; oak savanna. (484).

Schoenocrambe linearifolia (Gray) Rollins.
(*Thelypodiopsis l.* [Gray] Al-Shebaz., *Sisymbrium l.* [Gray] Payson) Uncommon; sandy washes, rocky slopes; widespread. (255).

Sisymbrium irio L. London Rocket
Uncommon; washes, sandy ground, foothills; widespread. Introduced. (78).

Streptanthella longirostris (Wats.) Rydb.
Very rare; sandy washes; riparian woodland. (551).

Streptanthus carinatus Wright ssp. **arizonicus** (Wats.) Kruckeberg, Rodman & Worthington. Twist Flower. (*S. a.* Wats.). Rare; rocky slopes, sandy washes; widespread. (90).

Thelypodium wrightii Gray
Rare; rocky slopes, washes; widespread. (477).

CACTACEAE

Cereus greggii Engelm. Night-blooming Cereus, Reina de la Noche
(*Peniocereus g.* [Engelm.] Britt. & Rose.) Rare; rocky and gravelly soils; desertscrub. (330).

Coryphantha vivipara (Nutt.) Britton & Rose var. **bisbeeana** (Orcutt) L. Benson.
Arizona Pincushion. Uncommon; rocky slopes; widespread. (422).

Echinocereus fendleri (Engelm.) ex Rumpl. var. **rectispinus** (Peebles) L. Benson. Fendler Needle Hedgehog. Uncommon; rocky hills and slopes; widespread. (410).

Echinocereus ledingii Peebles. Leding Hedgehog
Rare; a few plants on Bowie Peak. (561).

Echinocereus pectinatus (Scheidw.) Engelm. var. **rigidissimus** (Engelm.) ex Rumpl.
Rainbow Cactus. Common; rocky slopes, gravelly slopes; widespread. (400).

Ferocactus wislizenii (Englem.) Britton & Rose. Barrel Cactus, Bisnaga
Uncommon; rocky slopes and hills washes; widespread. (327).

Mammillaria heyderi (Muhl.) var. **macdougalii** (Rose) L. Benson. Pancake Pincushion
Occasional; rocky slopes, under trees, among rocks; widespread. (418).

Mammillaria microcarpa Engelm. Fish-hook Pincushion
Uncommon; localized areas, rocky slopes; widespread. (423).

Opuntia chlorotica Engelm. & Bigel. Clock-face Prickly-pear
Rare; rocky hills and slopes; widespread. (419).

Opuntia kleiniae DC. Klein Cholla
Very rare; sandy soils, washes; mesquite savanna. (413).

Opuntia leptocaulis DC. Desert Christmas Cactus
Occasional; canyons, washes, slopes; widespread. (414).

Opuntia phaeacantha Engelm. var. **discata** (Griffiths) L. Benson & Walkington.
Engelmann Prickly-pear. Common; rocky slopes and hills, sandy washes; widespread. (208).

Opuntia phaeacantha Engelm. var. **major** Engelm. Engelmann Prickly-pear
Common; rocky hills, slopes, washes, canyons; widespread. (207).

Opuntia spinosior (Engelm.) Toumey. Cane Cholla
Common; washes, canyons, slopes; widespread. (288).

Opuntia violacea Engelm. var. **violacea.** Purple Prickly-pear
Rare; rocky slopes; widespread. (398).

CAMPANULACEAE

Triodanis perfoliata (L.) Nieuwl. Venus' Looking-glass
Very rare; sandy washes; oak woodland. (587).

CAPPARIDACEAE

Polanisia dodecandra (L.) DC. Clammy-weed
(*P. trachysperma* Torr. & Gray) Uncommon; sandy washes; widespread. (187).

CHENOPODIACEAE

Atriplex canescens (Pursh) Nutt. Fourwing Saltbush
Common; localized areas, grassland and desertscrub. (325).

Atriplex elegans (Moq.) Dietr. Wheel-scale Saltbush
Rare; disturbed areas, washes; riparian woodland. (279).

Ceratoides lanata (Pursh) Howell. Winter Fat
(*Eurotia l.* [Pursh] Moq.) Common; slopes, rocky hills, washes; widespread. (39).

Chenopodium dessiccatum A. Nels. Slim-leaf Goosefoot
(*C. pratericola* Rydb.) Common; sandy soils, disturbed areas, washes; widespread. (40).

Chenopodium fremontii Wats. Little-leaf Goosefoot
Common; disturbed areas, washes, sandy soils; widespread. (223, 506).

Chenopodium watsonii A. Nels. Goosefoot
Uncommon; sandy soils, slopes, washes; widespread. (456).

Salsola iberica Sennen & Pau. Russian Thistle, Tumbleweed
(*S. kali* L.) Common; disturbed areas; widespread. Introduced. (190).

COMMELINACEAE

Commelina dianthifolia Delile. Dayflower
Rare; rocky washes, moist places; oak woodland and savanna. (491).

CONVOLVULACEAE

Convolvulus arvensis L. Bind-weed
(*C. incanus* Vahl). Rare; disturbed areas. Introduced. (407).

Evolvulus sericeus Swartz. Morning Glory
Uncommon; plains, sandy soils; mesquite savanna. (442).

Ipomoea barbatisepala Gray. Morning Glory
Rare; sandy washes; riparian woodland and oak woodland. (569).

Ipomoea coccinea L. Scarlet Morning Glory
Occasional; sandy soils, washes, slopes; widespread. (306).

Ipomoea purpurea (L.) Roth. Woolly Morning Glory
(*I. hirsutula* Jacq.) Occasional; sandy soils, washes, slopes; widespread. (321, 346).

CRASSULACEAE

Sedum griffithsii Rose. Stone-crop
Very rare; rocky hills, moist and shade places; Helen's Dome. (237).

CUCURBITACEAE

Apodanthera undulata Gray. Melon-loco
Rare; roadsides, disturbed areas, sandy soils; oak savanna and grassland. (263).

Cucurbita digitata Gray. Finger-leaf Gourd
Common; sandy soils, washes, plains, slopes; widespread. (289, 290).

Cucurbita foetidissima H.B.K. Buffalo Gourd, Calabacilla Loca
Uncommon; sandy soils, washes, slopes; widespread. (228).

Marah gilensis Greene. Big-root, Wild Cucumber
Very rare; sandy washes; riparian woodland. (586).

CYPERACEAE

Cyperus aristatus Rottb. Flat Sedge
Rare; canyons, near water; oak woodland. (472).

Cyperus esculentus L. Chufa, Yellow Nutgrass
Rare; temporary streams; oak woodland and savanna. (540).

Cyperus fendlerianus Boeckl. var. **debilis** (Britton) Kükenth. Flat Sedge
(*C. rusbyi* Britton) Rare; rocky grassy slopes; widespread. (464, 477).

ERICACEAE

Arctostaphylos pungens H.B.K. Point-leaf Manzanita
Common; slopes, hills, canyons, washes; widespread. (64, 376).

EUPHORBIACEAE

Acalypha neomexicana Muell.-Arg. New Mexico Copper-leaf
Rare; washes, canyons, slopes; riparian woodland. (394, 505).

Chamaesyce albomarginata (Torr. & Gray) Small. Spurge
(*Euphorbia a.* Torr. & Gray) Occasional; gravelly soil, rocky hills; grassland. (19).

Chamaesyce hyssopifolia (L.) Standl.
(*Euphorbia h.* L.) Rare; sandy soils, washes; oak woodland and riparian woodland. (284).

Chamaesyce revoluta (Engelm.) Small. Spurge
(*Euphorbia r.* Engelm.) Rare; sandy soils, canyons; oak woodland and riparian woodland. (478).

Chamaesyce stictospora Engelm.) Small. Narrow-seeded Spurge
(*Euphorbia s.* Engelm.) Rare; gravelly slopes. (559).

Croton pottsii (Klotzsch) Muell.-Arg. var. **pottsii.** Leather Weed
(*C. corymbulosus* Engelm.). Uncommon; rocky slopes and hills; widespread. (132).

Tragia nepetifolia Cav. Nose-burn
Occasional; sandy soils, gravelly slopes; widespread. (294, 384).

FABACEAE (LEGUMINOSAE)

Acacia angustissima (Mill.) Kuntze. Fern Acacia, White-ball Acacia
Uncommon; rocky slopes, grassy locations; widespread. (462).

Acacia constricta Benth. White-thorn Acacia
Very rare; only one plant found in Apache Pass Road. (552).

Acacia greggii Gray. Cat-claw Acacia
Uncommon; sandy washes; riparian woodland and mesquite savanna. (227).

Amorpha fruticosa L. Stinking Willow, Mock Locust
Rare; sandy washes; oak woodlands. (177).

Astragalus allochrous Gray. Halfmoon Loco-weed
Common; plains, slopes, hills, washes; widespread. (166).

Astragalus arizonicus Gray. Milk-vetch
Rare; rocky slopes, plains; widespread. (388).

Astragalus calycosus Torr. ex Wats. Gray Loco-weed
Uncommon; rocky hills, slopes; widespread. (117).

Astragalus nothoxys Gray. Sheep Loco-weed
Common; rocky hills, slopes, plains; widespread. (77, 351, 365).

Astragalus nuttallianus DC. Sheep Loco-weed
Common; rocky hills, plains, slopes; widespread. (93).

Astragalus tephrodes Gray. Milk-vetch, Loco-weed
Rare; rocky slopes; savanna. (333).

Astragalus thurberi Gray. Milk-vetch
Uncommon; canyons, rocky and gravelly slopes; widespread. (371).

Astragalus wootonii Sheldon. Wooton Loco-weed
Common; slopes, washes, hills; widespread. (122).

Calliandra eriophylla Benth. Fairy Duster
Common; slopes, foothills; widespread. (111, 389).

Calliandra humilis Benth. var. **humilis.** False Mesquite
Uncommon; slopes, foothills; widespread. (261).

Calliandra humilis var. **reticulata** (Gray) L. Benson. False Mesquite
Uncommon; rocky slopes, foothills; widespread. (523).

Cassia bauhinioides Gray. Desert Senna
(*Senna b.* [Gray] Irwin & Barneby) Uncommon; slopes, foothills, grassy plains; widespread. (295).

Dalea albiflora Gray. Indigo-bush, Pea-bush
Occasional; rocky slopes, hills; widespread. (51).

Dalea formosa Torr. Feather-plume Dalea, Indigo-bush
Common; rocky slopes and hills; widespread. (110).

Dalea nana Torr. Indigo-bush, Pea-bush, Dwarf Dalea
Uncommon; grassy places, slopes; widespread. (107, 492).

Dalea pogonathera Gray. Hierba del Corazon, Indigo-bush, Pea-bush
Uncommon; disturbed areas, slopes, plains; widespread. (211).

Dalea versicolor Zucc. Indigo-bush, Pea-bush
(*D. wislizeni* Gray) Rare; sandy soils; riparian woodland. (554).

Dalea wrightii Gray. Indigo-bush, Pea-bush
Uncommon; disturbed areas, slopes, plains; widespread. (45).

Desmanthus cooleyi (Eaton) Trel. James Bundleflower
Uncommon; slopes, plains; widespread. (260, 493).

Desmodium procumbens (Mill.) Hitchc. Tick-clover
Uncommon; rocky slopes, hills; widespread. (345).

Galactia wrightii Gray
Uncommon; sandy washes; oak woodland, riparian woodland. (475, 530).

Hoffmanseggia drepanocarpa Gray. Sicklepad Rush-pea
Common; slopes, hills, disturbed areas; widespread. (108).

Hoffmanseggia glauca (Ortega) Eifort. Hog Potato, Camote de Raton
(*H. densiflora* Benth. ex Gray) Uncommon; foothills, slopes, disturbed areas; widespread. (277).

Lotus greenei (Wooton & Standl.) Ottley ex Kearney & Peebles. Deer-vetch
Uncommon; slopes, sandy soils, canyons; widespread. (72, 451).

Lotus humistratus Greene. Hill Lotus
Uncommon; rocky slopes, hills, sandy soils; widespread. (150).

Lotus oroboides (H.B.K.) Ottley ex Kearney & Peebles. Deer-vetch
Uncommon; washes, canyons; widespread. (315).

Lotus rigidus (Benth.) Greene. Desert Rock-pea
Rare; sandy and rocky canyons; oak woodland and savanna. (181).

Lotus wrightii (Gray) Greene. Deer-vetch
Rare; slopes and canyons; oak woodland and savanna. (555).

Lupinus brevicaulis Wats. Short-stemmed Blue-lupine
Uncommon; rocky slopes, foothills, grassy plains; widespread. (119).

Lupinus concinnus Agardh. Elegant Lupine
Uncommon; grassy plains, washes; widespread. (80).

Lupinus sparsiflorus Benth. Lupine
Rare; grassy plains, rocky slopes; mesquite savanna and oak woodland. (556).

Marina calycosa (Gray) Barneby. Indigo-bush, Pea-bush
(*Dalea c.* Gray) Uncommon; gravelly slopes, rocky hills; widespread. (210, 377).

Mimosa biuncifera Benth. Catclaw Mimosa
Uncommon; washes, canyons, slopes; widespread. (344).

Phaseolus acutifolius Gray. Tepary Bean
Uncommon; localized areas, sandy washes; oak woodland and riparian woodland. (390, 531).

Phaseolus heterophyllus Willd. Bean
Occasional; gravelly slopes; widespread. (274, 461).

Prosopis glandulosa Torr. var. **torreyana** (L. Benson) M.C. Johnst. Honey Mesquite
(*P. juliflora* [Swartz] DC. var. *t.* L. Benson) Occasional; washes, plains, slopes, widespread. (331).

Prosopis velutina Wooton Velvet Mesquite
(*P. juliflora* [Swartz] DC. var. *v.* [Wooton] Sarg.) Common; washes, canyons, slopes; widespread. (185).

Rhynchosia senna Gillies ex Hook. var. **angustifolia** (Gray) Grear. Rosary-bean
(*R. texana* Torr. & Gray) Uncommon; sandy washes, slopes; widespread. (220).

Robinia neomexicana Gray. New Mexican Locust
Rare; sandy washes; oak woodland. (192).

Vicia pulchella H.B.K. Vetch
Rare; sandy and disturbed areas. (557).

FAGACEAE

Quercus arizonica Sarg. Arizona White Oak
Uncommon; washes, canyons, slopes; widespread. (242).

Quercus dunnii Kell. Palmer Oak
(*Q. palmeri* Engelm.) Rare; rocky hills; chaparral and oak savanna. (141).

Quercus emoryi Torr. Emory Oak
Common; canyons, slopes; widespread. (82).

Quercus grisea Liebm. Gray Oak
Uncommon; washes, canyons, slopes; widespread. (88).

Quercus hypoleucoides Camus. Silverleaf Oak
Rare; higher elevations, Bowie Peak. (248).

Quercus pungens Liebm. Sandpaper Oak
Rare; washes, canyons, slopes; oak woodland and savanna. (245).

Quercus rugosa Née. Netleaf Oak
(*Q. reticulata* Humb. & Bonpl.) Occasional; washes, canyons; widespread. (240).

Quercus toumeyi Sarg. Toumey Oak
Uncommon; washes, canyons, slopes; oak woodland and savanna. (247).

Quercus turbinella Greene. Scrub Oak
Common; rocky hills, slopes, canyons, washes; widespread. (236).

FOUQUIERIACEAE

Fouquieria splendens Engelm. Ocotillo
Common; dry rocky slopes and hills, especially on limestone; grasslands and desertscrub. (214).

GARRYACEAE

Garrya wrightii Torr. Silk Tassel
Common; slopes, hills, canyons; widespread. (52).

GERANIACEAE

Erodium cicutarium (L.) L'Hér. Heron-bill, Filaree
Uncommon; sandy soils, washes, disturbed areas; widespread. Introduced. (84).

Erodium texanum Gray. Heron-bill, Filaree
Uncommon; slopes, foothills sandy soils; widespread. (91).

HYDROPHYLLACEAE

Nama hispidum Gray. Purple Mat
Rare; sandy washes; riparian woodland. (573).

Phacelia arizonica Gray. Arizona Phacelia
Rare; sandy soils, washes; riparian woodland. (364).

Phacelia congesta Hook.
Rare; rocky slopes; grassland. (349).

Phacelia crenulata Torr. Wild-heliotrope
Uncommon; plains, slopes, gravelly grounds; widespread. (100, 350).

JUGLANDACEAE

Juglans major (Torr.) Heller. Arizona Walnut
Common; canyons; riparian woodland. (180).

JUNCACEAE

Juncus drummondii E. Mey. Rush
Rare; along streams; oak woodland. (368).

Juncus saximontanus A. Nels. Rush
Rare; along streams; oak woodland. (176).

Juncus tenuis Willd. Rush
Rare; along water; oak woodland. (164).

KRAMERIACEAE

Krameria lanceolata Torr. Ratany
Uncommon; slopes, foothills; widespread. (112, 529).

LAMIACEAE (LABIATAE)

Hedeoma drummondii Benth. Mock-pennyroyal
Rare; roadsides, gravelly soils; woodland shrubsteppe savanna complex. (276).

Hedeoma nanum (Torr.) Briq. Mock-pennyroyal
Uncommon; slopes, hills, washes; widespread. (155).

Lamium amplexicaule L. Dead-nettle
Rare; disturbed areas, sandy and gravelly soils. Introduced. (404).

Marrubium vulgare L. Horehound
Common; washes, plains, slopes; widespread. Introduced. (103).

Salvia columbariae Benth. Chia
Occasional; slopes, sandy and gravelly soils; mesquite savanna and turpentine-bush shrubsteppe. (104).

Salvia henryi Gray. Sage
Occasional; gravelly and rocky slopes, usually on limestone; Desert Deerbrush—Alder-leaf Mountain-mahogany—Desert Sumac association. (138, 395).

Salvia lemmoni Gray. Sage
Rare; sandy soils, canyons; riparian woodland. (580).

Salvia subincisa Benth. Sage
Occasional; plains, canyons, washes; widespread. (269).

Stachys coccinea Jacq. Betony, Hedge-nettle
Uncommon; sandy washes, canyons; oak woodland and riparian woodland. (280).

Trichostema arizonicum Gray. Blue-curls
Rare; sandy soils, rocky hills; widespread. (343).

LILIACEAE

Allium macropetalum Rydb. Wild Onion
Uncommon; slopes, rocky hills; widespread. (98, 353).

Anthericum torreyi Baker. Crag-lily, Amber Lily
Rare; rocky slopes; oak woodland and savanna. (266).

Calochortus ambiguus (Jones) Ownbey. Mariposa, Sego Lily
Rare; slopes, rocky hills; widespread. (541).

Dichelostemma pulchellum (Salisb.) Heller. Bluedicks
Occasional; slopes, grassy areas; widespread. (67).

LINACEAE

Linum lewisii Pursh. Blue Flax
Occasional; rocky hills, slopes; savanna. (157).

Linum puberulum (Engelm.) Heller. Flax
Uncommon; rocky slopes widespread. (156).

Linum usitatissimum L. Common Flax
Uncommon; canyons, rocky slopes; widespread. Introduced. (97).

LOASACEAE

Cevallia sinuata Lag.
Rare; rocky slopes, plains. (189).

Mentzelia albicaulis (Dougl. ex Hook) Torr. & Gray. Small-flowered Blazing-star, Stick-leaf. Uncommon; roadsides, plains, sandy soil; widespread. (167).

Mentzelia multiflora (Nutt.) Gray. Stick-leaf
(*M. pumila* [Nutt.] Torr. & Gray) Common; localized areas, sandy soils, washes; widespread. (168).

LORANTHACEAE (VISCACEAE)

Phoradendron californicum Nutt. California Mistletoe
Common; on *Prosopis* sp. and *Condalia spathulata*; widespread. (335).

Phoradendron capitellatum Torr. ex Trel. Ball Mistletoe
Common; on *Juniperus*; widespread. (42).

Phoradendron villosum (Nutt.) Nutt. ssp. **coryae** (Trel.) Wiens. Cory Mistletoe Common; on *Quercus* sp. and *Fraxinus velutina*; widespread. (53).

MALPIGHIACEAE

Janusia gracilis Gray
Rare; rock hills; desertscrub and shrub-grassland. (172).

MALVACEAE

Abutilon parvulum Gray. Indian Mallow
Uncommon; disturbed areas, slopes, foothills; widespread. (283, 403).

Malvella lepidota (Gray) Fryx. Scurfy sida
Occasional; disturbed areas; roadsides; (282, 458).

Sida physocalyx Gray
Occasional; sandy soils, disturbed areas; widespread. (445).

Sida procumbens Swartz
Uncommon; rocky slopes, sandy ground; widespread. (131).

Sphaeralcea laxa Wooton & Standl. Desert Mallow, Globe Mallow
Common; disturbed areas, washes, slopes; widespread. (106, 143).

Sphaeralcea subhastata Coult. Globe Mallow
Uncommon; disturbed areas, limestone soils, washes; widespread. (142).

MARTYNIACEAE

Proboscidea parviflora (Wooton) Wooton & Standl. Devils's-claw, Unicorn Plant
Occasional; sandy soils, washes; widespread. (308).

MORACEAE

Morus microphylla Buckl. Texas Mulberry
Occasional; washes, slopes; widespread. (415).

NYCTAGINACEAE

Allionia incarnata L. Trailing Four-0'Clock
Common; sandy soils, rocky slopes, washes, disturbed areas; widespread. (191).

Boerhaavia diffusa L. var. **diffusa**. Red Spiderling
(*B. coccinea* Mill.). Uncommon; washes, sandy soils; widespread. (265, 473).

Boerhaavia intermedia Jones. Spiderling, Five-winged Ringstem
Uncommon; sandy soils, washes, slopes; widespread. (287, 470).

Boerhaavia purpurascens Gray. Purple Spiderling
Rare; washes, sandy soils; oak woodlands and ash-walnut woodlands. (546).

Boerhaavia spicata Choisy. Spiderling
Rare; washes, sandy soils; ash-walnut woodlands. (474).

Mirabilis bigelovii Gray. Four-O'Clock
Very rare; washes, sandy soils; oak woodland and riparian woodland. (598).

Mirabilis coccineus (Torr.) Benth. & Hook. Scarlet Four-O'Clock
(*Oxybaphus c.* Torr.) Uncommon; washes, sandy ground, grassy slopes; widespread. (178).

Mirabilis linearis (Pursh) Heimerl. Four-O'Clock
(*Oxybaphus l.* [Pursh] Robins) Uncommon; canyons, washes, slopes; riparian woodland and oak woodland. (216, 436).

Mirabilis longiflora L. Longflower Four-O'clock
Rare; washes, slopes, sandy soils; oak woodland and riparian woodland. (291).

Mirabilis multiflora (Torr.) Gray. Wild Four-O'Clock, Colorado Four-O'Clock
Uncommon; washes, roadsides, among rocks and shrubs; widespread. (204).

Mirabilis oblongifolia (Gray) Heimerl. Four-O'Clock
(*Oxybaphus comatus* [Small] Weath.) Rare; sandy slopes. (495, 532, 533).

Mirabilis pumila Standl. Four-O'Clock
(*Oxybaphus p.* Standl.) Rare; sandy washes; oak woodland. (494).

OLEACEAE

Fraxinus velutina Torr. Velvet Ash
Uncommon; canyons, washes; riparian woodland. (412).

Menodora scabra (Engelm.) Gray
Rare; canyons, sandy soils; oak woodland. (455).

ONAGRACEAE

Calylophus hartwegii (Benth.) Raven. Evening Primrose, Sun-drops
(*Oenothera greggii* Gray). Rare; dry rocky slopes, drainages; grassland. (129).

Camissonia californica (Nutt. ex Torr. & Gray) Raven. Sun-drops
(*Oenothera leptocarpa* Greene). Rare; rocky slopes; savanna and shrub-grassland. (562).

Camissonia contorta (Dougl.) Kearney. Sun-drops, Dwarf Contorted Primrose
Rare; rocky hills; widespread. (133).

Epilobium canum (Greene) Raven ssp. **latifolia** (Hook.) Raven. Hummingbird Trumpet
(*Zauschneria l.* [Hook.] Greene) Rare; moist ground, canyons; oak woodland. (564).

Gaura hexandra Ortega ssp. **gracilis** (Wooton & Standl.) Raven & Gregory. Scarlet Gaura, Butterfly-weed. (*G. g.* Wooton & Standl.) Rare; rocky slopes, hills; widespread. (387, 439).

Oenothera brachycarpa Gray. Sun-drops
Rare; dry rocky slopes; oak woodland and savanna. (212).

Oenothera caespitosa Nutt. White Desert Primrose
Uncommon; rocky slopes; widespread. (123).

Oenothera pallida ssp. **runcinata** (Engelm.) Munz & Klein. Creeping Primrose
Very rare; sandy soils, plains; mesquite savanna. (563).

Oenothera primiveris Gray. Yellow Desert Primrose
Uncommon; plains, sandy soils, slopes; widespread. (358).

OROBANCHACEAE

Orobanche cooperi (Gray) Heller. Broom-rape
(*O. ludoviciana* Nutt.) Occasional; slopes, hills, plains; widespread.

PAPAVERACEAE

Argemone pleiacantha Greene ssp. **pleiacantha** Ownbey. Prickly Poppy
(*A. platyceras* Link & Otto) Uncommon; washes, sandy soils, roadsides; widespread. (102).

Corydalis aurea Willd. Scrambled Eggs
Uncommon; washes, sandy and rocky slopes; widespread. (549).

Eschscholtzia californica Cham. ssp. **mexicana** (Greene) C. Clark. Golden Poppy
(*E. m.* Greene) Rare; sandy soils, open ground; mesquite savanna and grassland. (397).

PLANTAGINACEAE

Plantago patagonica Jacq. var. **gnaphaloides** (Nutt.) Gray. Plantain
(*P. purshii* Roem. & Schult.) Common; slopes, plains, disturbed areas; widespread. (81).

POACEAE (GRAMINAE)

Agrostis semiverticillata (Forsk.) C. Christ. Water Bent
Rare; along running water, canyons, washes. Introduced. (163, 175).

Aristida adscensionis L. Six-week Three-awn
Uncommon; disturbed and sandy soil; mesquite savanna. (603).

Aristida glauca (Nees) Walp. Three-awn
Uncommon; rocky slopes, plains; widespread. (517).

Aristida hamulosa Henr. Three-awn
Rare; disturbed soil, sandy ground. (4, 515).

Aristida longiseta Steud. Red Three-awn
Uncommon; alluvium, plains, sandy ground; riparian woodland, mesquite savanna and oak woodland. (165, 366).

Aristida purpurea Nutt. Purple Three-awn
Uncommon; foothills, plains, sandy ground; widespread. (18, 449).

Aristida ternipes Cav. Spider Grass
Uncommon; rocky hills, plains; oak savanna and mesquite savanna. (374).

Bothriochloa barbinodis (Lag.) Herter. Cane Beard Grass
(*Andropogon b.* Lag.) Uncommon; rocky and sandy soils, open ground. (5, 503).

Bothriochloa saccharoides (Swartz) Rydb. Silver Beard Grass
(*Andropogon s.* Swartz) Rare; disturbed soil, open sandy soils, rocky slopes. (405, 468).

Bouteloua aristidoides (H.B.K.) Griseb. Needle Grama
Rare; disturbed ground, sandy soils; mesquite savanna. (539).

Bouteloua barbata Lag. Six-week Grama
Common; washes, sandy ground, slopes, plains; widespread. (184).

Bouteloua chondrosioides (H.B.K.) Benth. ex Wats. Spruce-top Grama
Common; southern slopes, rocky hills; widespread. (34, 459).

Bouteloua curtipendula (Michx.) Torr. Sideoats Grama
Common; slopes, washes, foothills, plains; widespread. (8, 375).

Bouteloua eriopoda Torr. Black Grama
Common; open ground, slopes, mesas; widespread. (15, 490).

Bouteloua gracilis (Willd. ex H.B.K.) Lag. ex Steud. Blue Grama
Common; plains, slopes, foothills; widespread. (27).

Bouteloua hirsuta Lag. Hairy Grama
Uncommon; rocky slopes, plains; widespread. (367, 479).

Bouteloua repens (H.B.K.) Scribn. & Merr. Slender Grama
(*B. filiformis* [Fourn.] Griffiths) Occasional; rocky foothills, plains; widespread. (275).

Bromus tectorum L. Cheatgrass Brome
Rare; rocky slopes, sandy ground; oak savanna and oak woodland. Introduced. (406).

Cenchrus incertus Curtis. Field Sand-bur
(*C. pauciflorus* Benth.) Rare; disturbed ground, sandy soils; mesquite savanna. (222).

Chloris virgata Swartz. Feather Fingergrass
Uncommon; plains, sandy soils, disturbed ground; widespread. (20).

Cynodon dactylon (L.) Pers. Bermuda Grass
Uncommon; canyons, plains, along water; widespread. Introduced. (159).

Digitaria californica (Benth.) Henr. Arizona Cottontop
(*Trichachne c.* [Benth.] Chase). Uncommon; washes, open ground, slopes; widespread. (10, 251).

Digitaria cognatum (Schult.) Pilger. Fall Witchgrass
(*Leptoloma c.* [Schult.] Chase.) Uncommon; rocky slopes, gravelly plains; aloysia-deerbrush shrubsteppe. (152, 441).

Digitaria sanguinalis (L.) Scop. Crab Grass
Uncommon; washes, slopes, roadsides; widespread. Introduced. (292).

Echinochloa colonum (L.) Link. Jungle-rice
Rare; sandy and moist ground; oak woodland and riparian woodland. Introduced. (426).

Echinochloa crusgalli (L.) Beauv. Barnyard Grass
Rare; sandy and moist ground; riparian woodland. Introduced. (453).

Enneapogon desvauxii Beauv. Spike Pappusgrass
Uncommon; rocky hills, eroded areas; widespread. (21).

Eragrostis cilianensis (All.) Mosher. Stink Grass
Uncommon; disturbed ground, sandy soils; widespread. Introduced. (32).

Eragrostis intermedia Hitchc. Plains Lovegrass
Uncommon; canyons, gravelly slopes, plains; widespread. (518).

Eragrostis lehmanniana Nees. Lehmann Lovegrass
Common; localized areas, disturbed and sandy ground; widespread. Introduced. (29).

Eragrostis pectinacea (Michx.) Nees. Spreading Lovegrass
(*E. diffusa* Buckl.) Rare; canyons, sandy ground; oak woodland and riparian woodland. (428).

Eragrostis tephrosanthos Schultes. Desert Lovegrass
(*E. arida* Hitchc.) Uncommon; rocky and sandy soils, disturbed ground; widespread. (427).

Eriochloa lemmonii Vasey & Scribn. Southwestern Cupgrass
Occasional; sandy ground, rocky and grassy slopes; widespread. (480).

Erioneuron grandiflorum (Vasey) Tateoka. Shortleaf Tridens
(*Tridens g.* [Vasey] Wooton & Standl.) Common; slopes, foothills, sandy and rocky soils; widespread. (23).

Erioneuron pulchellum (H.B.K.) Tateoka. Fluff Grass
(*Tridens p.* [H.B.K.] Hitchc.) Common; slopes, plains, rocky hills; widespread. (13).

Heteropogon contortus (L.) Beauv. ex Roemer & Schultes. Tanglehead
Uncommon; rocky foothills, sandy ground, canyons; widespread. (35).

Hilaria belangeri (Steud.) Nash. Curly Mesquite
Uncommon; rocky slopes and foothills, plains; widespread. (373).

Hilaria mutica (Buckl.) Benth. Tobosa Grass
Uncommon; in localized areas, rocky foothills, plains; grassland. (396).

Hordeum leporinum Link. Mouse Barley
Uncommon; eroded areas, sandy ground; mesquite savanna. Introduced. (101).

Koeleria cristata (L.) Pers. June Grass
(*K. pyramidata* [Lam.] Beauv.) Rare; along moist ground; woodland shrubsteppe savanna complex and oak woodlands. (135, 174).

Leptochloa dubia (H.B.K.) Nees. Green Sprangletop
Common; localized areas, plains, open ground, rocky hills. (483, 502).

Lycurus phleoides H.B.K. Wolftail, Texas Timothy
(*L. setosus* [Nutt.] C. Reeder) Common; rocky slopes, sandy ground, plains; widespread. (33, 301, 463).

Muhlenbergia arenacea (Buckl.) Hitchc. Ear Muhly
Rare; eroded areas, sandy ground. (2).

Muhlenbergia arenicola Buckl. Sand Muhly
Uncommon; plains, sandy ground; mesquite savanna. (14, 516).

Muhlenbergia emersleyi Vasey. Bullgrass
Common; rocky hills and slopes; oak woodland and savanna. (56).

Muhlenbergia porteri Scribn. ex Beal. Bush Muhly
Uncommon; protected places, plains, slopes; widespread. (9).

Muhlenbergia repens (Presl.) Hitchc. Aparejo Grass
Rare; forming patches, sandy and rocky ground. (28).

Panicum capillare L. Witchgrass
Rare; moist places, sandy ground; oak woodland and savanna. (268).

Panicum hallii Vasey. Hall Panicum
Uncommon; open ground, rocky slopes; mesquite savanna. (25).

Panicum obtusum H.B.K. Vine Mesquite
Uncommon; open ground, slopes; widespread. (26).

Poa annua L. Annual Bluegrass
Rare; canyon, eroded areas; riparian woodland. Introduced. (383).

Schizachyrium cirratum (Hack.) Wooton & Standl. Texas Bluestem
(*Andropogon c.* Hack.) Rare; rocky slopes, plains; widespread. (485).

Scleropogon brevifolius Phil. Burro Grass
Uncommon; open ground, slopes; mesquite savanna. (30).

Setaria grisebachii Fourn. Grisebach Bristlegrass
Rare; sandy ground; riparian woodland. (504).

Setaria macrostachya H.B.K. Plains Bristlegrass
Common; sandy ground, rocky slopes, canyons; widespread. (11).

Sitanion hystrix (Nutt.) J.G. Smith. Bottlebrush Squirreltail
(*Elymus elymoides* [Rafn.] Swezey) Rare; sandy and rocky soils, canyons; riparian woodland. (17, 83).

Sporobolus contractus Hitchc. Spike Dropseed
Uncommon; sandy soils, slopes, plains; widespread. (22).

Sporobolus cryptandrus (Torr.) Gray. Sand Dropseed
Common; sandy soils, roadsides, slopes; widespread. (6).

Sporobolus wrightii Munro. ex Scribn. Sacaton
Uncommon; localized areas, sandy soils, open ground; grassland. (501).

Stipa neomexicana (Thurb.) Scribn. New Mexico needlegrass
Rare; rocky slopes; shrub-grassland. (386).

Tragus berteronianus Schult. Bur Grass
Rare; open ground, disturbed areas. Introduced. (553).

Tridens muticus (Torr.) Nash. Slim Tridens
Common; slopes, gravelly and rocky ground; desertscrub and grassland. (24, 128).

Vulpia octoflora (Walt.) Rydb. Six-week Fescue
(*Festuca o.* Walt.) Common; rocky slopes, sandy ground, plains, canyons; widespread. (124, 382, 381).

POLEMONIACEAE

Allophyllum gilioides (Benth.) A. & V. Grant
(Gilia g. [Benth.] Greene) Rare; sandy washes; riparian woodland. (355).

Eriastrum diffusum (Gray) Mason
Uncommon; plains, washes, sandy soils; widespread. (169).

Gilia ophthalmoides Brand
Rare; disturbed areas, gravelly soils; shrub-grassland. (94, 357).

Gilia sinuata Dougl. ex Benth.
Rare; disturbed soils. (571).

Ipomopsis longiflora (Torr.) V. Grant. Star-flowered Gilia
(*Gilia l.* [Torr.] G. Don) Uncommon; plains, slopes, roadsides; widespread. (92).

Ipomopsis multiflora (Nutt.) V. Grant. Many-flowered Gilia
(*Gilia m.* Nutt.). Very rare; along roads; oak woodland and savanna. (570).

Linanthus aureus (Nutt.) Greene
Occasional; sandy soils, plains; mesquite savanna. (356).

Phlox austromontana Coville. Phlox
Rare; rocky slopes; savanna. (572).

Phlox nana Nutt. Phlox
Rare; gravelly slopes, canyons; oak woodland. (116).

POLYGALACEAE

Polygala longa Blake. Milk-wort
Uncommon; washes, slopes; widespread. (304).

Polygala macradenia Gray. Milk-wort
Rare; rocky slopes; shrub-grassland. (356).

Polygala racemosa Blake. Milk-wort
Rare; rocky slopes on limestone; shrub-grassland. (130).

POLYGONACEAE

Eriogonum abertianum Torr. Wild Buckwheat
Uncommon; washes, sandy soils; widespread. (272, 446).

Eriogonum deflexum Torr. Skeleton Weed
Common; plains, sandy soils, foothills; widespread. (229).

Eriogonum polycladon Benth. Sorrel Eriogonum
Common; localized areas, washes, sandy soils; oak woodland and riparian woodland. (497).

Eriogonum wrightii Torr. ex Benth. Wild Buckwheat
Common; washes, plains, sandy soils, eroded areas; widespread. (48).

Polygonum convolvulus L. Corn-bind, Black Bindweed
Very rare; disturbed areas. Introduced. (545).

Rumex crispus L. Curlyleaf Dock, Curley Dock
Rare; canyons, along water; oak woodland. Introduced. (465).

Rumex hymenosepalus Torr. Canaigre, Wild Rhubarb
Common; sandy soils, roadsides, washes; widespread. (86).

PORTULACACEAE

Portulaca parvula Gray. Portulaca, Purslane
Uncommon; sandy soils, washes, plains, slopes; widespread. (318).

Portulaca retusa Engelm. Portulaca, Western Pusley
Rare; rocky slopes; mesquite savanna. (310, 499).

Portulaca suffrutescens Engelm. Portulaca, Purslane
Uncommon; rocky slopes, sandy soils; oak woodland. (259, 507, 508).

Talinum aurantiacum Engelm. Flame Flower
Rare; rocky ground, grassy plains; widespread. (271, 341).

Talinum parviflorum Nutt. ex Torr. & Gray. Dwarf Flame Flower
(*T. gooddingii* P. Wilson). Uncommon; rocky slopes, grassy plains; widespread. (270).

RANUNCULACEAE

Anemone tuberosa Rydb. Anemone, Desert Windflower
Uncommon; rocky slopes; widespread. (12).

Clematis drummondii Torr. & Gray. Western Virgin's Bower, Barbas de Chivato.
Rare; washes, among shrubs; riparian woodland. (548).

Delphinium virescens Nutt. Plains Larkspur
Rare; rocky hills and slopes; widespread. (379, 380).

RHAMNACEAE

Ceanothus greggii Gray. Desert Deerbrush
Uncommon; rocky and gravelly hills; widespread. (14).

Condalia warnockii Johnst. var. **kearneyana** Johnst. Mexican Crucillo
(*C. spathulata* Gray). Common; in localized areas, gravelly and rocky hills and slopes; shrub-grassland. (332).

Rhamnus californica Esch. California Buck-thorn, Coffee-Berry
Rare; sandy and rocky washes; oak woodland. (448).

Ziziphus obtusifolia (Hook. ex Torr. & Gray) Gray. Gray-thorn
(*Condalia lycioides* (Gray) Weberb.) Uncommon; washes, slopes, canyons; oak woodland and riparian woodland. (323).

ROSACEAE

Cercocarpus montanus Raf. var. **paucidentatus** (Wats.) Martin. Alder-leaf Mountain-mahogany. (*C. breviflorus* Gray) Uncommon; rocky slopes and hills; widespread. (235).

Fallugia paradoxa (D. Don) Endl. Apache Plume
Rare; sandy washes, gravelly slopes; oak woodland and savanna. (193).

RUBIACEAE

Bouvardia ternifolia (Cav.) Schlecht. Smooth Bouvardia
(*B. glaberrima* Engelm.) Occasional; rocky ground, canyons, slopes; Oak woodland. (267, 846).

Diodia teres Walt. Rough Buttonbush
Uncommon; sandy soils, moist places, washes, plains; widespread. (311).

Galium proliferum Gray. Bedstraw
Rare; rocky slopes, and hills, especially on limestone; shrub-grassland. (334).

Galium wrightii Gray. Bedstraw
(*G. rothrockii* Gray). Rare; sandy soils, washes, slopes; ash-walnut woodlands. (443).

RUTACEAE

Ptelea trifoliata L. Narrow-leaf Hop-tree
(*P. angustifolia* Benth.). Uncommon; washes, slopes, canyons; widespread. (416).

Thamnosma texana (Gray) Torr. Turpentine Broom
Occasional; rocky slopes, hills; widespread. (16).

SALICACEAE

Populus fremontii Wats. Fremont Cottonwood
Rare; canyons, along streams; riparian woodland. (215).

Salix exigua Nutt. Coyote Willow
Common; washes, canyons, along streams; widespread. (99).

Salix gooddingii Ball. Goodding Willow
Rare; Apache Spring Wash; riparian woodland. (203).

SANTALACEAE

Comandra umbellata (L.) Nutt. ssp. **pallida** (A. DC.) Piehl. Bastard Toadflax
(*C. p.* A. DC.) Rare; rocky slopes; oak woodland. (544).

SAPINDACEAE

Sapindus drummondii Hook. & Arn. Soapberry
(*S. saponaria* L. var. *d.* [Hook. & Arn.] L. Benson). Uncommon; canyons, washes; oak woodland and riparian woodland. (179).

SAPOTACEAE

Bumelia lanuginosa (Michx.) Pers. var. **rigida** Gray. Gum Bumelia, Chittan-wood
Common; localized areas, canyons, washes, sandy soils; riparian woodland. (218).

SAXIFRAGACEAE

Fendlera rupicola Gray. False Mock-orange
Rare; rocky slopes, higher elevations; Bowie Mountain. (238).

Heuchera sanguinea Engelm. Coral Bell
Rare; among rocks, moist locations, higher elevations; Bowie Mountain and Helen's Dome. (234).

SCROPHULARIACEAE

Castilleja austromontana Standl. & Blumer. Indian Paintbrush
Rare; rocky slopes; oak woodland and savanna. (463).

Castilleja integra Gray. Indian Paintbrush
Occasional; rocky slopes, washes; widespread. (137, 369, 370).

Castilleja lanata Gray. Indian Paintbrush
Occasional; rocky slopes, foothills; widespread. (120).

Castilleja sessiliflora Pursh. Indian Paintbrush
Uncommon; localized areas, dry rocky and sandy soils, hills, slopes on limestone; shrub-grassland. (121).

Linaria genistifolia (L.) Mill. ssp. **dalmatica** Mill. Toad-flax
Rare; sandy soils, washes; oak woodland. Introduced. (488).

Maurandya antirrhiniflora Humb. & Bonpl. ex Willd. Snapdragon Vine, Blue Maurandya
Uncommon; rocky ground, washes; widespread. (173).

Mimulus guttatus Fisch. ex DC. Monkey-flower
Rare; sandy washes, moist ground; oak woodland. (162).

Mimulus rubellus Gray. Monkey-flower
Rare; sandy washes, moist ground; oak woodland. (162).

Pedicularis procera Gray. Louse-wort
(*P. grayi* Nels.) Rare; sandy washes; oak woodland and riparian woodland. (585).

Penstemon barbatus (Cav.) Roth. Beardtongue
Occasional; sandy washes, slopes; widespread. (432).

Penstemon lanceolatus Benth. Beardtongue
Uncommon; slopes, canyons; widespread. (158).

Penstemon linarioides Gray. Beardtongue
Occasional; washes, slopes; widespread. (219).

Veronica peregrina L. Speedwell
Rare; washes, moist ground; widespread. (160).

SOLANACEAE

Chamaesaracha coronopus (Duval) Gray. Ground-cherry
Rare; disturbed areas. (581).

Chamaesaracha sordida (Duval) Gray. Ground-cherry
(*C. coniodes* [Moric.] Britton) Uncommon; disturbed areas, plains. (118, 408).

Datura innoxia Miller. Sacred Datura, Indian-apple
(*D. meteloides* DC.) Common; sandy soils, washes; widespread. (188).

Lycium fremontii Gray. Wolfberry
Occasional; sandy washes; riparian woodland. (582).

Lycium pallidum Miers. Pale Wolfberry, Rabbit-thorn
Occasional; sandy and gravelly soils, slopes, canyons; widespread. (88).

Nicotiana trigonophylla Dunal. Desert Tobacco, Tabaqillo
Occasional; sandy soils, among rocks; riparian woodland. (113).

Physalis acutifolia (Miers) Sandw. Ground-cherry, Husk-tomato
(*P. wrightii* Gray) Occasional; slopes, gravely soil. (305).

Physalis hederifolia Gray var. **cordifolia** (Gray) Waterfall. Ground-cherry, Husk-tomato
(*P. fendleri* Gray). Rare; slopes, sandy soils; oak woodland and riparian woodland. (471).

Physalis virginiana Mill. var. **sonorae** (Torr.) Waterfall. Ground-cherry, Husk-tomato
(*P. longifolia* Nutt.) Rare; sandy soils, canyons; oak woodland and riparian woodland. (583).

Solanum americanum Mill. American Nightshade, Hierba Mora Negra
Rare; sandy washes, disturbed areas; oak woodland and riparian woodland. (285).

Solanum elaeagnifolium Cav. White Horse-nettle, Trompillo
Common; slopes, washes, disturbed areas, rocky hills; widespread. (151).

Solanum nodiflorum Jacq. Nightshade
Rare; sandy washes and slopes; oak woodland and riparian woodland. (431).

ULMACEAE

Celtis reticulata Torr. Netleaf Hackberry, Palo Blanco
Common; washes, canyons, slopes; widespread. (543).

VERBENACEAE

Aloysia wrightii (Gray) Heller. Wright Lippia, Oreganillo
Common; hills, slopes, washes; widespread. (328).

Glandularia bipinnatifida (Nutt.) Nutt. Dakota Vervain
(*Verbena b.* Nutt., *V. ambrosifolia* Rydb., *V. ciliata* Benth.) Occasional; rocky hills and slopes, sandy soil; widespread. (75, 444, 469, 498, 579)

Tetraclea coulteri Gray
Rare; sandy soils, canyons, slopes; widespread. (183).

Verbena gracilis Desf. Vervain
Occasional; disturbed areas, sandy soils; widespread. (231).

Glandularia wrightii (Gray) Umber. Desert Verbena
(*Verbena w.* Gray) Occasional; slopes, rocky hills; widespread. (43).

VIOLACEAE

Hybanthus verticillatus (Ortega) Baill. Green Violet
Rare; sandy washes; riparian woodland. (560).

VITACEAE

Vitis arizonica Engelm. Canyon Grape
Common; sandy washes and canyons; riparian woodland. (126).

ZYGOPHYLLACEAE

Kallstroemia grandiflora Torr. ex Gray. Arizona poppy, Mexican Poppy
Uncommon; grassy slopes and plains; widespread. (258).

Kallstroemia parviflora Norton
Uncommon; grassy plains; mesquite savanna. (286).

Larrea tridentata (Sesse & Moc. ex DC.) Coville. Creosote-bush, Gobernadora (*L. divaricata* Cav.). Common; desertscrub. (213).

Tribulus terrestris L. Puncture Vine, Goat's Head
Rare; disturbed areas. Introduced. (481).

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The cover photograph was taken October 4, 1935, in Saguaro National Monument by the first National Park Service photographer, George Alexander Grant (1891-1964).



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