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THE VASCULAR FLORA OF THE OWENS PEAK EASTERN WATERSHED, SOUTHERN SIERRA NEVADA, CALIFORNIA

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ABSTRACT

Owens Peak lies at the southern end of the Sierra Nevada within the Bureau of Land Management’s Owens Peak Wilderness Area in Kern County, California. The study site, ca. 50 square miles, encompasses Owens Peak’s eastern watershed, and ranges in elevation from 800–2600 m (2600–8400 ft). Granite rocks of the Sierra Nevada batholith underlie the study area. The eastern watershed of Owens Peak is botanically diverse, with 64 families, 230 genera, and 440 taxa currently documented. Floristic elements within the study area include the southern Sierra Nevada, Great Basin, and Mojave Desert. The flora previously was poorly documented, as discovered through a search of California’s largest herbaria (CAS/DS, RSA-POM, UC/JEPS). A total of 56 collecting days was spent in the field between 2002 and 2005. Approximately 1300 vascular plant collections were made within the study area. Several rare taxa are found in the study area, including seven endemic to the southern Sierra Nevada, and two species described in 1988. One species, Lomatium shevockii, is endemic to the study area. Salvia latifolia was previously known from several mountain ranges in San Bernardino and Riverside counties, and one disjunct population in Inyo County. The discovery of this species within the study area not only extends its range, but also is a new record for Kern County. The primary objectives of this study were to catalogue, voucher, and create an annotated checklist of the watershed’s vascular flora, describe the vegetation patterns, and assess the status of the rare species in the area.

Key words: California, eastern Sierra Nevada, flora, floristics, Great Basin, Mojave Desert, Owens Peak, rare plants, southern Sierra Nevada.

INTRODUCTION

There are several factors bearing on the discovery and loss of biodiversity. These include the inaccessibility of areas for botanical collection, the encroachment of urbanization on wild lands, the deleterious impacts of exotic plants, and the existence of areas that have been overlooked by botanists (Shevock 1988; Wohlmgemuth 1998; Prather et al. 2004). Given that there are regions in California that have not been well documented botanically, it is evident that floristic research will continue to be of great importance (Soza et al. 2000). It is estimated that 5% of the vascular plant species in North America remain undescribed (Prather et al. 2004). Through systematic floristic inventories of discrete physiographic regions we can gain a better understanding of the most fundamental aspect of studying plant diversity (Wohlgemuth 1998).

California is a hotspot of plant diversity and endemism, with more than 6200 native species, of which 24% are endemic (Hickman 1993). This level of diversity exceeds that of areas of equivalent size in North America and most of continental Eurasia, and can be attributed to the diversity California exhibits in geology, climate, and topography (Hickman 1993). Although California’s flora is relatively well documented, our knowledge of its complexity is continually growing—62 taxa have been described since The Jepson Manual (Hickman 1993) was published, and 366 taxa, either newly naturalized exotics or range extensions from outside California, have been documented (Jepson Online Interchange 2005).

Since 1982, the southern Sierra Nevada has been a source of many of these discoveries (Shevock 1996; York 2001). Prior to 1982 only sporadic collecting had occurred along the Sierran Crest of Olanca Peak (Shevock 1988). Discoveries in the region include Allium shevockii D.W.McNeal, Astragalus ertterae Barneby & Shevock, and Mimulus shevockii L.R.Heckard & R.Bacigalupi, all described since 1986 (Heckard & Bacigalupi 1986; Barneby and Shevock 1987; McNeal 1987; Shevock 1988). These recent discoveries, combined with a lack of systematic botanical collections, make this region ideal for a floristic study.

Owens Peak lies at the southern end of the Sierra Nevada in Kern County, California (Fig. 1). Its eastern watershed contains considerable topographic and botanical diversity. Elevations range from 800 m (2600 ft) on the creosote bush dominated bajadas to 2600 m (8400 ft) where lie its forested peaks. This section of the Sierra Nevada forms the most southerly high-rising portion of the range. The study area is situated on the interface between the Mojave Desert, the Great Basin, and the Sierra Nevada floristic regions.

Prior to my research, there had been little botanical collecting documented in the study area. Despite the lack of documentation, the area has yielded several interesting botanical discoveries in recent years, including new species and significant range extensions (Shevock 1988). The exiguous documentation is a paradox, as the easily accessed Short Canyon is well known to wildflower enthusiasts for its beautiful and often abundant displays of winter annuals. Furthermore, the diverse array of habitats and landscapes, known to hold several rare endemics and disjunct species, are reason enough to document the flora of this region.

The primary objectives of this study were to catalogue, voucher, and create an annotated checklist of the vascular flora of the Owens Peak eastern watershed, describe the
Fig. 1. A map of the Owens Peak eastern watershed and its location in California. The study area is outlined in red.
vegetation patterns, and assess the status of the rare species. Floristic documentation of this area will aid our understanding of the floristic province boundaries of California and will be of value in managing the region’s botanical diversity.

**PHYSICAL SETTING**

**Location**

The Sierra Nevada, one of the major mountain ranges in North America, is a northwest-trending mountain range in California that is 50–80 miles wide and nearly 400 miles long (Hill 1975). The range extends from as far north as Plumas County near Mount Lassen (40° N) to its southern limit at Tehachapi Pass (35° N) in Kern County (Hill 1975; Wernicke et al. 1996; Smith 2000). Owens Peak is located on the Sierra Nevada crest in Kern County and rises to 2576 m (8453 ft) (Fig. 2). The study area encompasses the eastern watershed of Owens Peak, which rises sharply above Indian Wells Valley northwest of Ridgecrest (Fig. 1).

The study area falls between 35°45'26" and 35°36'8"N latitude and between 118°0'8" and 117°51'57"W longitude, encompassing an area of 12,950 hectares (30 sq miles). The majority of the site is located within the Owens Peak 7.5' USGS topographic quadrangle, with portions of the site contained on the Inyo, Lamont Peak, Ninemile Canyon, and Walker Pass 7.5' USGS topographic quadrangles.

Geographic features were primarily used as natural boundaries. The northern and southern boundaries were defined, respectively, by ridgelines above Grapevine Canyon and Indian Wells Canyon, which subsume the watershed (Fig. 1). The western boundary is the Sierra Nevada crest, which includes three peaks—Owens Peak, Mount Jenkins, and Morris Peak (north to south, respectively). California State Route 14 (SR 14) and US Highway 395 (Hwy 395) were used to define the eastern boundary; the intersection of these two highways is identified by the landmark of Brady’s Gas Station (Fig. 1). The major physiographic features of the watershed are outlined below.

**Physiography**

**Sierra Nevada crest.**—There are three prominent peaks that delineate the western boundary of the study site. These include Owens Peak (2576 m [8453 ft]), Mount Jenkins (2414 m [7921 ft]) and Morris Peak (2199 m [7215 ft]). Owens Peak is the highest point in the southern Sierra Nevada, and Kern County; the crest of the range rarely reaches above 1800 m (6000 ft) south of the study area. The gray, east face of Owens Peak and the precipitous escarpment is a characteristic and prominent feature of the landscape above the Indian Wells Valley. Five Fingers, also known as Aquilla Peak, rising to 1577 m (5174 ft) is a series of large finger-like spires extending from the east ridgeline of Owens Peak (Fig. 1).

The ridgeline that extends east of Morris Peak just north of Walker Pass includes two peaks around 2100 m (7000 ft) in elevation. While these peaks are not named on the Owens Peak USGS 7.5’ topographic quadrangle, the Sierra Club registers located on the summits show the names of Russell Peak (2041 m [6696 ft]) and Backus Peak (2027 m [6651 ft]), west to east, respectively (Fig. 1).

**Canyons.**—There are three major canyons that form the eastern watershed of Owens Peak and drain into Indian Wells Valley. North to south, these canyons are Grapevine Canyon, Short Canyon, and Indian Wells Canyon. Several smaller canyons are found west and southwest of Indian Wells.
Canyon; these are Morris Canyon, Manuel Canyon, an unnamed canyon, and Buena Vista Canyon, north to south, respectively. These smaller canyons drain into Indian Wells Canyon and make up the eastern watershed of Morris Peak.

Each of the main canyons is unique in its physiography. Grapevine Canyon is significantly more mesic than Indian Wells and Short canyons as is evidenced by the difference in riparian vegetation (Fig. 1). Short Canyon is indeed a short canyon by comparison with the other two. It is characterized by large granite boulders, tall spires, and is interlaced with several springs. Indian Wells Canyon is wide and expansive when compared to the other two, and serves as the watershed for two additional peaks (Morris Peak and Mount Jenkins).

**Geology**

**Formation of the Sierra Nevada.**—Geologically the Sierra Nevada is considered a single range unlike the Rocky Mountains to the east, which are a mountain system (Hill 1975). Beginning with a violent volcanic episode about 20 million years ago, the Sierra rose to great heights to form the mountains we currently know (Smith 2000). The major fault lines, which parallel the mountains along the east side, are known as the Sierran Frontal Faults; these are responsible for the continued uplift of the range (Diggles et al. 1987; Smith 2000). The eastern slope is precipitous compared to the more gentle western slope—the result of the westward thrust of the faults (Smith 2000).

**Geologic structure.**—The study area is underlain by granitic rocks of the Sierra Nevada batholith. A series of en echelon faults that cut west-northwest have controlled the formation of the major canyons (Fig. 3); these canyons form at right angles to the range (Hill 1975; Diggles et al. 1987; Smith 2000). The rocks have undergone at least two periods of uplift followed by major intrusive events. This is evident by foliations in Indian Wells Canyon that trend northwest to southeast (Diggles et al. 1987).

**Rock types.**—Within the study area, the Sierra Nevada crest is primarily composed of granite formed during the Cretaceous and metamorphic rocks from the Paleozoic (Jennings and Strand 1969; Diggles et al. 1987; Fig. 3). Specifically, Owens Peak is composed of largely leucocratic, coarse-grained, equigranular, biotite granite. The ridgeline extending east of Owens Peak, and leading to Five Fingers, is composed of the same granite type. The summit and portions of the east face of Owens Peak are composed of metamorphic rocks. The east side of Mount Jenkins is predominantly composed of metamorphic rocks interfacing with the same type of granite as on Owens Peak and the diorite of Indian Wells Canyon. The granite of Morris Peak is characterized as medium-grained, biotite-porphyritic granodiorite (Fig. 3).

The westward trending ridgeline forming the southern boundary of the study area is composed of metamorphic rocks along the top. Below, on the south side of Indian Wells Canyon, is mesocratic, medium-grained, serrate, foliated to gneissic diorite (Diggles et al. 1987). At the easternmost end of Grapevine Canyon at Indian Wells Valley lies Quaternary alluvium (Jennings and Strand 1969; Diggles et al. 1987). The canyons are filled with younger alluvium of Quaternary origin, which are dissected stream channel deposits (Diggles et al. 1987; Fig. 3).

**CLIMATE**

The eastern face of the Sierra Nevada lies in a rain shadow, characterized by low annual precipitation, seasonally strong winds, and large seasonal fluctuations in temperature (Smith 2000). The temperature and precipitation vary widely with elevation (Smith 2000). The canyon floors are hot and arid, and any standing water residual from snowmelt is ephemeral. In contrast to the lowlands, the higher elevations remain cooler throughout the year. As a consequence, moisture is retained longer. Snow occurs at the higher elevations, generally at or above 1500 m (5000 ft). The north-facing slopes of the highest peaks are coolest and snow persists there the longest.

Long-term climate records do not exist for the study area proper. There is one weather station located in Indian Wells Canyon at 35°41’06” N and 117°53’22” W and 1220 m (4000 ft) in elevation (Western Regional Climate Center 2005), however, the data are not presented here. Precipitation and temperature data from nearby Inyokern (ca. 6 km [4 miles] east of the site; elevation 820 m [2700 ft]) were used (United States Geological Survey [USGS] 2005a).

Precipitation tends to follow a unimodal, winter rainfall pattern characteristic of the western Mojave Desert (Fig. 4, 5), in contrast to the eastern Mojave Desert that has a bimodal distribution of precipitation (USGS 2005a). The majority of the rainfall occurs November through March (Fig. 4). The average annual precipitation at Inyokern is 104 mm (4 in.); total annual
rainfall varies widely from year to year (Fig. 5). Precipitation is expected to be greater with increasing elevation.

The winter month of January is the coldest and during the summer, July is the hottest month. The maximum temperatures in January and July, respectively, are 15°C (59°F), and 39°C (103°F). The minimum temperatures for January and July, respectively, are −1°C (30°F), and 19°C (66°F). Overall temperatures are expected to decrease with increasing elevation.

HUMAN IMPACTS

Pre-European Inhabitants

The first human inhabitants of Indian Wells Valley and surrounding areas are known from 11,000 to 9000 yr ago (Babcock 2002). During this time, the region was cool and wet (Axelrod and Raven 1985). Indian Wells Valley and neighboring China Lake were filled with water and coniferous forests covered the land (Axelrod and Raven 1985; Babcock 2002). Inhabitants were adapted to hunting the now-extinct American horse, camel, mammoth, and Pleistocene bison (Youkin 1998). Fluted hunting points characteristic of these “Paleoindians” have been found in the region (Youkin 1998; Babcock 2002). About 4000 yr ago the climate of the Indian Wells Valley became similar to present-day conditions (Babcock 2002). By this time, camps had developed in pinyon groves with the local inhabitants primarily subsisting on pine nuts (Youkin 1998; Babcock 2002).

It wasn’t until 1000 yr ago that the people known as the Shoshone and Paiute appeared who spoke the language known as Numic. These people lived in the areas of the southern Sierra Nevada, Mojave Desert, and Great Basin (Youkin 1998). The inhabitants who possibly occupied the study area were the southern Paiute (the Tubatulabal or “pine-nut eaters”). These people remained in the area until the early twentieth century, when mining and homesteading by European immigrants became prevalent (Youkin 1998; Babcock 2002). Evidence of these native people inhabiting the study area includes petroglyph sites and several rock outcrops containing mortar indentations, a result of grinding foodstuffs (Fig. 6).

Early European Explorers

Padre Pedro Font is credited with placing the Sierra Nevada on a map for the first time in 1776, referring to the mountains as “una gran sierra” (Farquhar 1925). However, many historians believe that J. R. Walker was the first European to enter Indian Wells Valley (Babcock 2002). Walker discovered the pass, which now bears his name, and led several parties through, including the famous Jayhawker party in 1834. Walker later accompanied J. C. Fremont on his third expedition to the West in 1845 (Weiss 1999; Babcock 2002). Fremont led several expeditions for the United States Government in its effort to expand and settle the West (Weiss 1999). In the 1845 expedition, Fremont explored and mapped Indian Wells and Owens valleys, along with his companions J. R. Walker and G. Kern (his cartographer). Traveling through Owens Valley, Fremont encountered a lake and named it for Richard Owens, who he had traveled with and admired (Fremont 1887). The valley and nearby peak were subsequently named after Owens. In his report to the government Fremont (1887) wrote:

That Owens was a good man it is enough to say that he and Carson were friends. Cool, brave, and of good judgment; a good
hunter and good shot; experienced in mountain life; he was an acquisition, and proved valuable throughout the campaign.

The most important product from the Fremont expeditions was an accurate map that included the Sierra Nevada and Great Basin (Weiss 1999).

Many “49ers” and other European settlers made their way down the east side of the Sierra Nevada to Indian Wells Valley. Indian Wells (Fig. 1), a spring at the mouth of Indian Wells Canyon, was most likely an important watering hole for early settlers of the west who were traveling through the desert on their way to Walker Pass (Babcock 2002). William Brewer, a botanist with the Geological Survey of California (1860–1864), traveled through Indian Wells Valley and said, “A more god-forsaken, cheerless place I have seldom seen—a spring of water—nothing else” (Brewer 1863), referring to the once-frequented spring.

Miners and Homesteaders

Mining boomed in the area in the late nineteenth century. However, mining efforts within the study area did not prove as profitable as in surrounding areas (e.g., the Cerro Gordo Mine to the north; Babcock 2002). Several mining sites are indicated on the Owens Peak 7.5’ USGS topographic quadrangle. However, little evidence of activity remains except for an old mining cabin, complete with mineshaft, testing laboratories, and miscellaneous equipment, located at the head of Indian Wells Canyon (Fig. 7). This is the site of the Nadeau-Magnolia Mine. The cabin is maintained by the Bureau of Land Management (BLM) and serves as historical evidence of mining activity in the area. Tungsten and gold ore were the primary products mined at this site; operations were discontinued in 1945 (BLM Volunteer Service 2002).

Profitable mines such as Cerro Gordo to the north brought high volumes of freight running through Indian Wells Valley. After Cerro Gordo shut down in 1879, freight service declined and ceased operation (Babcock 2002). The valley remained quiet until 1908, when construction of the Los Angeles Aqueduct began. Work on the aqueduct attracted many families to the area. During the late nineteenth and early twentieth centuries many homesteaders flocked to the region. Freeman Raymond became the Valley’s first recorded homesteader in 1894 (Babcock 2002). A portion of his former land, now called Freeman Junction, sits in the southeast corner of the study area. Construction of the Los Angeles Aqueduct ran from 1908 to 1913. The old black-pipe siphon is still visible in Short Canyon. A replacement aqueduct was completed in 1970 (Babcock 2002).

Current Uses

The majority of the study area is land managed by the BLM, with private parcels interspersed near the highways and in Grapevine Canyon. Much of the area is now used for recreational activities. Short Canyon was designated an Area of Critical Environmental Concern (ACEC) in 1987 thanks to the efforts of Mary Ann Henry and her botanical work (BLM 1996). Much of the study area also falls within the Owens Peak Wilderness Area (Fig. 10) designated in 1994 (Sierra Nevada Wild 2005). This area includes the Sierra Nevada crest and the upper reaches of the main canyons. The main trail running through the site is the Pacific Crest Trail (PCT), the majority of which runs along the east side of Mount Jenkins (Fig. 10). The mountain is named for Jim Jenkins who was instrumental in the construction of this section of the PCT (Jenkins and Jenkins 1992). There are spur trails to the summits of each peak from the PCT and there is also a shorter trail to Owens...
Fig. 6–9. Human impacts.—6. A pictograph panel at the head of Indian Wells Canyon.—7. Cabin at the Nadeau-Magnolia mining claim at the head of Indian Wells Canyon.—8. A cow grazing in Indian Wells Canyon.—9. A Bureau of Land Management sign designating the Owens Peak Wilderness boundary.
Peak from the head of Indian Wells Canyon. The many old mining roads also provide a means to easily explore the wilderness area.

A wider recreational audience uses the non-Wilderness areas, including off-highway vehicle (OHV) users and gun enthusiasts (Fig. 9). Indian Wells Canyon is a popular destination for these recreational activities. Several forms of agriculture also exist within the study area. Cattle graze in the Owens Peak Wilderness and non-Wilderness lands (Fig. 8). In 2004, many cows were seen in Indian Wells Canyon with fewer in Short Canyon. Bee husbandry (apiculture) was also observed in Indian Wells Canyon.

There are several parcels of private property throughout the study area (Fig. 7). Access to Grapevine Canyon is blocked by a private parcel, which serves as a ranch and family home. There are two additional parcels located west of the first property. Commercial properties are prevalent along the eastern boundary of the site along SR 14 and Hwy 395. The old 49ers’ watering hole at Indian Wells now serves as a modern-day watering hole—the Indian Wells Steak House and Brewery. The Homestead Café and Brady’s Gas Station are other commercial properties within the study area.


early botanic exploration

Two early botanical expeditions just grazed the study area. These expeditions to Death Valley (75 miles to the east), headed by botanist Fredrick V. Coville (1891–1893), and to the Argus Mountains in 1897 (35 miles to the northeast), led by Carl Purpus. On the two expeditions, no plant collections were made in the study area, but the lead botanists made note of having passed through the area. Coville (1893) collected the type specimen of \textit{Eriogonum brachyanthum} just a few miles north of the study area and Purpus (1897) made notes of plants he observed in the area, including \textit{Fremontia \textit{[= Fremontiodendron californicum]}, O. basilaris, O. echinocarpa \textit{[= Cylindropuntia echinocarpa]}, \textit{Salvia dorril}, and \textit{Yucca brevifolia}}.

floristic provinces

On 5 January 1891, Coville entered the western Mojave Desert and made the following observation, “...the characteristic flora of the San Bernardino Valley abruptly gives way to the weird and equally characteristic flora of the Mohave Desert.” Characteristic indeed, although weird is subjective. Communities dominated by \textit{Larrea tridentata} and \textit{Yucca brevifolia}, characteristic of the Mojave Desert, are prevalent within the study area. However, these species approach their northern limits here (Beatley 1975; USGS 2005b) as this region of the southern Sierra Nevada approaches “the edge of the Great Basin” (Smith 2000).

A transition between floristic provinces is characterized by the range limits of a high proportion of indigenous species (Meyer 1978). The transition from \textit{Larrea tridentata} (characteristic of the Mojave Desert) to \textit{Artemisia tridentata} (characteristic of the Great Basin Desert) is marked primarily by climatic factors such as rainfall and temperature (Beatley 1975). Topographic gradients introduce a third floristic province into the site, as plants indigenous to the Sierra Nevada enter the study area at the higher elevations (Axelrod and Raven 1985). This mix of floristic influences makes for a diverse and unique flora where species on the edge of their northern, southern, and eastern distributions are sympatric.

methods

Searches of herbaria at CAS/DS, RSA-POM, and UC/JEPS were conducted in order to include historical collections as a part of the study. Most collections were made from March to September; however, collections were made in all months of the year. An effort was made to collect at all possible locations, from all major physiographic features, geologic and edaphic substrates, and plant communities. All specimens examined were verified and annotated. Vouchers were deposited at RSA with duplicates to be sent to CAS/DS, UC/JEPS, UCR, and elsewhere.

Notes were taken at each collection site indicating the locality, latitude and longitude (via global positioning system receiver), elevation, substrate, aspect, habitat, associated species, and plant attributes (flower color, life form, etc.). The information was entered into the RSA-POM database from which labels were generated. Plant determinations were made using several references, including \textit{The Jepson Desert Manual} (Baldwin et al. 2002), \textit{The Jepson Manual: Higher Plants of California} (Hickman 1993), \textit{A Flora of Southern California} (Munz 1974), \textit{A Flora of Kern County, California} (Twisselman 1967), \textit{Intermountain Flora} ( Cronquist et al. 1984), and the RSA-POM herbarium. All nomenclature conforms to Hickman (1993) with the exception of new treatments for \textit{Cactaceae} (Griffith 2004), \textit{Polemoniaceae} (Porter and Johnson 2000), and \textit{Madiinae} (Baldwin 1999).


results and discussion

previous collections

All persons who made collections within the study site are listed in Table 1. A total of 379 herbarium specimens from 52 collectors was collected prior to this study. The RSA-POM search yielded 170 specimens. A search at CAS/DS produced 156 specimens and a search of the herbaria at UC/JEPS produced 54 specimens. The first plant collection (\textit{Mentzelia epiophila}) was made in the area in 1927 by M. Peirson on the east slope of Walker Pass, perhaps just outside the study area. Major collectors from the study area include J. Keefe (43 collections), a botanist at Glendale Community College, whose personal herbarium was acquired by RSA-POM following his death; he had done the most general collecting prior to this study. Ernest Twisselman (37 collections), who wrote \textit{A Flora of Kern County}, visited the three major canyons in the study area and the east slope of Morris Peak. Javier Peñalosa (33 collections) collected primarily in Indian Wells Canyon from 1960–1962. Frank J. Kirby (22 collections) made several collections from 1954–1960. Verne Grant (15 collections), a noted authority on \textit{Polemoniaceae}, made several \textit{Gilia Ruiz & Pav.} specimens in Short Canyon.

Mary Ann Heny and Jim Shevock deserve special mention. These botanists have brought attention to the area and the rarities that occur here. Heny (1992) produced the first checklist of Short Canyon. A plaque commemorating her work sits at the canyon trailhead. Shevock made several important
Fig. 10. A map of all documented collecting localities. The Owens Peak Wilderness boundary is shaded in dark gray; white rectangles = private parcels; circles = collections made by Naomi Fraga; X = historical collection sites. Map © 2004 Delorme reproduced with permission of TopoUSA® 5.0.
collections in the area including two species described in 1988, *Lomatium shevockii* and *Monardella bencei* (Hartman and Constance 1988; Shevock 1988). In addition, he documented several rare species in the area, *Carliniopsis murrir*, *Ericameria gilmanii*, *Erigeron aquifolius*, and *Eriogonum breedei* var. *shevockii* (Shevock 1988). *Lomatium shevockii* is of special note because it is the only species endemic to the study site.

Other important collections include *Deinandra mohavensis* and *Quercus palmeri*, both collected by A. C. Sanders, S. Boyd, and V. Soza (1998). *Deinandra mohavensis* was once thought extinct, but was rediscovered in Riverside and San Diego counties (Sanders et al. 1997). It subsequently was found within the Owens Peak eastern watershed, and farther south near Cross Mountain (California Natural Diversity Database 2006). The discoveries of *D. mohavensis* and *Q. palmeri* are significant range extensions and also new records for Kern County.

**Collections In This Study**

A total of 56 collecting days was spent in the field between 2002 and 2005. Approximately 1300 vascular plant collections were made within the study area. Plants were collected at all major physiographic features, substrates, and plant communities. Prior to this study, botanists had collected in only a few locations. Through the course of my study I collected at significantly more sites (Fig. 10).

**Vegetation**

Several classification schemes for California plant communities have been proposed (e.g., Munz and Keck 1949; Thorne 1982; Holland and Keil 1995; Sawyer and Keeler-Wolf 1995). These classifications aim to describe broad vegetation patterns, but are often inconsistent and give varying levels of detail. From a Gleasonian perspective, these inconsistencies can serve to support the idea that plant communities are merely random assemblages of species with shared ecological tolerances (Gleason 1926).

A plant community can be defined as a characteristic assemblage of plants. Following this definition, these communities in which repeated patterns of dominant plants and common associated species can be recognized are described here. The names of the plant communities presented in the study are based on the classification of Holland and Keil (1995).

Plant communities within the site include salt bush scrub, desert dunes, creosote bush scrub (Fig. 11), black bush scrub, Joshua tree woodland (Fig. 12), sagebrush scrub, pinyon-oak woodland, mixed coniferous forest (Fig. 14), riparian scrub (Fig. 13), and riparian forest. A schematic diagram of transitions in vegetation within the site is illustrated in Fig. 15.

**Salt bush scrub.**—Occurring on bajadas and alluvial slopes at 900–1100 m (3000–3500 ft) in elevation, this community is dominated by four-winged salt bush, *Atriplex canescens*. Common shrubs include *Ambrosia dumosa*, *Atriplex polycarpa*, *Chrysothamnus nauseosus*, *Ephedra nevadensis*, *Lepidium fremontii*, and *Petalonyx thurberi*. Common herbaceous plants include *Cryptantha barbigera*, *C. pterocarya*, *Eriogonum inflatum*, *E. heermannii*, *Erodium cicutarium*, and *Pectocarya penicillata*.

**Desert dunes.**—A few sand dunes are found at the mouth of Short Canyon at 850–920 m (2800–3000 ft) in elevation. The dunes are composed of fine sand of granite origin, sparsely covered with vegetation, and dominated primarily by herbaceous plants, including *Abronia pogonantha*, *A. villosa*, *Acanthatherum hymenoideae*, *Camissonia claviformis*, *Dyssereca californica*, *Eriogonum pusillum*, *Lupinus concinnus*, *Namacladus gracilis*, and *Oenothera californica*.

**Creosote bush scrub.**—Dominated by the creosote bush, *Larrea tridentata*, this community occurs on the bajadas at 790–1000 m (2600–3400 ft) in elevation and is particularly favored by annuals. Common shrubs include *Ambrosia dumosa*, *Chrysothamnus nauseosus*, *Cylindropuntia echeunicarpa*, *Hymenoclea salsoa*, *Isomeris arborea*, *Opuntia basilaris*, *Petalonyx thurberi*, and *Psorothamnus arborescens*. Common herbaceous plants include *Camissonia campestris*, *C. claviformis*, *C. pallida*, *C. palmeri*, *Chaenactis xantiana*, *Cryptantha spp.*, *Eriogonum pusillum*, *Eriophyllum pringlei*, *E. wallacei*, *Gilia alquanta*, *G. sinuata*, *Linanthus aureus*, *L. dichotomus*, *L. parryae*, *Malacothrix glabrata*, *Nama demissum*, *Phacelia distans*, *P. fremontii*, *Rafinesquia neomexicana*, and *Schismus barbatus*.

**Black bush scrub.**—This community is intermediate in elevation between creosote bush scrub and Joshua tree woodland (1100–1200 m [3700–4000 ft]), and commonly occurs on alluvial slopes. It is dominated by black bush, *Coleogyne ramosissima*. Common shrubs include *Euphedia viridis*, *Ericameria linearifolia*, *Eriogonum fasciculatum var. polifolium*, *Grayia spinosa*, *Hymenoclea salsoa*, *Krascheninnikovia lanata*, *Lycium andersonii*, *L. cooperi*, *Opuntia basilaris*, and *Salazaria mexicana*. Common herbaceous plants include *Bromus tectorum*, *Camissonia campestris*, *C. kermenis*, *Castilleja angustifolia*, *Chaenactis fremontii*, *C. xantiana*, *Eriogonum fasciculatum var. polifolium*, *Eriophyllum confertifolium*, *E. pringlei*, *Gilia brecciarum* subsp. *neglecta*, *G. ochroleuca*, *Linanthus aureus*, and *L. dichotomus*.

**Joshua tree woodland.**—Open woodlands dominated by the Joshua tree, *Yucca brevifolia*, are found at the heads of the major canyons and along the north slopes of Five Fingers at 1200–1600 m (3800–5300 ft) in elevation. Common shrubs include *Artemisia tridentata*, *Ephedra viridis*, *Ericameria cooperi*, *E. linearifolia*, *Eriogonum fasciculatum var. polifolium*, *Grayia spinosa*, *Linanthus excubitus*, *Lycium cooperi*, *Prunus andersonii*, *Tetradynea axillaris*, and *T. stenolepis*. Common herbaceous plants include *Bromus tectorum*, *Camissonia kermenis*, *Chaenactis stevoni*, *C. xantiana*, *Eriogonum fasciculatum var. polifolium*, *E. nudum* var. *westonii*, *Eriophyllum pringlei*, *Gilia brecciarum* subsp. *neglecta*, *G. ochroleuca*, *Lavaya glandulosa*, and *Linanthus dichotomus*.

**Sagebrush scrub.**—This community is dominated by Great Basin sagebrush, *Artemisia tridentata*, and commonly occurs at the heads of canyons near Joshua tree woodland at 1200–1600 m (3800–5300 ft) in elevation. It is most similar to the Joshua tree woodland, but *Yucca brevifolia* is not present. Common shrubs include *Chrysothamnus nauseosus*, *Ephedra viridis*, *Ericameria cooperi*, *E. linearifolia*, *Eriogonum fascicu-

Pinyon-oak woodland.—The transition from pinyon-oak woodland to sagebrush scrub is the most striking in the study area. The co-dominated single-leaf pinyon, Pinus monophylla, stops abruptly at ca. 2200 m (7200 ft). The community occurs at 1700–2200 m (5500–7200 ft) in elevation and occurs primarily on north slopes. It is dominated by P. monophylla and Quercus chrysolepis. Other woody associates include Artemisia tridentata, Ceanothus greggii, Ephedra viridis,

Table 1. Botanical collectors in the Owens Peak eastern watershed, based on herbarium specimens at CAS/DS, RSA-POM, and UC/JEPS.

<table>
<thead>
<tr>
<th>Collector</th>
<th>Date</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>M. Peirson</td>
<td>1927</td>
<td>East slope of Walker Pass</td>
</tr>
<tr>
<td>R. S. Ferris</td>
<td>1930</td>
<td>Indian Wells</td>
</tr>
<tr>
<td>R. Hoffmann</td>
<td>1931</td>
<td>Indian Wells</td>
</tr>
<tr>
<td>L. N. Benson</td>
<td>1933</td>
<td>Indian Wells Valley</td>
</tr>
<tr>
<td>H. L. Mason</td>
<td>1935</td>
<td>Desert near Inyokern</td>
</tr>
<tr>
<td>A. M. Alexander</td>
<td>1940</td>
<td>Inyokern</td>
</tr>
<tr>
<td>C. N. Smith</td>
<td>1940</td>
<td>Freeman Junction</td>
</tr>
<tr>
<td>A. A. Beetle</td>
<td>1941</td>
<td>Indian Wells Valley</td>
</tr>
<tr>
<td>R. Moran</td>
<td>1946</td>
<td>Grapevine Canyon</td>
</tr>
<tr>
<td>V. Grant</td>
<td>1950, 1954, 1958</td>
<td>Short Canyon</td>
</tr>
<tr>
<td>L. Constance</td>
<td>1952</td>
<td>Indian Wells Valley</td>
</tr>
<tr>
<td>A. M. Vollmer</td>
<td>1953</td>
<td>Short Canyon</td>
</tr>
<tr>
<td>J. Janish</td>
<td>1954</td>
<td>Short Canyon</td>
</tr>
<tr>
<td>H. D. Ripley</td>
<td>1954</td>
<td>E base of Walker Pass</td>
</tr>
<tr>
<td>R. Smith</td>
<td>1954</td>
<td>Short Canyon</td>
</tr>
<tr>
<td>M. DeDecker</td>
<td>1958, 1978, 1982</td>
<td>Indian Wells Valley</td>
</tr>
<tr>
<td>P. C. Everett</td>
<td>1958</td>
<td>Short Canyon</td>
</tr>
<tr>
<td>A. Grant</td>
<td>1958</td>
<td>Short Canyon</td>
</tr>
<tr>
<td>C. T. Powers</td>
<td>1959</td>
<td>Short Canyon</td>
</tr>
<tr>
<td>J. R. Powers</td>
<td>1959</td>
<td>Short Canyon</td>
</tr>
<tr>
<td>P. Raven</td>
<td>1959</td>
<td>Short Canyon</td>
</tr>
<tr>
<td>R. W. Thorn</td>
<td>1959</td>
<td>Short Canyon</td>
</tr>
<tr>
<td>C. Budgett</td>
<td>1960</td>
<td>Indian Wells Canyon</td>
</tr>
<tr>
<td>D. Chivers</td>
<td>1960</td>
<td>Indian Wells Canyon</td>
</tr>
<tr>
<td>E. G. Linsley</td>
<td>1960</td>
<td>Short Canyon</td>
</tr>
<tr>
<td>J. Peialosa</td>
<td>1960</td>
<td>Indian Wells Canyon</td>
</tr>
<tr>
<td>J. Turner</td>
<td>1962</td>
<td>Short Canyon</td>
</tr>
<tr>
<td>C. Davidson</td>
<td>1967</td>
<td>Junction of Hwy 395 with SR 14</td>
</tr>
<tr>
<td>J. T. Howell</td>
<td>1967</td>
<td>Hwy 395, Indian Wells Valley</td>
</tr>
<tr>
<td>L. S. Rose</td>
<td>1967</td>
<td>Freeman Junction</td>
</tr>
<tr>
<td>L. C. Wheeler</td>
<td>1969</td>
<td>Indian Wells Canyon</td>
</tr>
<tr>
<td>J. M. Keefe</td>
<td>1973</td>
<td>Morrise Peak Saddle, Indian Wells Canyon, Owens Peak, Short Canyon</td>
</tr>
<tr>
<td>J. L. Strother</td>
<td>1973</td>
<td>Junction of Hwy 395 with SR 14</td>
</tr>
<tr>
<td>H. M. Hall</td>
<td>1975</td>
<td>Indian Wells</td>
</tr>
<tr>
<td>M. E. Larson</td>
<td>1975</td>
<td>Grapevine Canyon</td>
</tr>
<tr>
<td>T. R. Ericson</td>
<td>1977</td>
<td>Junction of Hwy 395 with SR 14</td>
</tr>
<tr>
<td>D. W. McNeal</td>
<td>1985</td>
<td>SR 14, N of Hwy 178</td>
</tr>
<tr>
<td>B. Erter</td>
<td>1986</td>
<td>Owens Peak</td>
</tr>
<tr>
<td>D. Charlton</td>
<td>1992</td>
<td>Short Canyon</td>
</tr>
<tr>
<td>D. M. Thompson</td>
<td>1992</td>
<td>Indian Wells Canyon</td>
</tr>
<tr>
<td>I. Anderson</td>
<td>1996</td>
<td>Grapevine Canyon</td>
</tr>
<tr>
<td>A. C. Sanders</td>
<td>1998</td>
<td>Short Canyon; Indian Wells Canyon</td>
</tr>
<tr>
<td>D. H. Wilken</td>
<td>1998</td>
<td>Short Canyon</td>
</tr>
<tr>
<td>S. Boyd</td>
<td>2001</td>
<td>Short Canyon</td>
</tr>
<tr>
<td>B. O’Brien</td>
<td>2003</td>
<td>Five Fingers</td>
</tr>
<tr>
<td>T. Thabault</td>
<td>2003</td>
<td>Five Fingers, Short Canyon</td>
</tr>
</tbody>
</table>

**Mixed coniferous forest.**—This community is limited to the northeastern slope of Mount Jenkins and the upper slopes of Owens Peak at 2200–2600 m (7200–8400 ft) in elevation. Dominants are Abies concolor, Juniperus occidentalis var. australis, Pinus jeffreyi, and P. lambertiana. Woody associates include Cercocarpus ledifolius, Eriogonum umbellatum var. subaridum, Holodiscus microphyllus, Penstemon newberryi, Pinus flexilis, Quercus chrysolepis, and Salvia pachyphylla. Common herbaceous plants include Delphinium hians subsp. kernense, Dudleya abramsii, Eriogonum brevicaulare, Lupinus latius, Orochaeactus thysonocarpa, Phacelia austromontana, and Selaginella watsonii.

**Riparian scrub.**—Dominated primarily by phreatophytic shrubs with a few scattered trees, riparian scrub is restricted to stream channels with ephemeral water between the elevations of 900–1200 m (3000–3800 ft). It is dominated by Salix lasiogloides with scattered Populus fremontii and S. laevigata. Common shrubs include Baccharis salicifolia, B. sergilooides, and Pluchea sereica. Common herbaceous plants include Artemisia dracunculus, A. ludoviciana, Asclepias fascicularis, Berula erecta, Elymus parviflorus, Lythrum californicum, Polypogon monspeliensis, and Rorippa nasturtium-aquaticum. Annual aquatics include Azolla filiculoides and Lemna gibba. Clumps of Muhlenbergia rigens commonly grow along the edges of the stream channel.

**Riparian forest.**—This community is dominated primarily by phreatophytic trees with a few scattered shrubs, and is restricted to stream channels with permanent water from springs at 1200–1800 m (3800–5800 ft) in elevation. It is limited to the north and south forks of Grapevine Canyon (Fig. 1). The dominant trees are Alnus rhombifolia, Fraxinus velutina, and Salix laevigata. Other woody associates include Baccharis salicifolia, B. sergilooides, Populus fremontii, Salix lasiogloides, and Vitis riparia. Common herbaceous plants include Epilobium ciliatum, Polypogon monspeliensis, Rorippa nasturtium-aquaticum, Stachys albens, and Urtica dioica.

**Paleo-Vegetation**

The rise of the Sierra Nevada over the last 20 million yr altered not only the landscape, but also the patterns of vegetation. Changes in vegetation can be attributed to changes in climate associated with the rise of the mountains (Smith 2000). Several local studies have documented these changes in vegetation. Pliocene sediments containing fossil pollen from the Owens and Panamint valleys have been analyzed (Axelrod and Ting 1960). Additionally, several studies of packrat (Neotoma) middens of Pleistocene age near the study area have been conducted, including in the Alabama Hills (Koehler and Anderson 1995), the southern Sierra Nevada (Davis et al. 1985), and Robber’s Roost in the Western Mojave (McCarten and Van Devender 1988). No studies of middens from within the study area have been published. From these studies, one can describe general patterns of paleo-vegetation transitions, as changes in vegetation are believed to be quite similar in this broader region of interest (e.g., the interface between the Mojave and Great Basin deserts).

The Sierra Nevada imposes a significant rain shadow on the modern landscape, contributing to the vast Great Basin and Mojave deserts. Before the rise of this significant mountain range, these vast areas were not as arid as they are today. Instead, they are thought to have been dominated by coniferous forest and pinyon–juniper woodland (Axelrod and Ting 1960; McCarten and Van Devender 1988; Koehler and Anderson 1995). It is also thought that at one time pinyon–juniper woodland was restricted to the Mojave Desert region, south of latitude 37° (Axelrod et al. 1960). During warming in the early Holocene (ca. 8000 yr ago), subalpine and coniferous forest taxa shifted to higher altitudes in the mountains (Axelrod and Raven 1985).

Packrat midden data from the late Wisconsin (13,000–12,000 yr ago) was obtained from Robber’s Roost (1190–1230 m [3904–4035 ft]) (McCarten and Van Devender 1988), just 4.3 km (2.7 miles) southwest of the most southeastern portion of the study area. These data show that the Robber’s Roost area during the late Wisconsin was dominated by Juniperus californica and Pinus monophylla, in association with Artemisia tridentata, Ceanothus greggi, Ericameria canescens, Eriogonum fasciculatum, Purshia tridentata var. glandulosa, and Yucca brevifolia (Table 2). With the exception of Juniperus californica, all of these species now occur in the pinyon zone within the Owens Peak study area, which occurs above 1524 m (5000 ft). While J. californica does occur within the study area, it is scarce and scattered, and seldom found above 1524 m.

The vegetation in the pinyon zone within the study area appears to have a high degree of similarity with the vegetation that was once more prevalent in the valleys and basins that are now the Mojave and Great Basin deserts. These enormous expanses now dominated by Atriplex confertiflora and Larrea tridentata were once forested areas of Pinus monophylla, interspersed with Artemisia tridentata and Ceanothus greggi.

<p>| Table 2. Fossil plants from the late Wisconsin at Robber’s Roost (McCarten et al. 1988). ka = thousands of years ago; (+) = present in the area, (−) = absent in the area. |</p>
<table>
<thead>
<tr>
<th>Species</th>
<th>Owens Peak Study Area</th>
<th>Robber’s Roost</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.9 ka</td>
<td>13.0 ka</td>
<td>13.3 ka</td>
</tr>
<tr>
<td>Amsinckia tesselata</td>
<td>+</td>
<td>−</td>
</tr>
<tr>
<td>Artemisia tridentata</td>
<td>+</td>
<td>−</td>
</tr>
<tr>
<td>Ceanothus greggi</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Ericameria arborescens</td>
<td>−</td>
<td>+</td>
</tr>
<tr>
<td>E. camata</td>
<td>+</td>
<td>−</td>
</tr>
<tr>
<td>Eriogonum fasciculatum</td>
<td>+</td>
<td>−</td>
</tr>
<tr>
<td>Juniperus californica</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Lepidium fremontii</td>
<td>+</td>
<td>−</td>
</tr>
<tr>
<td>Lupinus excubitus</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Opuntia basilaris</td>
<td>+</td>
<td>−</td>
</tr>
<tr>
<td>O. echnocarpa</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Penstemon incertus</td>
<td>+</td>
<td>−</td>
</tr>
<tr>
<td>Pinus monophylla</td>
<td>+</td>
<td>−</td>
</tr>
<tr>
<td>Parshia glandulosa</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Quercus turbinella</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>Yucca brevifolia</td>
<td>+</td>
<td>−</td>
</tr>
</tbody>
</table>
Along the eastern slopes of the Sierra Nevada, one can observe sharp bands of vegetation contouring the slopes, each upwardly successive band changing with increasing moisture and decreasing temperature. Climate change in eastern California has significantly impacted the vegetation patterns, with many species migrating together based on shared ecological tolerances (i.e., temperature and the moisture availability; Beatley 1975; Axelrod and Raven 1985).

**Flora**

**Numerical summary.**—This study documents 440 vascular plant taxa (including species, subspecies, varieties, and hybrids) as occurring in the study area (Appendix 1). These include 64 families and 230 genera (sensu Hickman 1993; Table 3). Asteraceae are by far the largest family, accounting for 17.5% of the total flora. The five largest genera in the study area are *Eriogonum* (25), *Mimulus* (12), *Phacelia* (12), *Cryptantha* (10), and *Camissonia* (8). A summary of life forms is also provided in Table 3 and shows that annuals dominate the landscape of the study area.

**Non-Native Taxa**

Non-native taxa account for 5% of the total flora. A list of non-native taxa is given in Table 4. The area has a relatively intact native flora compared with the State of California in which 17.4% of the total flora is non-native (Hickman 1993). *Encelia farinosa*, while native to California, is not native to this portion of the Mojave Desert. Plants have been planted near the roadside at the intersection of SR 14 and Hwy 395. Seedlings of *E. farinosa* were collected adjacent to the SR 14; neither mature plants nor evidence of hybridization (between *E. farinosa* and the native *E. actoni*) were observed over the course of this study.

Non-native taxa within the study area occur primarily in mesic areas near riparian areas, and disturbed areas from along roadsides. Several species were documented adjacent to SR 14 near the Indian Wells Steak House and Brewery. Non-native species that are widespread throughout the area are *Bromus tectorum*, *B. rubens*, *Erodium cicutarium*, and *Schismus barbatus*. *Bromus tectorum* is the most widespread of these, occurring on the low elevation desert slopes, and near the summit of Owens Peak. *Bromus rubens* is common on low elevation desert slopes, while *E. cicutarium* and *S. barbatus* are most abundant on the bajadas.

### Table 3. Numerical summary of taxa.

<table>
<thead>
<tr>
<th>Total taxa</th>
<th>% of the total flora</th>
</tr>
</thead>
<tbody>
<tr>
<td>Families</td>
<td>64</td>
</tr>
<tr>
<td>Genera</td>
<td>233</td>
</tr>
<tr>
<td>Taxa (species, subsp., vars., hybrids)</td>
<td>441</td>
</tr>
<tr>
<td>Nativity</td>
<td></td>
</tr>
<tr>
<td>Native</td>
<td>420</td>
</tr>
<tr>
<td>Non-native</td>
<td>21</td>
</tr>
<tr>
<td>Lifeforms</td>
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</tr>
<tr>
<td>Annual</td>
<td>188</td>
</tr>
<tr>
<td>Perennial herb</td>
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</tr>
<tr>
<td>Small shrub</td>
<td>54</td>
</tr>
<tr>
<td>Suffruticose perennial</td>
<td>24</td>
</tr>
<tr>
<td>Geophyte</td>
<td>16</td>
</tr>
<tr>
<td>Large shrub</td>
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<tr>
<td>Tree</td>
<td>15</td>
</tr>
<tr>
<td>Parastic perennial</td>
<td>6</td>
</tr>
<tr>
<td>Succulent perennial herb</td>
<td>4</td>
</tr>
<tr>
<td>Biennial herb</td>
<td>3</td>
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<tr>
<td>Succulent shrub</td>
<td>3</td>
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<tr>
<td>Aquatic annual</td>
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</tr>
<tr>
<td>Liana</td>
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<td>Five Largest Families</td>
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<td>Asteraceae</td>
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<td>Poaceae</td>
<td>29</td>
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<tr>
<td>Polygonaceae</td>
<td>29</td>
</tr>
<tr>
<td>Polemoniaceae</td>
<td>25</td>
</tr>
<tr>
<td>Scrophulariaceae</td>
<td>23</td>
</tr>
</tbody>
</table>

### Table 4. Non-native taxa documented in the study area.

<table>
<thead>
<tr>
<th>Taxon</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Agrostis viridis</em></td>
<td></td>
</tr>
<tr>
<td><em>Bromus arenarius</em></td>
<td></td>
</tr>
<tr>
<td><em>B. diandrus</em></td>
<td></td>
</tr>
<tr>
<td><em>B. rubens</em></td>
<td></td>
</tr>
<tr>
<td><em>B. tectorum</em></td>
<td></td>
</tr>
<tr>
<td><em>Erodium cicutarium</em></td>
<td></td>
</tr>
<tr>
<td><em>Gnaphalium luteo-album</em></td>
<td></td>
</tr>
<tr>
<td><em>Hordeum murinum subsp. glaucum</em></td>
<td></td>
</tr>
<tr>
<td><em>Malva neglecta</em></td>
<td></td>
</tr>
<tr>
<td><em>Melilotus albus</em></td>
<td></td>
</tr>
<tr>
<td><em>Poa annua</em></td>
<td></td>
</tr>
<tr>
<td><em>Polypogon monspeliensis</em></td>
<td></td>
</tr>
<tr>
<td><em>Salsola paulsenii</em></td>
<td></td>
</tr>
<tr>
<td><em>Schismus arabicus</em></td>
<td></td>
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<tr>
<td><em>S. barbatus</em></td>
<td></td>
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<tr>
<td><em>Sisymbrium orientale</em></td>
<td></td>
</tr>
<tr>
<td><em>S. oleraceus</em></td>
<td></td>
</tr>
<tr>
<td><em>Tamarix ramosissima</em></td>
<td></td>
</tr>
<tr>
<td><em>Taraxacum officinale</em></td>
<td></td>
</tr>
<tr>
<td><em>Tribulus terrestris</em></td>
<td></td>
</tr>
<tr>
<td><em>Veronica anagallis-aquatica</em></td>
<td></td>
</tr>
</tbody>
</table>
Distribution.—Several taxa characteristic of the Mojave Desert reach their northern limits near the study area. Larrea tridentata and Yucca brevifolia are seldom seen north of Owens Valley (Thorne 1982; USGS 2005b). Within the study site the areas that are most characteristic of the Mojave Desert are at the lower elevations (790–1524 m [2600–5000 ft]) on alluvial slopes, bajadas, and canyon bottoms. However, there are several Mojavean species that are broadly distributed throughout the study site. Opuntia basilaris is probably the most widespread of these, occurring on bajadas and canyon slopes, but also near the summit of Owens Peak in the shade of Mixed Coniferous Forest. Other Mojavean species occurring at higher altitudes include Eriogonum ambiguum var. paleaceum and Minnula fremontii.

Species characteristic of the Great Basin are most common at mid-elevations (1130–1524 m [3700–5000 ft]) and on northern slopes where temperatures are cooler and thus moisture availability is greater. These include Artenisia tridentata, Coleogyne ramosissima, and Pinus monophylla (Turner 1982). Artenisia tridentata and P. monophylla characteristically occur in high density on northern aspects throughout the study area.

With increasing elevation, species associated with the Sierra Nevada floristic province are encountered. Most of these species appear to have ecological requirements that require colder and wetter conditions. The Sierra Nevada taxa are typically restricted to the cold moist drainages and occur at higher elevations throughout the site (1980–2560 m [6500–8400 ft]). One exception is Pinus subiniana. This species is most abundant in the shaded upper reaches of Indian Wells Canyon at the base of Owens Peak, however, this Sierra Nevada species is distributed sparingly along the canyon floors of Short and Grapevine canyons as it reaches its eastern limit.

Rare species.—Rarity in vascular plants is a statement about the geographic distribution and population sizes of a species (Brown 1984). The Inventory of Rare and Endangered Plants in California published by the California Native Plant Society (CNPS 2001) is a widely cited document containing information about California’s rare plants. This volume contains information on the CNPS listing system, which aims to categorize degrees of rarity (CNPS 2001). Additionally, the CNPS hosts an online inventory of rare and endangered plants (CNPS 2005). Eight CNPS (2001) List 1B taxa (plants rare, threatened, or endangered in California) and nine List 4 taxa (plants of limited distribution—a watch list) have been documented within the study area (Table 5). Deinandra mohavensis is the only government-listed species in the study area (listed as endangered by the State of California).

Carlquistia muirii, Erigeron aequifolius, Erigeronum breedlovei var. shevockii, Lomatium shevockii, Monardella benceolens, and Phacelia nashiana are endemic to the southern Sierra Nevada and populations are within the study area. Lomatium shevockii is a highly restricted species from known only from two locations, on the east slopes of Owens Peak and Mount Jenkins, and is endemic to the study area. The occurrence of Ericameria gilmanii on Owens Peak extends the range of this highly restricted species by 100 km to the south from Telescope Peak (Shevock and Jorister 1990). Saltugilia latimeri was previously known from the foothills of the Little San Bernardino, San Bernardino, Santa Rosa, and Granite (of central San Bernardino County) mountains and one disjunct collection from the Panamint Mountains of Inyo County (Weese and Johnson 2001). Two new localities documented over the course of this study (Five Fingers and Grapevine Canyon) extend the range of this species and are the first collection of any member of the genus Saltugilia in Kern County (Fraga and Porter 2003).

Phacelia novemmillensis was previously thought to occur within the study area (California Natural Diversity Database 2006). Upon careful examination of historical collections and voucher specimens made as a result of this study, those occurrences that were cited as P. novemmillensis have been identified as two other species of Phacelia. These are P. curvipes, and P. humilis var. dudleyi.

Table 5. Sensitive plants from the Owens Peak eastern watershed (CNPS Online Inventory 2005).

<table>
<thead>
<tr>
<th>Taxon</th>
<th>CNPS List</th>
<th>CA State List</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allium atrorubens var. cristatum</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Cnidosia kernensis subsp. kernensis</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Canbya candida</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Chamaesyce valls-morae</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Cordylanthus eremicus subsp. eremicus</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Cordylanthus rigidus subsp. brevibracteatus</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Ericogonum breedlovei var. shevockii</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Fritillaria peneorum</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Maulla coronata</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Carlquistia muirii</td>
<td>1B</td>
<td></td>
</tr>
<tr>
<td>Deinandra mohavensis</td>
<td>1B</td>
<td>Endangered</td>
</tr>
<tr>
<td>Ericameria gilmanii</td>
<td>1B</td>
<td></td>
</tr>
<tr>
<td>Erigeron aequifolius</td>
<td>1B</td>
<td></td>
</tr>
<tr>
<td>Lomatium shevockii</td>
<td>1B</td>
<td></td>
</tr>
<tr>
<td>Monardella benceolens</td>
<td>1B</td>
<td></td>
</tr>
<tr>
<td>Phacelia nashiana</td>
<td>1B</td>
<td></td>
</tr>
<tr>
<td>Saltugilia latimeri</td>
<td>1B</td>
<td></td>
</tr>
</tbody>
</table>

* 1B: Rare, threatened, or endangered in California; 4: Limited distribution (watch list).

ANOTATED CATALOG OF THE VASCULAR FLORA

The following is a list of all vascular plant taxa documented from the eastern watershed of Owens Peak. This catalog is a result of field work and herbarium searches conducted as of March 2005. Family classification follows FNA (2003), while classification of genera and species conforms to Hickman (1993), with the exception of Cactaceae (Griffith 2004), Polemoniaceae (Porter and Johnson 2000), and Madinae (Baldwin 1999). Specimens that are cited are housed at RSA unless designated by CAS, DS, JEPS, POM, or UC. Common, locally common, occasional, uncommon, and rare are used as an indication of the distribution of taxa across the study area. Non-native taxa are denoted by an asterisk (*). Rare taxa are denoted by a dagger (†).

FERNS AND FERN ALLIES

Selaginellaceae

Selaginella watsonii L. Underw. Perennial herb. Uncommon from rock crevices and between large boulders. 2300–2400 m (7500–7800 ft) Fraga & Griffith 1225.

Equisetaceae

AZOLLACEAE


PTERIDACEAE

CHELANThES COVILLEI Maxon. Perennial herb. Common from rock crevices and between large boulders. 1100–2400 m (3500–7800 ft) Fraga & Soza 876.

CONIFERACEAE

CUPRESSACEAE


EPIDEREACEAE


PINACEAE


Pinus flexilis E James. Tree. Rare on the upper east slopes and the summit of Owens Peak. 2600 m (8400 ft) Fraga & Gross 957.


ANGIOSPERMAE - DICOTYLEDONES

ACERACEAE

Acer glabrum Torrey var. diffusum (Greene) F.J.Smale. Large shrub. Rare on the north slope of Mount Jenkins. 2200 m (7200 ft) Fraga & Anderson 1002.

APICAEAE


ASCLEPIADACEAE


ASTERACEAE


Agoseris retortensis (Benth.) Greene. Perennial herb. Uncommon on rocky mountain slopes, often in shade of pines. 2100–2400 m (7000–7800 ft) Fraga & Anderson 1131.


Artemisia dracunculus L. Sulfuricute perennial. Occasional along banks above stream channels. 980–1200 m (3200–4000 ft) Fraga, Boyd, Denislow & Gross 571.


†Carlquistia murii (A.Gray) B.G.Baldwin. Suffruticose perennial. Rare from large granite outcrops on Owens Peak. 2400–2500 m (8000–8200 ft) Erter, Bagley, Bramlet & Daniel 6442 (UC).
Chrysothamnus parryi (A.Gray) Greene subsp. vulcanicus (Greene) H.M.Hall & Clem. Small shrub. Rare on the summit of Owens Peak. 2600 m (8600 ft) Fraga & Gross 979.
Chrysothamnus viscidiflorus (Hook.) Nutt. subsp. viscidiflorus. Small shrub. Uncommon along the trail from Indian Wells Canyon to Owens Peak. 1800 m (6000 ft) Fraga & Gross 969.
†Encelia farinosa Twisselman & A.Gray. Small shrub. Rare; from one collection along SR 14 near the Indian Wells Steakhouse. Only seedlings collected, the source population is located along the highway. No plants seen naturalizing further into the study area. 800 m (2600 ft) Fraga, Bigelow & Den slow 1017.
†Eriocameria gilmanii (S.F.Blake) G.Neson. Small shrub. Rare at the base of granite boulders and granite outcrops on Owens Peak. 2500 m (8200 ft) Fraga, Anderson, Gross & Kempton 1655.
†Eriocameria aquifolius (H.M.Hall. Perennial herb. Rare from granite outcrops on Owens Peak 2500–2600 m (8000–8400 ft) Fraga 709.
Eriocameria brevifolia (A.Gray var. ovulifoli) (Greene) G.Neson. Perennial herb. Occasional on shaded steep slopes in mixed coniferous forest. 2440 m (8000 ft) Fraga, Anderson, Gross & Kempton 1655.
Eriophyllum ambiguum (A.Gray) A.Gray var. paeleaiatum (Brandego) Ferris. Annual. Common on desert slope, exposed ridgelines and canyon floors. 900–7600 m (3000–7600 ft) Fraga & Soza 770.
Eriophyllum confertiflorum (DC.) A.Gray var. confertiflorum. Suffruticose perennial. Common from granite rock outcrops and desert slopes. 900–2400 m (3000–7800 ft) Twisselman 4519 (JEPS).
Gnaphalium stramineum Kunth. Annual or biennial herb. Uncommon in moist drainages. 1710 m (5600 ft) Fraga, Anderson, Gross & Kempton 1640.
*Helenium annuus L. Annual. Rare; documented from one locality along the aqueduct road between Short Canyon and Five Fingers. 975 m (3200 ft) Fraga & De Groot 984.
Hieracium horridum Ertter. Perennial herb. Rare; from the rocky slopes of Owens Peak, at the base of granitic outcrops. 2500 m (8100 ft) Erter, Bagley, Bramlet & Daniel 6439 (UC).
Lavina glandulosa (Hook.) Hook. & Arn. Annual. Locally abundant on open desert slopes and canyon bottoms. 1100–1900 m (3500–6300 ft) Fraga & Griffith 1087.
Lespingia filaginifolia (Hook. & Arn.) M.A.Lane var. filaginifolia. Suffruticose perennial. Occasional in the shade of pinyon–oak woodland, and shaded areas and rock outcrops along canyon floors. 975–2000 m (3200–6400 ft) Fraga & Gross 976.
MACHAERANTHERA CANESCENS (Parsh) A.Gray var. CANESCENS. Perennial herb. Uncommon on rocky mountain slopes. 2100–2600 m (7000–8400 ft) Fraga & Soza 866.

MADIA ELEGANS Lindl. subsp. ELEGANS. Annual. Occasional on rocky slopes in open pinyon forest, and steep talus slopes. 1800–2400 m (6000–8000 ft) Fraga & Griffith 810.


MONOPILON BELLIDIFORME A.Gray. Annual. Uncommon; from one collection in Short Canyon in a dry alluvial wash with fine sandy soil. 1000 m (3400 ft) Fraga & Denslow 527.


PLUCHEA SERICEA (Nutt.) Coville. Large shrub. Uncommon in stream channels. 900–1100 m (3000–3500 ft) Twisselman 6528 (CAS).


SENECIO FLACCIDUS Less. var. MONOENSIS (Greene) B.L.Turner & T.M.Barkley. Small shrub. Occasional from desert slopes and near dry stream channels. 1100–1400 m (3500–4600 ft) Fraga, Maurice, Scovell & Virgen 899.


*SONCHUS OLERACEUS* L. Annual. Rare in canyon drainages. 1100–1700 m (3600–5600 ft) Fraga & Tessell 833.


SYNTRACHEPHA FREMONTI A.Gray. Annual. Uncommon on desert slopes. 1200–1525 m (4000–5000 ft) Fraga et al. (Field trip attendees) 1544.

*TARAXACUM OFFICINALE* Weber ex G.H.Wiggers. Perennial herb. Rare; from one collection in Short Canyon on wet soil from seeps and springs. 1200 m (3900 ft) Fraga & Griffith 1083.


XANTHIUM STRUMARIUM L. Annual. Rare; from one collection near moist canyon drainage in Indian Wells Canyon. 1100 m (3600 ft) Fraga & Brock 1339.

granite outcrops in Short Canyon. 1160–2600 m (3800–8400 ft) Fraga & Soza 873.

**ARABIS PULCHRA** M.E.Jones var. PULCHRA. Perennial herb. Common in the shade of pinyons, and canyon bottoms, exposed ridges and rocky mountain slopes. 1200–2600 m (3800–8400 ft) Fraga, Honer & Soza 728.


**ERYTHRIS CAPITATUM** (Douglass) Greene. Biennial herb. Occasional in shade of pinyons and on exposed talus slopes. 1220–2200 m (4000–7200 ft) Fraga & Griffith 1149.


**SISYRRHUM ORIENTALE** L. Annual. Uncommon; from one location near the Indian Wells Steak House and Brewery. 800 m (2600 ft) Fraga, Bigelow & Denolow 1019.


**CARTACEAE**


**OPUNTIA ERIACA** Engelm. & J.M.Bigelow. Succulent shrub. Rare; from one collection of a seedling in coniferous understory growing in dense pine duff. Further surveys warranted. 2380 m (7800 ft) Fraga, Anderson, Gross & Kempton 1645.

**CAMPANULACEAE**

**NEMALADIUS ISMIOIDES** G.T.Robbins. Annual. Uncommon from the bajada of Short Canyon on sand dunes. 900–1000 m (2800–3400 ft) Fraga et al. (field trip attendees) 1099.

**CAPPARACEAE**


**CAPRIFOLIACEAE**

**LONCERA INTERRUPTA** Bentham. Liana, sometimes a scendent shrub. Uncommon in shade of pinyon forest. 1600–2100 m (5300–6800 ft) Fraga & Griffith 798.

**SAMBURUS MEXICANA** C. Presl ex DC. Large shrub. Uncommon in shade of pinyon-oak woodland on rocky mountain slopes. 1900–2300 m (6100–7400 ft) Fraga & Griffith 805.

**CARYOPHYLLACEAE**


**MINUARTIA PULSILLA** (S.Watson) Mattf. Annual. Locally common in moist areas fed by springs on coarse sand in Short Canyon. 1100 m (3600 ft) Fraga & Brock 1517.


**CHENOPODIACEAE**


**CHENOPODIUM CALIFORNICUM** (S.Watson) S.Watson. Perennial herb. Rare, from one location in Short Canyon in moist shaded areas. 1200 m (3900 ft) Fraga, Griffith & Walker 573.


**SASCOLA PAUSELSEI** Litv. Annual. Rare; from one collection at the Indian Wells Steak House and Brewery. 800 m (2600 ft) Fraga, Bigelow & Denolow 1013.

**CONVOLVULACEAE**


**CRASSULACEAE**


**DUSEYIA ABRAMII** ROSE subsp. ABRAMII. Succulent perennial herb. Uncommon on the rocky talus slopes of Owens Peak and Mount Jenkins 2300–2400 m (7500–8000 ft) Fraga & Soza 877.


CUCCURBITACEAE

CUCCURBITA PEOETISSIMA Kunth. Geophyte. Locally common in Indian Wells Canyon on dry flats above stream channels. 1100–1220 m (3700–4000 ft) Fraga, Maurice, Scovell & Virgen 908.

CUCURBITACEAE


CUCURBITA DENTICULATA Engelm. Parasitic annual. Rare from one collection in Indian Wells Canyon on desert slopes, generally growing on Astragalus polyacarpus. 975 m (3200 ft) Fraga & Soza 793.

CUCURBITA SUBEINQUISITA Durand & Hilg. Parasitic annual. Rare; from one collection in Short Canyon from large granite boulders on Artemisia ludoviciana. 1200 m (3800 ft) Fraga & Anderson 1003.

UPHORBIEACEAE

CHAMAEYCYCE ALBOMARGINATA (Tart, & A.Gray) Small. Perennial herb. Occasional from head of Indian Wells Canyon in open or disturbed places. 800–2100 m (2600–7000 ft) Fraga, Gross & Navidara 1057.


FABACEAE

ASTRALAGUS DIDYMOCARPUS Hook., & Arn. var. DIDYMOCARPUS. Annual. Occasional from one location at Short Canyon growing on moist sand from seeps. 1100–1200 m (3500–3800 ft) Fraga, Griffith & Walker 560.

ASTRALAGUS LAYNEAE Greene. Perennial herb. Rare; from the southeast end of the study area at Freeman Junction. 800–1000 m (2600–3300 ft) Rose s.n. 3 Apr 1967 67011.


ASTRALAGUS PACHYPUS Greene var. PACHYPUS. Suffruticoser perennial. Uncommon from the desert slopes of Short Canyon. 850–1200 m (2800–4000 ft) Berry 269 (UCR).


GLYCYYRZHA LEPIDOTA Pursh. Perennial herb. Locally common in Grapevine Canyon in moist areas near drainages. 915–1040 m (3000–3400 ft) Fraga & Mills 1220.

LOTUS ARGOPHYLLUS (A.Gray) Greene var. ARGOPHYLLUS. Perennial herb. Uncommon from from crevices and in between granite boulders. 1100–1520 m (3600–5000 ft) Fraga & Tessel 145.


LOTUS ORBONGIFOLIUS (Benth.) Greene var. ORBONGIFOLIUS. Perennial herb. Locally common from moist stream channels. 1100–1590 m (3500–5200 ft) Fraga, Maurice, Scovell & Virgen 915.

LOTUS PROCUMBENS (Greene) Greene var. PROCUMBENS. Perennial herb. Occasional in shade of pinyon woodland and on open rocky mountain slopes. 1830–2200 m (6000–7000 ft) Fraga & Anderson 1273.


MELLOTUS ALBUS Medikus. Annual to perennial herb. Uncommon along the moist stream channel, from one collection at Indian Wells Canyon. 1100 m (3500 ft) Fraga & Brock 1328.


TRIFOLIUM MICROCEPHALUM Pursh. Annual. Rare; from one collection in Short Canyon on moist bank above stream edge. 1100 m (3600 ft) Fraga & Fraga 1104.

TRIFOLIUM WILDENENSI Spreng. Annual. Uncommon from moist areas on banks above stream, or vernally wet from nearby springs in Short Canyon. 1100 m (3600 ft) Fraga, Griffith & Walker 559.

TRIFOLIUM WORMSKILDHI Leh. Perennial herb. Rare; from one collection near vernally moist depression fed by spring in Short Canyon. 1200 m (3800 ft) Fraga & Anderson 1102.

FAGACEAE

CHRYSEOLEPSIS SEMPERVIRENS (Kellogg) Hjelmq. Large shrub. Occasional on steep slopes in understory of mixed coniferous forest on the east slope of Owens Peak. 2440 m (8000 ft) Fraga, Anderson, Gross & Kempken 1649.

QUERCUS CHRYSEOLEPSIS Lieb. Tree or large shrub. Common on north slopes of canyons and rocky mountain slopes. 1100–2400 m (3500–8000 ft) Fraga & Boyd 387.

QUERCUS PALMIERI Engelm. Large shrub. Uncommon; from Short Canyon growing above streams and vernally moist places. 1000–1200 m (3400–3800 ft) Sanders & Boyd 22350.

QUERCUS WILDENENSI A.DC. Tree. Occasional on north slopes of canyons and on rocky mountain slopes. 1000–1800 m (3400–6000 ft) Fraga, Honer & Soza 705.

QUERCUS XMORENSI Kellogg. Tree. Rare; from one collection near the trail to Owens Peak; upper reaches of Indian Wells Canyon. 1800 m (6000 ft) Fraga & Gross 967.

GARRYACEAE


GENTIANACEAE

CENTAURY EXALTATUM (Griseb.) Piperr. Annual. Rare; near moist places associated with springs in Short Canyon. 1100 m (3600 ft) Fraga & Fraga 132.

CENTAURY VENUSTUM (A.Gray) B.L.Rob. Annual. Rare; from moist places in Short Canyon. 1200 m (4000 ft) Luthey s.n. 14 Sep 1978 (CAS).
**GERANIACEAE**


**GROSSULARIACEAE**


**HYDROPHYLLACEAE**


*Phacelia curvipes* S.Watson Annual. Uncommon in openings between trees and shrubs in pine-oak woodland, from one collection in Grapevine Canyon. 1816 m (5960 ft) *I. Anderson* 870a.


*Phacelia lemmonii* A.Gray. Annual. Locally common on vernaly moist areas on banks above stream in Short Canyon, moisture often associated with springs. 1200 m (3800 ft) *Fraga*, *Boyd*, *Denslow* & *Gross* 434.


*Phacelia ramosissima* Douglas ex Lehm. var. *ramosissima*. Perennial herb. Uncommon growing from rock crevices or between shrubs. 1000–1500 m (3400–5000 ft) *Fraga*, *Honer* & *Soza* 724.


**LAMIACEAE**

†*Monardella benedolens* Shevock, Ertter & Jokerst. Perennial herb. Rare; on Owens Peak on granitic and metamorphic scree and bedrock in open mixed coniferous forest. 2500–2600 m (8200–8400 ft) (Holotype CAS; isotypes FSC, MO, NY, RSA, UC) Shevock, Bartel & York 11727.


*Salvia pachyphylla* Epling ex Munz. Small shrub. Occasional on exposed ridgelines and mountain slopes in open coniferous forest. 1900–2400 m (6000–8000 ft) *Fraga* & *De Groot* 924.


**LENNOACEAE**

*Pilosia arenarium* Hook. Parasitic perennial herb. Rare; in open places in sandy soil and along road cuts. 1100–1400 m (3500–4500 ft) *Fraga* & *De Groot* 841.

**LOASACEAE**


*Mentzelia eremophila* (Jeps.) H.J.Thompson & *J.E.Roberts*. Annual. Rare on desert slopes, only known from one early collection. 800–1400 m (2600–4500 ft) *Peterson* 7341.


**LYTHRACEAE**

MALVACEAE

EREMALCHE EXILIS (A.Gray) Greene. Annual. Rare; from one collection in Short Canyon on fine sandy soil on the canyon bajadas. 915 m (3000 ft) Fraga & Denslow 490.


*MALVA NEGLECTA* Wallr. Annual. Rare; from one collection at the Indian Wells Steak House and Brewery, on open disturbed roadside. 800 m (2600 ft) Fraga, Bigelow & Denslow 1011.


SPIRRALEA AMBIGUA A.Gray var. ROSACEA (Munz & I.M.Johnst.) Kearney. Suffruticoso perennial. Rare; from one collection on the summit of Backus Peak (Unnamed Peak 6651 ft on Owens Peak USGS topoquad). 2027 m (6651 ft) Fraga & Anderson 1117.

NYCTAGINACEAE

ABBONIA POGONANTHA Heimerl. Annual. Locally common on sand dunes of Short Canyon and sandy slopes. 800–975 m (2600–3200 ft) Fraga & Denslow 493.

ABBONIA VILLOSA S.Watson var. VILLOSA. Annual. Locally common on sand dunes of Short Canyon and sandy slopes. 900–975 m (2800–3200 ft) Fraga & Denslow 503.


OLEACEAE


ONAGRACEAE

CAMISSONIA BOOTHII (Douglas) P.H.Raven subsp. DESERTORUM (Munz) P.H.Raven. Annual. Rare; from one collection near SR 14. 800 m (2600 ft) Elythria 523 (CAS).

CAMISSONIA CAMPESTRIS (Greene) P.Raven subsp. CAMPESTRIS. Annual. Common on bajadas and desert slopes. 800–1220 m (2600–4000 ft) Fraga & Denslow 454.


CAMISSONIA PUBENS (S.Watson) P.H.Raven. Annual. Rare; from one collection in Buena Vista Canyon. 1500 m (5000 ft) Fraga, De Groot & Porter 658.


EPLOEBUM CANUM (Greene) P.H.Raven subsp. CANUM. Suffruticoso perennial. Occasional from desert slopes, and near edges of stream channels. 1000–1220 m (3400–4000 ft) Fraga, De Groot & Hobbs 593.

EPLOEBUM CANUM (Greene) P.H.Raven subsp. LATIFOLIUM (Hook.) P.H.Raven. Suffruticoso perennial. Occasional from rocky mountain slopes. 1500–2600 m (5000–8400 ft) Fraga & Gross 980.

EPLOEBUM CILIATUM Raf. subsp. CILIATUM. Perennial herb. Locally common in stream channels. 1100–1300 m (3500–4200 ft) Fraga, Maurice, Scovell & Virgen 917.


OKRAngIACEAE


CASTILLEJA LINARIIFOLIA Benth. Parasitic perennial herb. Uncommon on desert slopes, near riparian areas. 1100–1200 m (3500–3800 ft) Fraga & Tessel 142.


*CORYDANDRANTHUS RIGIDUS* (Benth.) Jeps. subsp. BREBRIRACTEAUS (A.Gray) J.F.Mach. Parasitic annual. Locally common in the understory of shaded mixed coniferous forest. 1710 m (5600 ft) Fraga, Anderson, Gross & Kempton 1643.


PAPAVERACEAE

ARGE MEONE MUNITA Durand & Hilg. Annual to perennial herb. Uncommon from open habitats, often along roadsides. 1220–1700 m (4000–5500 ft) Fraga & Fraga 1253.


Polo meni aceae


Al cicella sp. nov. Annual. Occasional on bajadas and desert slopes. 800–1100 m (2600–3500 ft) Fraga & Denslow 326.


Er irastrum densifolium (Benth.) H.Mason subsp. elongatum (Benth.) H.Mason. Suffruticose perennial. Rare; from one collection in Short Canyon. Vollmer s.n. 1 Jul 1953 (DS).

Er irastrum densifolium (Benth.) H.Mason subsp. mohavense (Craig) H.Mason. Suffruticose perennial. Occasional on bajadas and desert slopes. 1200–1700 m (3800–5500 ft) Fraga & Tessel 155.

Er irastrum diffusum (A. Gray) H.Mason × eremicum (Jeps.) H.Mason. Annual. Rare; from one collection along the Los Angeles Aqueduct road east of Indian Wells Canyon, growing along roadside. 975 m (3200 ft) Fraga & De Groot 845.

Er irastrum eremicum (Jeps.) H.Mason. Annual. Occasional in open habitats, on desert slopes. 900–1500 m (2800–5000 ft) Twisselman 4574 (CAS).


Gil ia cana (M.E. Jones) A.Heller subsp. speciosa (Jeps.) A.D. Grant & V.E. Grant. Annual. Occasional on desert slopes. 915–2200 m (3000–7200 ft) Fraga, Gross & Navidara 1082.

Gil ia leptanth a Parish subsp. punctata (Milliken) A.D. Grant & V.E. Grant. Annual. Occasional on upper desert slopes and mountain slopes. 1500–2100 m (5000–7000 ft) Fraga & Mills 1249.


Langloss a seto sisima (Torr. & A.Gray) Greene subsp. punctata (Coville) Timbrook. Annual. Rare; documented from one collection in the desert, near Inyokern. 800 m (2600 ft) Mason 8296 (UC).


Polygonaceae


Eriogon um kennedyi S.Watson var. purpurii (Brandeger) Reveal. Perennial herb. Rare; from one location on a gravelly flat in Indian Wells Canyon. 1600 m (5400 ft) Fraga & Brock 1338.


Eriogon um nodul arium Coville. Annual. Occasional in open habitats on fine granite sand. 915–1400 m (3000–4500 ft) Fraga & Soza 878.


**Eriogonum reniforme** Torr. & Frém. Annual. Rare on canyon bajadas and desert slopes. 8000–1000 m (2600–3300 ft) Lathey 324 (CAS).

**Eriogonum roseum** Durand & Hig. Annual. Occasional on mountain slopes. 1600–2100 m (5500–7000 ft) Fraga & De Groot 920.


**Eriogonum vittatum** Douglas ex Bent. Annual. Locally common in sagebrush and mountain sagebrush on mountain slopes. 1100–2100 m (3600–6800 ft) Fraga & Gross 962.

**Rumex salicifolius** Wemn. Perennial herb. Rare, in shaded upper reaches of Indian Wells Canyon near the base of Owens Peak. 1900–2000 m (6100–6400 ft) Fraga & Griffith 806.

**Portulacaceae**

**Calandrinia ciliata** (Ruiz & Pav.) DC. Annual. Uncommon on canyon bottoms and shaded north slopes. 1400–1700 m (4500–5550 ft) Fraga & Boyd 401.


**Claytonia parviflora** Douglas ex Hook. subsp. parviflora. Annual. Occasional from north slopes in moist areas under rock crevices. 915–1900 m (3000–6000 ft) Fraga & Griffith 1092.


**Claytonia perfoliata** Donn ex Wild. subsp. perfoliata. Annual. Occasional from north slopes in moist areas under rock crevices. 1220–2000 m (4000–6500 ft) Fraga & Griffith 1142.

**Leuca rediviva** Pursh subsp. minor (Rydby.) Munz. Geophyte. Locally common; from one location on a gravelly flat in Indian Wells Canyon. 1600 m (5400 ft) Fraga et al. (Field Trip Attendees) 1538.

**Ranunculaceae**

**Delphinium hansenii** (Greene) Greene subsp. kernenii (Davidson) Ewan. Geophyte. Uncommon in shade of mixed coniferous forest on steep mountain slopes. 2200–2400 m (7000–7800 ft) Fraga & Griffith 1226.


**Rhamnaceae**

**Ceanothus greggii** A.Gray var. vitetus (Greene) McMinn. Large shrub. Occasional in open pinyon woodland in the upper reaches of canyons and mountain slopes. 1000–2200 m (3400–7200 ft) Fraga & Mills 1244.

**Rhamnus tomentella** Benth. subsp. cuspisata (Greene) J.O.Sawyer. Large shrub. Occasional at the upper reaches of canyons and mountain slopes. 1220–2200 m (4000–7200 ft) Fraga & Maurice 174.

**Rosa**

**Cercocarpus ledifolius** Nutt. var. ledifolius. Large shrub. Occasional on open mountain slopes. 1500–2400 m (5000–8000 ft) Fraga & Soza 870.


**Ivesia santolinesa** A.Gray. Perennial herb. Occasional on steep granite slopes on the east side of Owens Peak. 2440 m (8000 ft) Fraga, Anderson, Gross & Kempton 1651.

**Ivesia saxosa** (Greene) B.Ertter. Perennial herb. Occasional in the cracks of large granite outcrops on the east side of Owens Peak. 2440 m (8000 ft) Fraga, Anderson, Gross & Kempton 1652.


**Prunus andersonii** A.Gray. Large shrub. Occasional on desert slopes and in the shade of pinyon woodland. 1100–1500 m (3500–5000 ft) Fraga, Griffith & Walker 572.


**Rosa woodsii** Lindl. var. ultramontana (S.Watson) Jeps. Small shrub. Rare; from one collection in Buena Vista Canyon in Joshua tree woodland. 1400 m (4700 ft) Fraga, Maurice, Scovell & Virgen 906.

**Rubus**


**Galium helenoides** Dempter & Ehrend. subsp. helenoides. Perennial herb. Rare; from one collection at the upper reaches of Grapevine Canyon 1190–1220 m (3800–4000 ft) Fraga, Honer & Soza 736.


**Salix**


**Salix laevigata** Bebb. Tree. Occasional in riparian areas. 1220–1520 m (4000–5000 ft) Fraga, Gross & Navidara 1065.


**Saururaceae**

**Anemopsis californica** (Nutt.) Hook. & Arn. Perennial herb. Uncommon; on moist banks above riparian area. 1000–1220 m (3300–4000 ft) Fraga & Fraga 121.

**Saxifragaceae**

SCROPHULARIACEAE


COLLINSIA CHILDI A.Gray. Annual. Rare; from one collection in the shade of oaks on the trail to Owens Peak. 1700 m (5600 ft) Fraga & Griffith 801.


MIMULUS BIEGLOVAI (A.Gray) A.Gray var. bigelovii. Annual. Rare; from one collection on the trail to Owens Peak in pinyon woodland. 2300–2400 m (7500–8000 ft) Fraga & Griffith 814.

MIMULUS BREWERI (Greene) Coville. Annual. Rare; from one collection near the summit of Owens Peak. 2500 m (8100 ft) Ertter, Bagley, Bramlet & Daniel 5447a (UC).

MIMULUS CARDINALIS Bentham. Perennial herb. Uncommon in riparian areas. 975–1220 m (3200–4000 ft) Fraga & Maurice 162.


MIMULUS FREMONTII (Benth.) A.Gray. Annual. Rare; on bajadas and open mountain slopes. 915–2100 m (3000–6800 ft) Fraga & Denlow 484.

MIMULUS GUIPTATUS DC. Annual or perennial herb. Occasional in moist soil of riparian areas. 1100–1600 m (3500–5200 ft) Fraga & De Groot 817.

MIMULUS MONTRODIES A.Gray. Annual. Rare; near ridgeline east of the summit of Owens Peak 2500 m (8100 ft) Ertter, Bagley, Bramlet & Daniel 6447 (UC).


MIMULUS PILEOSUS (Benth.) S.Watson. Annual. Locally common in moist drainages. 1710 m (5600 ft) Fraga, Anderson, Gross & Kempton 1636.

MIMULUS WHITNEYI Congdon. Annual. Uncommon, on the summit of Owens Peak. 2600 m (8400 ft) Fraga & Griffith 865.


SCROPHULARIA CALIFORNICA Cham. & Schlcht. Perennial herb. Rare; from one collection on Five Fingers growing out of large granite outcrop. 1500 m (5000 ft) Fraga, De Groot & Hobbs s.n. 20 Oct 2003.

*VERONICA ANAGALLIS-AQUATICA* L. Perennial herb. Uncommon in riparian areas in Indian Wells Canyon. 915–1100 m (3000–3500 ft) Fraga & Brock 1331.

SOLANACEAE


STERCULIACEAE

FREMONDODENDRON CALIFORNICUM (Torr.) Coville. Annual. Rare; from one documented collection in Short Canyon. 800 m (2600 ft) Fraga & Brock 1348.

TAMARICACEAE

*TAMARRIX RAMOSISSIMA* Ledeb. Large shrub. Uncommon in stream channel of Indian Wells Canyon. 800 m (2600 ft) Fraga & Soza 792.

URTIACEAE


VERBENACEAE

VERBENA LASIOSTACHYS Link subsp. lasiostachys. Perennial herb. Rare; from one documented collection in Short Canyon. Henry s.n. 4 Jul 1991.

VISCACEAE


PHRAGMADENDRON VILLOSUM (Nutt.) Nutt. Parasitic perennial herb. Occasional on Quercus chrysolepis at the upper reaches of canyons and mountain slopes. 1220–1830 m (4000–6000 ft) Fraga & Boyd 388.

VITACEAE

VITIS GIRDANA Munson. Liana. Common, in riparian areas commonly growing on other shrubs. 1100–1800 m (3500–5800 ft) Fraga, Maurice, Virgen & Scovel 902.
**ZYGOPHYLLACEAE**

**Larrea tridentata** (Sessé & Moç. ex DC.) Coville. Large shrub. Common on bajadas in sandy soil. 800–1200 m (2600–3800 ft) Fraga & Fraga 552.

**Tribulus terrestris** L. Annual. Locally common along disturbed roadsides near highways. 792 m (2600 ft) Fraga, Brock, Fischer & Oberlin 1659.

**ANGIOSPERMAE—MONOCOTYLEDONES**

**Agavaceae**


**Cyperaceae**

**Carex alba** L. Bailey. Perennial herb. Uncommon in riparian areas, more commonly at the upper reaches of canyons. 975–2100 m (3200–6800 ft) Fraga & Gross 970.

**Eleocharis parviflora** Britton. Perennial herb. Occasional on moist edges of riparian areas. 1100–1500 m (3600–5000 ft) Fraga & Soza 788.

**Scirpus nevadensis** S. Watson. Perennial herb. Uncommon in moist soil of riparian areas. 1030 m (3400 ft) Fraga & Brock 1332.

**Juncaceae**

**Juncus arcticus** Willd. Perennial herb. Occasional on edges of riparian areas, often on banks above stream channels. 1100–1700 m (3500–5600 ft) Fraga & Soza 786.

**Juncus macropphyllus** Coville. Perennial herb. Locally common in moist drainages in pine-oak woodland. 1710 m (5600 ft) Fraga, Anderson, Gross & Kempton 1639.

**Juncus rugullosus** Engelm. Perennial herb. Uncommon on edges of riparian areas, in moist soil. 1100–1700 m (3500–5600 ft) Fraga, Maurice, Scovel & Virgin 912.


**Lemnaceae**

**Lemna gibba** L. Aquatic annual. Uncommon in standing water of stream channels. 1100–1400 m (3500–4500 ft) Fraga & Anderson 1024.

**Liliaceae**


**Allium burlewii** Davidson. Geophyte. Common on exposed ridgelines and mountain slopes in pinyon woodland. 1800–2300 m (6000–7500 ft) Fraga & Soza 757.


**Allium lacunosum** S. Watson var. kerriensis Mc Neal & Ownby. Geophyte. Rare; from one collection in Grapevine Canyon in an open flat of the canyon. 1030 m (3400 ft) Fraga, Honer & Soza 706.

**Calochortus invenustus** Greene. Geophyte. Uncommon on exposed ridgelines and mountain slopes. 1700–2600 m (5500–8400 ft) Fraga & Griffith 886.


**Festuella peniculata** Davidson. Geophyte. Rare; from one collection on steep talus slope just west of Russel Peak. 1920 m (6300 ft) Fraga & Soza 775.


**Poaceae**


**Bromus diandrus** Roth. Annual. Occasional in disturbed moist sites, often adjacent to roads. 800–1400 m (2600–4500 ft) Fraga & Soza 787.


**Bromus trinitis** Desv. Annual. Uncommon on desert slopes, often growing from between rock crevices. 1100–1400 m (3500–4500 ft) Fraga, Griffith & Walker 564.

**Distichlis spicata** (L.) Greene. Perennial herb. Occasional on alkaline flats near stream channels. 1100–1700 m (3500–5600 ft) Fraga & De Groot 832.

**Elymus elymoides** (Raf.) Swezy subsp. Californicus (J. G. Smith) Barkworth. Perennial herb. Common throughout the study area in open habitats on desert and mountain slopes. 918–2400 m (3000–7800 ft) Fraga, Honer & Soza 711.


**Elymus glaucus** Buckley subsp. glaucus. Perennial herb. Occasional in the shade of trees in moist sites, in Grapevine Canyon. 1100–1400 m (3500–4500 ft) Fraga, Honer & Soza 708.


**Leptochloa filiformis** (Lam.) Beauv. Perennial herb. Rare; from one collection in a cement crack at Brady’s Gas Station. 792 m (2600 ft) Fraga, Brock, Fischer & Oberlin 1659.

**Leymus triticiodes** (Buckl.) Pilg. Perennial herb. Occasional in moist sites near springs and stream channels in Grapevine Canyon. 1100–1300 m (3500–4200 ft) Fraga, Honer & Soza 710.

**Leymus imperfectus** Trin. Perennial herb. Occasional on mountain and desert slopes, often in shaded areas. 1100–2400 m (3500–7800 ft) Fraga & Griffith 1114.

**Melica stricta** Bol. Perennial herb. Uncommon on mountain and desert slopes, often in shaded areas. 1200–2400 m (4000–7800 ft) Fraga, Honer & Soza 745.

Muhlenbergia rigens (Benth.) Hitch. Perennial herb. Common on edges of stream channels and moist areas fed by springs. 1000–1400 m (3200–4500 ft) Fraga & Maurice 163.

Pirahmites australis (Cav.) Steud. Perennial herb. Uncommon, from one locality near the stream edge in Short Canyon. 1100–1200 m (3500–3800 ft) Fraga, Buck, McAllister, Morgan & Virgen 950.

*Poa annua*. Annual. Uncommon in moist soil near riparian areas in Indian Wells Canyon. 1400 m (4600 ft) Fraga & Soza 790.


**Typhaceae**


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**LITERATURE CITED**


