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Vascular Plants of a Desert Oasis: Flora and Ethnobotany of Quitobaquito, Organ Pipe Cactus National Monument, Arizona

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ABSTRACT.—A dependable supply of fresh water in an arid region, the Quitobaquito Oasis has been a crossroads of cultural activity as well as a center of biological dynamism and diversity. The study area includes approximately 350 hectares surrounding a series of springs along a fault on the south side of the Quitobaquito Hills along the U.S.–Mexico border in Organ Pipe Cactus National Monument, Arizona. The area straddles the boundary of Shreve's Arizona Upland and Lower Colorado Valley subdivisions of the Sonoran Desert. The vascular plant flora includes 271 species in 198 genera and 63 families; in addition, a number of plants were formerly cultivated at this desert oasis. The Quitobaquito region supports approximately 45% of the total flora of Organ Pipe Cactus National Monument, although the area constitutes only about 3.5% of the total area of the monument. Thirty-five species are wetland plants. Thirty-three species are not native to the region. The flora of the Quitobaquito region is dynamic: major vegetational and floristic changes have been due to human influences, which continue today. Minor changes and local immigrations and extinctions, especially in the non-wetland areas, are influenced by environmental factors such as winter freezing and fluctuations in rainfall. This flora includes indigenous Sonoran Tohono O'odham and Hia C-ed O'odham names and uses for plants at Quitobaquito. This is the first time such ethnobotanical information has been made available concerning the westernmost Piman speakers. We urge that cultural as well as biological processes be considered further in planning the long-term conservation and management of Quitobaquito.

RESUMEN.—Una fuente confiable de agua dulce en una región árida es el oasis de Quitobaquito. Este ha sido un lugar de paso de la actividad humana, al igual que un centro de cambio y diversidad biológica. El área de estudio incluye aproximadamente 350 hectáreas alrededor de un serie de manantiales en la falla que se encuentra al sur de las lomas de Quitobaquito, a lo largo de la frontera EUA–México, en el Organ Pipe Cactus National Monument, Arizona. El área se encuentra en la frontera entre las subdivisiones "Arizona Upland" y "Lower Colorado Valley" del Desierto Sonorense, de Shreve. La flora de plantas vasculares incluye 271 especies, en 198 géneros y 63 familias. Además, en este oasis desértico se cultivaban varias plantas por los nativos. La región de Quitobaquito contiene aproximadamente 45% de la flora total del Organ Pipe Cactus National Monument, aunque su superficie constituye sólo alrededor del 3.5% del área total de este parque. Treinta y cinco especies son plantas de humedales. Treinta y tres especies no son nativas de la región. La flora de la región de Quitobaquito es dinámica: cambios muy importantes en la vegetación y la flora se han debido a la influencia humana, misma que aún continúa. Cambios menores e inmigraciones y extinciones locales, especialmente en las áreas fuera de los humedales, están influenciados por factores ambientales como heladas y sequías. Esta flora incluye nombres y usos Hia C-ed O'odham (Pápagos occidentales). Esta es la primera vez en la que esta información etnobotánica de los pima más occidentales se publica. Se hace un llamado urgente a que los procesos biológicos y culturales sean considerados al planear la conservación y manejo a largo plazo de Quitobaquito.

INTRODUCTION

Quitobaquito is a legendary place, a shaded oasis in the desert. Because it provides dependable water in the central portion of the Sonoran Desert, it has consistently been a crossroads of human activity since early prehistoric times. These same factors have made it a center of biological dynamism and accumulated diversity. Conserving this diversity is dependent upon an understanding of both

natural and cultural processes leading to its accumulation.

A series of springs lies along a fault on the south side of the Quitobaquito Hills in Organ Pipe Cactus National Monument, in western Pima County, Arizona. These springs are, from large to small, Quitobaquito, Williams (Rincón), Aguajita, and Burro; there are also a few smaller springs and seeps. Although Quitobaquito is the best known of the springs in the region, the other associated

springs are also biotically important. Quitobaquito has the greatest flow of the springs in the complex and has been affected the most by people. Because of its unusual hydrological, ecological, and cultural features, the area has been recognized as a special management area by the National Park Service.

Our flora covers the Quitobaquito management area of approximately 350 hectares, defined by the international border with Mexico on the south, the crest of the Quitobaquito Hills on the north, Aguajita Wash on the east, and the first wash west of Williams Spring on the west (Figs. 1 and 2). The elevation spans 120 m, from 310 m on the international border to 430 m at the crest of the Quitobaquito Hills. The area lies along the interface of Shreve's (1951) Arizona Upland and Lower Colorado Valley subdivisions of the Sonoran Desert. The United States–Mexico boundary now separates a major portion of the fields formerly irrigated with water from Quitobaquito from the area covered in this flora (Fig. 3). In the early 1990s this portion of old field was still discernible as partially barren ground isolated along the south side of Mexico Highway 2 (Fig. 3).

A fault running parallel to the springs separates two different rock types: well-fractured granite to the east and dense fine-grained rock to the west. The dense impermeable material on the west side has created a dam stopping the movement of underground water. The water table intersects the surface at Quitobaquito because the unfractured rock to the south acts as an underground dam. Extensive light-colored carbonate clay spring deposits are found in the areas surrounding the several springs (Brown *et al.*, 1983; Cole and Whiteside, 1965).

The area covered by this flora is drained by a series of dry washes that generally lead southwest to the floodplain of the Río Sonoyta in adjacent Sonora. Aguajita Wash is the largest wash in our region; it drains an extensive area including the western portion of the La Abra Plain and the eastern and northern slopes of the Quitobaquito Hills. On the Sonora side of the international border fence Aguajita Wash passes El Papalote, a restaurant and bus and truck stop on the south side of Mexico Highway 2, and joins the Río Sonoyta about 4 km south of El Papalote (Fig. 2).

Springs such as those at Quitobaquito are unusual in the Sonoran Desert, and contrast dramatically with the relatively sparse surrounding desert scrub. The springs and the artificial pond below it support a diversity of wetland plants and animal life not found in the surrounding desert (Cole and Whiteside, 1965; Huey, 1942; Johnson *et al.*, 1983; Kingsley and Bailowitz, 1987; Kingsley *et al.*,

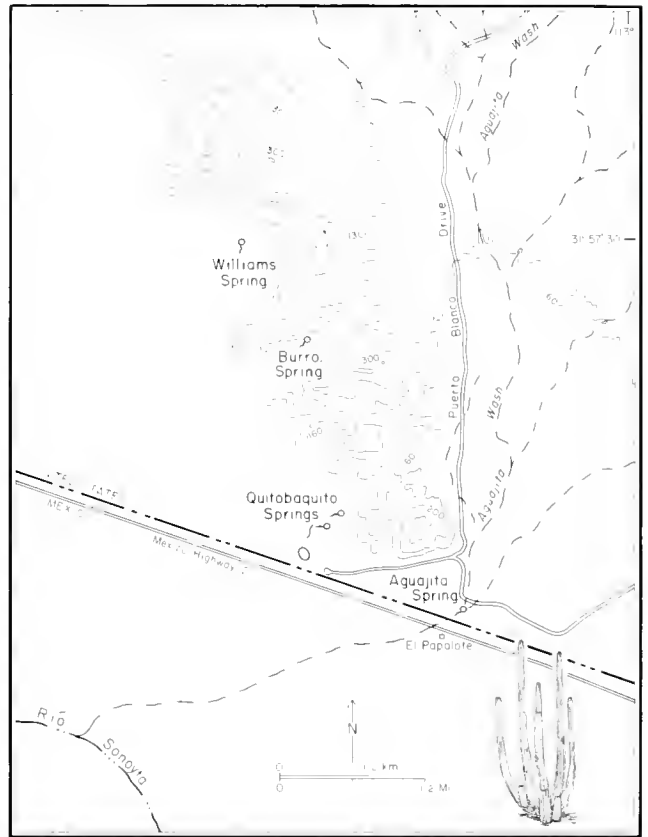


Figure 2. Quitobaquito and vicinity.

1987). Quitobaquito is a premier locale for eco-tourism, especially bird-watching (Johnson *et al.*, 1983). The wetlands and surrounding mesquite woodland support such breeding birds as the Yellow-breasted Chat (*Icteria virens*), Hooded Oriole (*Icterus cucullatus*), Vermilion Flycatcher (*Pyrocephalus rubinus*), and Western Kingbird (*Tyrannus verticalis*), as well as many migrants that are absent or rare in the surrounding desert scrub (Johnson *et al.*, 1983). The pond supports populations of the Sonoran Mudturtle (*Kinosternon sonoriense*) and Desert Pupfish (*Cyprinodon macularius*), the latter an endemic subspecies (*C. m. eremus*) known only from Quitobaquito and not found in the nearby Río Sonoyta (Miller and Fuiman, 1987).

Climate

Quitobaquito is on the fringe of the Lower Colorado Valley, the most arid region of North America. Rainfall is biseasonal. Winter-spring rains are usually gentle rains of cyclonic storms originating in the Pacific Ocean. Summer rains are convective thunderstorms, often highly localized and violent. In September or October, tropical storms (chubascos) can, on occasion, bring large amounts of rain into the area. The nearest station for which long-term precipitation data are available is Sonoyta, Sonora, where the annual average for 18 years, from 1949 to 1967, was 195.6 mm (Hastings and Humphrey, 1969). Annual average rainfall at Aguajita Wash from 1982 to 1990 was 266 mm (Organ Pipe Cactus National Monument, unpublished data). To the south and west precipitation declines sharply; the 30-year average at Puerto Peñasco, just 65 km to the southwest, is only 85.6 mm.

In many respects the unpredictability of rainfall is probably of

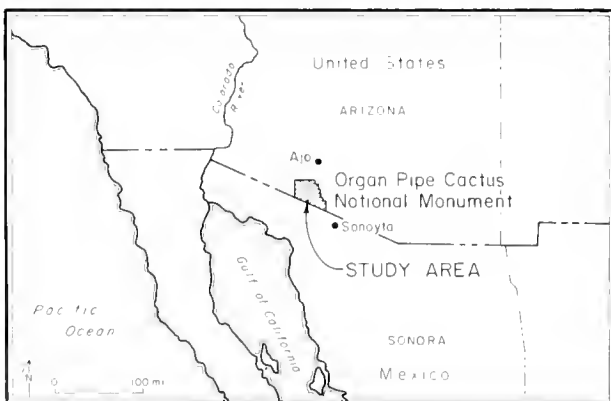


Figure 1. Location of study area.

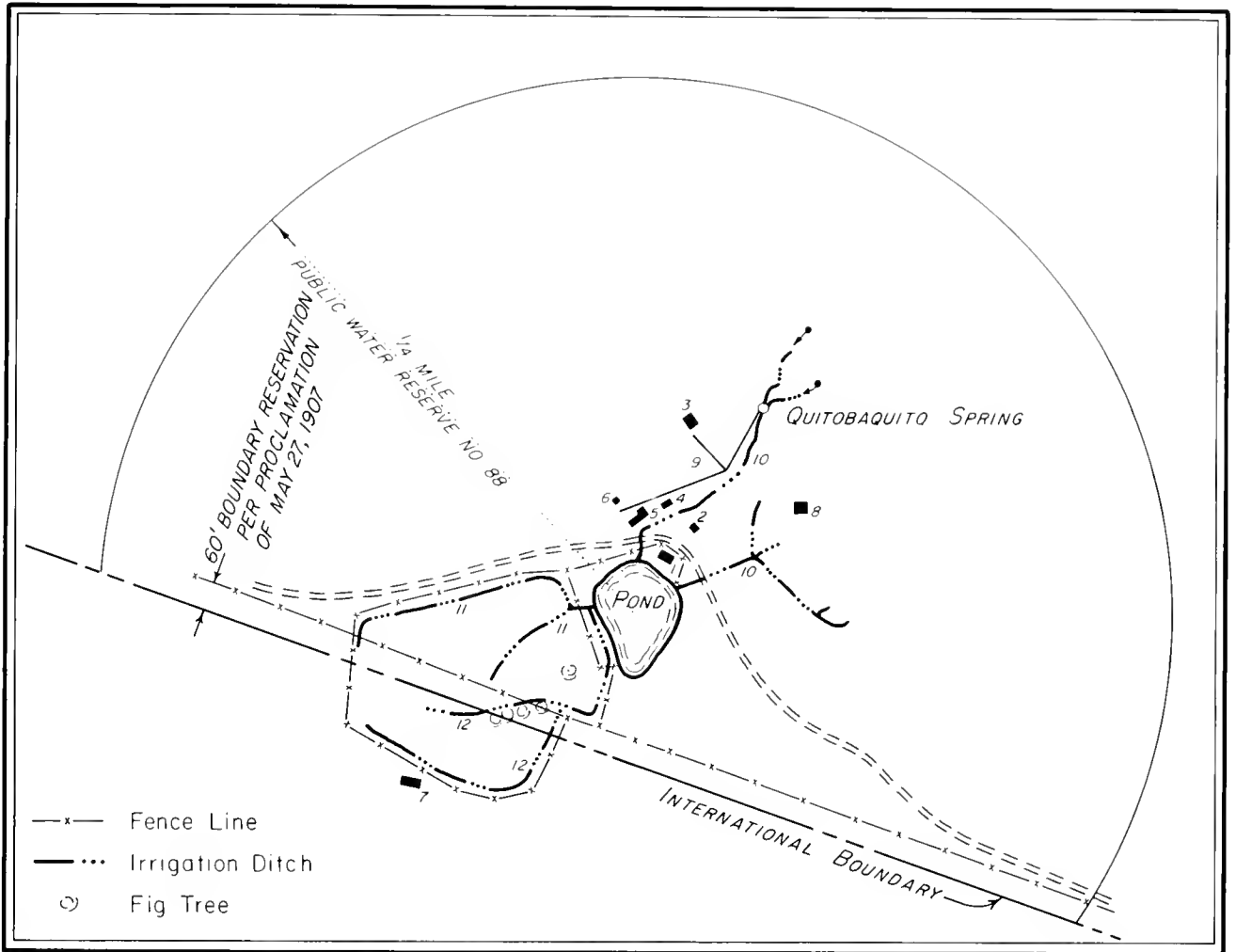


Figure 3. The Quitobaquito settlement in 1945.

greater significance to plant life in the area than yearly averages (Ezcurra and Rodrigues, 1986). For example, 134 mm, 70% of the annual average, was recorded at Aguajita Wash in just one day, 20 August 1988 (Organ Pipe Cactus National Monument, unpublished data). Yet in 1989 a six-month drought ensued.

Summers are long and hot. Average maximum daily temperature exceeds 38°C (100°F) during June, July, and August, and maximum daily temperatures exceeding 38°C are common from late April to early October (Organ Pipe Cactus National Monument, unpublished data). For the non-riparian plants the late spring and early summer drought together with high temperatures can be severely limiting, all the more so during years when summer rains are unusually meager.

The lack of severe frosts is a critical factor that permits a number of frost-sensitive species with subtropical affinities to survive in the region. The new weather station in Aguajita Wash recorded 22 days with overnight temperatures below 0°C during the winter of 1988–89, and temperatures remained below freezing in excess of eleven hours on just two of those days. However, for certain highly frost-sensitive species even these moderate freezing temperatures are severely limiting. Species that appear to be limited by freezing weather include *Jatropha cinerea*, *Hyptis emoryi*, *Lophocereus schottii*, and *Sapium biloculare*.

Landforms and Vegetation

Several studies document the vegetation of Quitobaquito and the surrounding area. The vegetation of the entire monument was described and mapped on a general scale by Warren *et al.* (1981). Nabhan *et al.* (1982) and Reichhardt *et al.* (1983) examined the vegetation of Quitobaquito in more detail, establishing permanent sampling transects in each of the major habitats near the oasis. Aerial photos used for this study are deposited at the Office of Arid Lands Studies of the University of Arizona. These studies compared the floristic and vegetational diversity of Quitobaquito and Quitovac, an O'odham-controlled but analagous oasis 35 km south of Sonoyta in northwestern Sonora. The physical structure of the mesquite bosque at Quitobaquito was documented by Brown and Warren (1986). Vegetational changes in the Quitobaquito management area between 1975 and 1984 were documented photographically and with permanent plots by Warren and Anderson (1987). The vegetation showed substantial recovery from grazing, which ceased in 1978. The vegetation of the nearby Pinacate region in northwestern Sonora was analyzed by Ezcurra *et al.* (1987).

Six major habitats are discernible in the Quitobaquito area: rocky slopes, gravelly bajadas, wetlands, washes, alkaline flats, and old fields.

Rocky slopes. The Quitobaquito Hills form the most extensive of the six habitats. This habitat is characterized by shallow, rocky soil with numerous rock outcrops. The predominant rocks are metamorphic granitic gneisses. Differences in slope exposure, steepness, soil depth, and drainage patterns contribute to local differences in community makeup. Conspicuous perennials include

<i>Ambrosia deltoidea</i>	<i>Ferocactus cylindraceus</i>
<i>A. dumosa</i>	<i>F. emoryi</i>
<i>Atriplex polycarpa</i>	<i>Fouquieria splendens</i>
<i>Calliandra eriophylla</i>	<i>Hibiscus denudatus</i>
<i>Carnegiea gigantea</i>	<i>Jatropha cuneata</i>
<i>Cercidium microphyllum</i>	<i>Krameria grayi</i>
<i>Chamaesyce polycarpa</i>	<i>Larrea divaricata</i>
<i>Cheilanthes deserti</i>	<i>Lycium andersonii</i>
<i>C. standleyi</i>	<i>Mammillaria grahamii</i>
<i>Ditaxis lanccolata</i>	<i>Opuntia acanthocarpa</i>
<i>Echinocereus engelmannii</i>	<i>O. bigelovii</i>
<i>Encelia farinosa</i>	<i>Porophyllum gracile</i>
<i>Eriogonum inflatum</i>	<i>Stenocereus thurberi</i>
<i>Eriogonum pulchellum</i>	<i>Trixis californicus</i>
<i>Fagonia californica</i>	

Bajadas. The coarse well-drained soils of the bajada extend along a gradient from the foot of the rocky hills to the valley bottom. One can distinguish two intergrading bajada habitats. The upper bajada has coarser, rockier soils than the sandy flats of the lower bajada. The gradient from rocky hillsides to valley bottom is shorter at Quitobaquito than in many other Sonoran Desert bajadas because of the narrow valley through which the Río Sonoyta passes south of the Quitobaquito Hills. Characteristic perennials include

<i>Ambrosia deltoidea</i>	<i>Machaeranthera coulteri</i>
<i>A. dumosa</i>	<i>Mammillaria grahamii</i>
<i>Atriplex linearis</i>	<i>M. thornberi</i>
<i>A. polycarpa</i>	<i>Olneya tesota</i>
<i>Echinocereus engelmannii</i>	<i>Opuntia acanthocarpa</i>
<i>Hymenoclea salsola</i>	<i>O. fulgida</i>
<i>Isocoma acradenia</i>	<i>O. kunzei</i>
<i>Krameria grayi</i>	<i>Orobancha cooperi</i>
<i>Larrea divaricata</i>	<i>Prosopis velutina</i>
<i>Lycium andersonii</i>	<i>Ziziphus obtusifolius</i>
<i>L. fremontii</i>	

Wetlands. The pond at Quitobaquito, covering 0.22 ha and about 1 m deep, is supplied with water from springs on the hillside north of the pond; there are many seeps along this hillside but only two main springs. From these springs water flowed about 100 m through open ditches to the pond, and at a later date portions of the ditch were replaced by underground pipes (Fig. 3). In 1989 the small ditch leading from the spring to the pond was rebuilt and lined with ferrocement, and the two main springs were encased in cement and covered with locked metal gates. Spring flow is reported to be about 125 liters per minute of rather alkaline water with an average temperature of about 23°C at the springs. Natural springs are rare in the region, and a cluster of four is unique.

The soil around the springs (at least prior to 1989) and at the pond is always moist and alkaline. Although conditions vary somewhat from spring to spring, the wetland habitat at each is basically similar. The wetland plants are listed below. Asterisks indicate non-native species.

<i>Anemopsis californica</i>	<i>Nitrophila occidentalis</i>
<i>Baccharis salicifolia</i>	<i>Phragmites australis</i>
<i>Centaurium calycosum</i>	<i>Pluchea odorata</i>
* <i>Cynodon dactylon</i>	<i>P. sericea</i>
<i>Cyperus laevigatus</i>	* <i>Poa annua</i>
<i>C. squarrosus</i>	* <i>Polypogon monspeliensis</i>
<i>Distichlis spicata</i>	* <i>P. viridis</i>
* <i>Eclipta prostrata</i>	<i>Populus fremontii</i>
<i>Eleocharis caribaea</i>	<i>Potamogeton pectinatus</i>
<i>I. rostellata</i>	<i>Prosopis pubescens</i>

<i>Eustoma exaltatum</i>	<i>Salix gooddingii</i>
<i>Heliotropium curassavicum</i>	<i>Scirpus americanus</i>
<i>Juncus balticus</i>	<i>Sporobolus airoides</i>
<i>J. bufonius</i>	* <i>Tamarix ramosissima</i>
<i>J. cooperi</i>	<i>Typha domingensis</i>
<i>Mvosarus minimus</i>	<i>Veronica peregrina</i>
<i>Najas marina</i>	<i>Zannichellia palustris</i>

Washes. The broad wash and its floodplain with smaller braided washes coursing through Aguajita is especially notable for its rich vegetation. This major wash drains a large watershed from the north and in flood can carry large quantities of water. The density and diversity of desert ephemerals can be high. In addition, there are several much smaller washes in the Quitobaquito, Williams, and Burro springs areas. Characteristic perennials of washes and their floodplains include

<i>Acacia greggii</i>	<i>Isocoma acradenia</i>
<i>Acalypha californica</i>	<i>Lycium andersonii</i>
<i>Ambrosia ambrosioides</i>	<i>L. fremontii</i>
<i>A. confertiflora</i>	<i>L. parishii</i>
<i>A. deltoidea</i>	<i>Lyrocarpa coulteri</i>
<i>Aristolochia watsonii</i>	<i>Machaeranthera coulteri</i>
<i>Atriplex polycarpa</i>	<i>Nicotiana trigonophylla</i>
<i>Bebbia juncea</i>	<i>Olneya tesota</i>
<i>Capparis atamisquea</i>	<i>Opuntia leptocaulis</i>
<i>Carlwrightia arizonica</i>	<i>Orobancha cooperi</i>
<i>Cercidium floridum</i>	<i>Petalonyx thurberi</i>
<i>Condalia globosa</i>	<i>Prosopis velutina</i>
<i>Hymenoclea monogyra</i>	<i>Psoralea spinosa</i>
<i>H. salsola</i>	<i>Sarcostemma cynanchoides</i>
<i>Hymenothrix wislizenii</i>	<i>Stephanomeria pauciflora</i>
<i>Hyptis emoryi</i>	<i>Ziziphus obtusifolius</i>

Alkaline flats. Alkaline flats with seasonally wet soil occur near the larger springs, Quitobaquito and Williams. Characteristic species include

<i>Aster intricatus</i>	<i>Juncus balticus</i>
<i>Atriplex lentiformis</i>	<i>J. cooperi</i>
<i>A. linearis</i>	<i>Machaeranthera coulteri</i>
<i>A. polycarpa</i>	<i>Nitrophila occidentalis</i>
<i>Calibrachoa parviflora</i>	<i>Opuntia fulgida</i>
<i>Distichlis spicata</i>	<i>Sporobolus airoides</i>
<i>Heliotropium curassavicum</i>	<i>Suaeda moquinii</i>
<i>Isocoma acradenia</i>	<i>Wislizenia refracta</i>

Old fields. Abandoned agricultural fields and orchards in low-lying flats were irrigated by a system of ditches from the springs at Quitobaquito. The old field immediately below the dam at Quitobaquito pond now supports a young stand of mesquite, a few *Capparis atamisquea* shrubs, and remnants of the fig and pomegranate groves. Another part of the old fields, immediately west of the young mesquite grove, is being colonized by desert trees and shrubs, such as *Acacia* and *Cercidium*, and small populations of vigorously growing plants of seven species of cacti. The fields also extended into Mexico (see Fig. 3). Perennials in the old fields include

<i>Acacia greggii</i>	<i>Isocoma acradenia</i>
<i>Ambrosia confertiflora</i>	<i>Lycium fremontii</i>
<i>A. deltoidea</i>	<i>L. macrodon</i>
<i>Atriplex linearis</i>	<i>L. parishii</i>
<i>A. polycarpa</i>	<i>Lyrocarpa coulteri</i>
<i>Baccharis salicifolia</i>	<i>Machaeranthera coulteri</i>
<i>B. sarothroides</i>	<i>Mammillaria grahamii</i>
<i>Capparis atamisquea</i>	<i>Opuntia acanthocarpa</i>
<i>Carnegiea gigantea</i>	<i>O. fulgida</i>
<i>Cercidium floridum</i>	<i>O. engelmannii</i>
<i>Condalia globosa</i>	<i>Pluchea sericea</i>
<i>Cynodon dactylon</i>	<i>Prosopis glandulosa</i>
<i>Distichlis spicata</i>	<i>P. velutina</i>
<i>Echinocereus engelmannii</i>	<i>Punica granatum</i>

<i>Encelba farinosa</i>	<i>Sarcostemma cynanchoides</i>
<i>Ferocactus emoryi</i>	<i>Sphaeralcea emoryi</i>
<i>Ficus carica</i>	<i>Stenocereus thurberi</i>
<i>Heliotropium curassavicum</i>	<i>Tamarix ramosissima</i>
<i>Hymenoclea salsola</i>	<i>Ziziphus obtusifolius</i>

Cultural History and Anthropogenic Influences on Vegetation

To the casual visitor the Quitobaquito area may seem a pristine wilderness, except for the sporadic roar of trucks and buses passing along nearby Mexico Highway 2. In fact, the site has a long and varied cultural history of land use and modification by people of diverse ethnic backgrounds. Over the last several thousand years it has probably experienced few periods without human occupation as long as the current period initiated in 1957 with the eviction of the O'odham. Changes continue to occur owing to current management practices, or lack thereof, and colonization by non-native weedy plants from nearby agricultural and urban areas in Mexico.

The Quitobaquito area was the oldest continuously occupied locality in Organ Pipe Cactus National Monument until 1957. The Paleoindian period (10,000–8000 B.C.) is represented by San Dieguito I (SD I) artifacts. Julian Hayden's archeological reconnaissance located these SD I stone tools, thought to have been used in woodworking, near now-extinct springs.

Occupation of the Quitobaquito region during the Archaic period (7000 B.C. to A.D. 150) has been documented by limited surveys of the area (Teague, 1977; Rankin, 1989). Two hunting and gathering traditions, the Amargosa of southeastern California and the Cochise of southeastern Arizona, have been identified in the Monument. Projectile points of both Archaic traditions have been recovered from the Quitobaquito region (Rankin 1989).

Continued use of the Quitobaquito region during the prehistoric ceramic period (300 B.C.–A.D. 1400) is indicated by artifacts affiliated with three distinct cultural groups. Hohokam presence is indicated by locally produced plain-ware ceramics and red-on-buff ceramics from the Phoenix basin and red-on-brown ware from the Tucson basin. Use of the area by the Trincheras culture, from the Altar Valley of Sonora, is indicated by Trincheras purple-on-red ceramics. The occurrence of Lower Colorado buff wares indicates use by Patayan groups from the Lower Colorado River Valley. The varied ceramics left in these extensive sites indicate a great deal of cultural mixing. The sites contain many rock clusters cracked by roasting fires. The high frequency of obsidian and marine shells indicates that Quitobaquito was a major stop on the trade network of prehistoric people.

Historically, the Hia C-ed O'odham (the Western or "Sand" Papago) had a major village in the vicinity of Quitobaquito. The springs were a rest stop for the Tohono O'odham (Central Papago) on the salt pilgrimage to the Gulf of California. The occupations and modifications by earlier people, especially Hohokam, Hia C-ed O'odham, Tohono O'odham, European, and Mexican-American cultures, have dramatically affected the biota. The history of the Quitobaquito region has been summarized by Hoy (1970a), Greene (1977), Bell *et al.* (1980), Nabhan (1982), and Bennett and Kunzmann (1989). Hia C-ed O'odham oral history has been recorded by Anderson *et al.* (1982) and Zepeda (1985). Other sources containing historical information on the area include Bryan (1925), Burrus (1971), Childs (1954), Clotts (1915), Fontana (1974), Hackenberg (1964), Hornaday (1908), Hoy (1970a, b, c), Ives (1966), Jones (1969), Lumholtz (1912), McGee (1898, 1901), and Thomas (1963).

According to Juan Joe Cipriano, a former O'odham resident, the O'odham influences on the vegetation and flora included periodic burning, brush clearing, plowing, transplanting wild and cultivated plants, livestock grazing, irrigating, and harvesting wild plants (Nabhan *et al.*, 1989). It has been argued elsewhere that native management of the oasis habitat has enriched the flora and avifauna

(Nabhan *et al.*, 1982; Rea *et al.*, 1983) through both direct introductions and by creating relatively openly spaced wetland niches by managing the dynamics of ecological succession. Some of these influences persist at Quitobaquito in the form of remnant pomegranate, fig, and cottonwood plantings.

"A'al Waippia, "little springs" or "little wells," is the Hia C-ed O'odham name for Quitobaquito. In 1698 and 1699 the Jesuit explorer/missionary Padre Eusebio Kino visited the settlement of "A'al Waippia and called it San Sergio. Kino estimated that 1000 people lived in the Sonoyta valley area (Burrus, 1971). During the mid-1800s Mexican settlers began moving into the area, and in 1850 an estimated 250 acres were under cultivation in the Rio Sonoyta valley. The history of settlement at Quitobaquito is one of coming and going, and the area was probably always somewhat peripheral to the more extensive agricultural areas and settlements along the nearby Rio Sonoyta. Quitobaquito continues to be visited by the O'odham, who regard it as culturally important.

The first European Americans also began to settle in the area in the mid-1850s. The dam and ditches developing the pond at Quitobaquito were built by an American, Andrew Dorsey, in approximately 1860—or at least he improved the fields, ditches, and diversions developed by earlier inhabitants. In 1887 the Orozco family, who were Hia C-ed O'odham, settled at Quitobaquito, and remained until 1957, when the last resident family member, Jim Orozco, was bought out by the Park Service (Figs. 4, 5, 6, 7). When the well-known explorers of the Pinacate region, Daniel T. MacDougal and William T. Hornaday, visited Quitobaquito in 1907, they found eight houses, of which only four were occupied (Hornaday, 1908). The last historical residences at Quitobaquito were removed by the Park Service in 1960 and 1961 when the Orozco and other buildings were destroyed (Greene, 1977; Hoy, 1970c).

From ancient times until about the end of World War II many travelers passed through or stopped at the Quitobaquito oasis (Lumholtz, 1912; McGee, 1901; Mason, 1963). The water and gentle shade must have been a welcome respite on the route west from Sonoyta along the Camino del Diablo, which became infamous during the nineteenth century. It was the major route followed by Sonorans and others traveling to Yuma and California, and it played a prominent role in the California gold rush of 1848 and 1849. After Santo Domingo and Agua Dulce, only a few kilometers west of Quitobaquito, there was no water for more than 60 km until the trail reached El Tule and finally Tinajas Altas.

Cattle, introduced into the region at the end of the seventeenth century, thrived on the once lush vegetation in riparian habitats, such as those along the Rio Sonoyta. From time to time grazing pressure intensified in the Quitobaquito region, especially during the latter part of the nineteenth century and the first six or seven decades of the twentieth century. There were cattle, horses, burros, and now and then probably some goats. The Gray family had a cattle ranch in Organ Pipe Cactus National Monument from 1919 until 1978, when cattle grazing in the monument ceased (Hoy, 1970b). The area immediately surrounding the pond at Quitobaquito was fenced in 1961 to exclude cattle. Part of the Gray family's holdings included Aguajita Spring. Concerning Aguajita, Bobby Gray (*in* Hoy, 1970b) recounted, "We been working that place since the 1920s. Corral there is made out of mesquite, Indians and Mexicans worked together and they would catch those wild horses and their horses together. We'd catch our cattle there. . . . It was impossible to sleep there, there was so damn many burros at night. I mean hundreds of them. Aguajita is a flowing spring."

From time to time during the late nineteenth century a grain mill and small store functioned at Quitobaquito (Greene, 1977; Hackenberg, 1864). Storekeepers and mill operators included Andrew Dorsey, José Lorenzo Sestier, Albert Steinfeld, and J. C. Waterman, Mikul Levy, who had mining interests and several stores



Figure 4. Quitobaquito, looking southeast. Adobe home of José Juan Orozco in center (5 in Fig. 3), tent-frame structure of Bureau of Animal Industries on left, another such tent-frame structure (3 in Fig. 3) on right. Alkali flats in foreground, cottonwood trees near houses and pond in background. Photo by William R. Superbaugh, 8 December 1950; courtesy Organ Pipe Cactus National Monument (photo file 51A).

in the Sonoyta region, had one of his stores "out east in the flat a short distance from the Quitobaquito pond. [It] was active from about 1888 to 1892" (Hoy, 1970a).

Both annual and perennial crops probably were grown at Quitobaquito and along the nearby Río Sonoyta both prior to and after Kino's visit in the late seventeenth century. Oral histories, spanning the late nineteenth and first half of the twentieth century, tell of a number of crops grown at Quitobaquito (Bell *et al.*, 1980; Hoy, 1970a,b; Zepeda, 1985). Williams had a small garden at the spring that bears his name and perhaps also at Burro Springs; in the early twentieth century Williams "farmed and mostly made whiskey" (Bobby Gray, *in* Hoy, 1970b). These various reports tell of the following plants cultivated at the oasis:

Allalfa (*Medicago sativa*). Clotts (1915:76) recorded "a small field of about 8 acres of allalfa," at Quitobaquito, and that "most of this field is on the Mexican side." Bryan (1925:427) likewise reported "a small weed-grown allalfa field" on the Mexican side of the border.

Beans: pinto, red (*Phaseolus vulgaris*)
 Black-eyed peas (*Argemone munguiculata*)
 Cane sorghum (*Sorghum bicolor*)
 Cantaloupes (*Cucumis melo*)
 Chiles, green chile (*Capiscum annuum*)

Date palms (*Phoenix dactylifera*). There are vague references to dates at Quitobaquito, but no date palms are evident in any of the early photographs. Perhaps the reference is to Quitovac in Sonora or along the Río Sonoyta.

Figs (*Ficus carica*). See species account (Moraceae).

Grapes (*Vitis vinifera*)

Maize (corn) (*Zea mays*). "Much corn, many different kinds" (B. Melvin, *in* Zepeda, 1985:57, 59).

Onions (*Allium cepa*)

Pear (*Pyrus communis*)

Peaches (*Pruinus persica*). "Little peaches" (Betty Miller, *in* Zepeda, 1985:34–36).

Pomegranates (*Punica granatum*). See species account (Punicaceae).

Squash, pumpkins (*Cucurbita* spp.). "Many kinds" (B. Melvin, *in* Zepeda, 1985:57, 59).

Tepary beans (*Phaseolus acutifolius*)

Watercress (*Nasturtium officinale*). See species account (Brassicaceae).

Watermelon (*Citrullus lanatus*)

Wheat (*Triticum aestivum*). There was a mill for grinding wheat; the wheel was turned with a burro (Betty Miller, *in* Zepeda, 1985:34–36; also see Hoy, 1970a). However, some or most of the wheat milled at Quitobaquito may have been from other fields in the nearby Sonoyta Valley.

Hia C-ed O'odham oral histories of Quitobaquito paint vivid impressions of the oasis in the late nineteenth and early twentieth



Figure 5. Quitobaquito, home of José Juan Orozco on right, looking south-southwest. Larger trees are cottonwood (*Populus fremontii*), other trees are mesquite (*Prosopis velutina*); the pond is on left. The car, bearing a U.S. Government license plate, is probably William Supernauth's Park Service vehicle; Orozco's transportation, a buckboard, is beneath the two large mesquites to the left of the car. In 1990 the large mesquite near the buckboard was dead but still standing, and the smaller mesquite to the right of the buckboard but left of the car was still living. Photo by Frank Pinkley, J. Miller, and Nat Dodge, May 1939; courtesy Organ Pipe Cactus National Monument (photo file 2644).

centuries. "There were many houses there, only a few were mud (adobe), the majority of them were grass houses made of grasses, creosote bushes, and cactus ribs" (Miguel Velasco, in Zepeda, 1985:23). These dome-shaped houses had frames made from ocotillo and cactus ribs (probably mostly from sahuaro) and roofing or shading ("screen") of green creosotebush and grasses (Betty Miller, in Zepeda, 1985:34–36). "Many Indians lived in this area, because there was plenty of water and the Indians farmed. . . . The Indians made a canal and dam to gather the water that seeps from the mountain" (Miguel Velasco, in Bell *et al.*, 1980:60, 61). "They planted corn, wheat, chile, and there was also a pear tree. It was very beautiful. I just visited 'A'al Waippia recently, and it doesn't look anything like it used to be" (Hillman Ortega, in Bell *et al.*, 1980:66). "The old man José Jim Orozco had a beautiful farm there. He planted wheat, squash, and green chile" (Vacila Luna, in Bell *et al.*, 1980:69). Both the Hia C-ed O'odham and Tom Childs, Jr., planted wheat, corn, squash, watermelon, and beans (Molly Jim Orozco, in Bell *et al.*, 1980:87). The Hia C-ed O'odham traveled specifically to Quitobaquito to get fresh fruit and garden vegetables (Zepeda, 1985).

When Orozco's holdings were surveyed sometime around 1950, the survey map (see Fig. 3) showed "4,175 feet of irrigation ditches. . . . 1). double tent frame (Bureau of Animal Industry), 2). . . . shack made of scrap tin, 3). tent frame (Bureau of Animal Industry), 4). corral (36' x 33'), 5). two adobe houses, 6). out house, 7). remains of stone shed (in Mexico), 8). former home of Jim Orozco (made of saguaro ribs—completely fallen apart), 9). 1000 ft. of Bureau of Animal Industry pipe line—two faucets—3/4" pipe,

10). 1880 ft. of ditch north of the pond, 11). 1575 ft. of ditch in cultivated area within U.S.A., 12). 720 ft. of ditch in [the cultivated area] in Mexico (approx. lengths)" (Hoy 1970c:151a). The Bureau of Animal Industry operated the field station for control of hoof and mouth disease from about 1947 to 1952. The "three or four tent-frame houses [were] built among the old adobes on the north side of the pond at Quitobaquito, over the objections of Jim Orozco, who felt his property was being violated" (Hoy, 1970c:151a).

Ironically, the National Park Service, in its attempts at restoration and preservation, has probably brought about the greatest loss of biological and cultural diversity at Quitobaquito (Bennett and Kunzmann, 1989; Nabhan, 1982; Nabhan *et al.*, 1982; Steenbergh, 1969). Until 1961 the pond was shallow (Fig. 8). In late 1961 and early 1962 the pond was dredged, enlarged, and deepened (Figs. 9, 10). The bulldozing and deepening apparently eliminated habitat for certain wetland plants such as *Juncus bufonius* and *Myosurus minimus* and seriously affected the native pupfish. The fig and pomegranate orchards were neglected and many of the trees died or were in precarious condition until the Park Service took action in 1989 to preserve these heirloom varieties. In 1990 the Park Service was honored with an Arizona Regis-Tree award for reversing its policy and conserving the heirloom figs and pomegranates both *in situ* and *ex situ*.

Although Williams Spring had long been fenced to exclude cattle (Fig. 11), and the pond at Quitobaquito was fenced after Orozco was bought out, cattle grazing continued at the Monument until 1978 (Bennett and Kunzmann, 1989). The cessation of the earlier O'odham management practices and elimination of cattle



Figure 6. Quitobaquito, approximately the same view as in Figure 5 but 49 years later; the same cottonwood trees are visible in the earlier photo. The small trees are mesquite, the shrubs in front of the mesquite in the center are *Lycium fremontii*. Saltgrass (*Distichlis spicata*) covers the open areas, and alkali goldenbush (*Isocoma acradema*) is visible in the right foreground. Photo by Willow Bubul-Bennett, 11 December 1988.

grazing in the 1970s and 1980s encouraged dense, nearly pure stands of the large bulrush *Scirpus americanus*, which apparently excluded a number of other, smaller wetland plants. Changes in the vegetation due to elimination of cattle grazing have been documented by Warren and Anderson (1987); some of these changes can be seen in Figures 12–16.

A number of species included in this flora are no longer present. Their local demise seems largely a result of the extensive modifications and changes brought about following the end of the symbiotic relationship between the native American residents and the environment and its biota. Wetland plants no longer present include *Cyperus squarrosus*, *Juncus bufonius*, *Myosurus minimus*, *Najas marina*, *Poa annua*, and *Veronica peregrina*. In addition, there undoubtedly were others for which there are no herbarium records; for example, an early photo shows an emergent plant in shallow water that might be *Sagittaria*. Six species recorded from the Quitobaquito area have not been found in adjacent Sonora: *Centaureum calycosum*, *Eustoma exaltatum*, *Juncus bufonius*, *Myosurus minimus*, *Najas marina*, and *Polygonum viridis*.

From time to time non-riparian species, largely desert ephemerals and frost-sensitive perennials, migrate into the area or become locally extinct. This coming and going of populations at their geographic limits may be related, in part, to the position of Quitobaquito on the boundary of the two major phytogeographic regions described by Shreve. In addition, seeds and propagules of non-native plants disperse from disturbed habitats along the adjacent Mexico Highway 2 and nearby agricultural and urban areas in the Sonoyta Valley (Felger, 1990).

Non-native plants

There are 33 non-native species treated in this flora, which represents about 12% of the total flora (Table 1). However, 11 of these are not established as reproducing populations in the Quitobaquito region. For example, *Nasturtium officinale* (watercress) and *Poa annua* are no longer present, *Bromus tectorum* and *Carthamus tinctorius* (safflower) are not established as reproducing populations, and *Ficus carica* (fig) and *Punica granata* (pomegranate) are non-reproducing horticultural introductions. Relationships of the non-native plants in our flora to those of other adjacent or regional floras are shown in Table 2. In spite of the long history of human habitation and disturbance, the exotic flora is surprisingly small and comparable to that of the entire Organ Pipe Cactus National Monument. Some of the non-natives, including *Brassica tournefortii*, *Pennisetum ciliare*, and probably *Centaurea melitensis*, undoubtedly arrived on the scene since the last O'odham residents left.

Collection History

The list of collectors of herbarium specimens from the Quitobaquito region known to us reads like a Who's Who of southwestern botany (Table 3). The oldest herbarium specimen is of *Jatropha cinerea*, collected by Schott in 1855 (Torrey 1857–1859). The next recorded collection appears to have been made by Edgar A. Mearns (1907) during a survey of the U.S.–Mexico border in 1894.



Figure 7. Quitobaquito, looking southwest; the pond lies beyond the building (U.S. Bureau of Animal Industry station, established at Quitobaquito in 1949). Jim Orozco and his family took over the building as their home after it was abandoned by the government. Tallest tree (behind house) is cottonwood (*Populus fremontii*), other trees are mesquite (*Prosopis velutina*). Castor bean (*Ricinus communis*) is on the right in front of house. The foreground had been scraped as part of a "clean-up effort" by the National Park Service. This site, on the north side of the present-day pond, has now become a mesquite thicket. Photo by James M. Eden, 4 November 1957; courtesy Organ Pipe Cactus National Monument (photo file 334B).

SPECIES ACCOUNTS

The species accounts cover 271 species of vascular plants in 198 genera and 63 families. (Aquatic algae have been treated by Kidd and Wade, 1965.) Other Sonoran Desert floras are compared in Table 4, and a statistical summary of the flora is given in Table 5. This flora is presented alphabetically by family, genus, and species within (1) ferns and fern relatives, (2) dicotyledons, and (3) monocotyledons.

Common names are given first in English (not italicized), Spanish as used locally in Mexico and southern Arizona (italicized), and finally in the indigenous O'odham (not italicized). O'odham terms for plants at Quitobaquito are included in the text because of the centuries-long tradition of O'odham occupancy; this is the first flora to do so. Although O'odham consultants provided some of these terms while visiting the area, other O'odham names are from sources already published (Nabhan *et al.*, 1989). Most of these O'odham plant names are still in common usage. The orthography used here is that of Alvarez and Hale (1970), with the exception that

v is substituted for w. In Hia C-ed O'odham speech, v and w are both used, depending on context. Southern Tohono O'odham dialects emphasize w. Several knowledgeable O'odham interviewed at or near Quitobaquito provided Nabhan information on O'odham uses of these plants.

The annotations include the following information: growth form, local distribution and abundance, flowering phenology, and dominant color of the flowers. Relative abundance is expressed as rare, infrequent, common, or abundant. Distributional information includes the local habitat, or habitats, as described above. Flowering times are expressed by the season or months of probable or known flowering. In many cases flowering times or seasons vary greatly from year to year, and one can expect variation greater than presented here.

We distinguish three kinds of ephemerals (desert annuals that complete their life cycle within a single season): (1) Spring ephemerals grow during the cooler seasons and flower in late fall, winter, and/or spring. Some, such as *Perityle emoryi* and *Plantago insularis*, can



Figure 8. Quitobaquito pond, looking northwest; the pond is unusually full, undoubtedly because of summer rains. A cottonwood (*Populus fremontii*) and several mesquite trees (*Prosopis juliflora*) with desert mistletoe (*Phoradendron californicum*) on left, seepwillow (*Baccharis salicifolia*) in right foreground. Note emergent hydrophytes in shallow water, the probable habitat for several wetland species no longer present, e.g., *Cyperus squarrosus*, *Juncus biflorus*, *Myosurus minimus*, *Poa annua*, and *Veronica peregrina*. Photo by James M. Eden, 24 August 1957; courtesy Organ Pipe Cactus National Monument (photo file W-17A).

TABLE 1. Non-native plants in the Quitobaquito area.

Asteraceae	Poaceae
<i>Carthamus tinctorius</i> ^a	<i>Bromus rubens</i> ^a
<i>Centaurea melitensis</i>	<i>B. tectorum</i>
<i>Conyza coulteri</i> ^a	<i>Chloris virgata</i>
<i>Eclipta prostrata</i>	<i>Cynodon dactylon</i>
<i>Sonchus asper</i>	<i>Dactyloctenium aegyptium</i> ^a
<i>S. oleraceus</i>	<i>Echinochloa colomum</i>
Brassicaceae	<i>Eragrostis ciliaris</i>
<i>Brassica tournefortii</i>	<i>Hordeum murinum</i>
<i>Nasturtium officinale</i>	<i>Pennisetum ciliare</i>
<i>Sisymbrium irio</i>	<i>Poa annua</i> ^a
Chenopodiaceae	<i>Polypogon monspeliensis</i>
<i>Chenopodium murale</i>	<i>P. viridis</i>
<i>Salsola australis</i> ^a	<i>Schismus barbatus</i>
Fabaceae	Portulacaceae
<i>Melilotus indica</i>	<i>Portulaca oleracea</i>
Geraniaceae	Punicaceae
<i>Erodium cicutarium</i>	<i>Punica granatum</i> ^a
Malvaceae	Solanaceae
<i>Malva parvifolia</i>	<i>Calibrachoa parviflora</i>
Moraceae	Tamaricaceae
<i>Ficus carica</i> ^a	<i>Tamarix ramosissima</i>
Nyctaginaceae	
<i>Boerhavia erecta</i> var. <i>erecta</i> ^a	

^aNot established as a reproducing population in the Quitobaquito region.

TABLE 2. Non-native components of selected Arizona and Sonoran Desert floras.

Region	No. of exotic species	Percentage of total flora	Sources
Quitobaquito area			This study
Actually established	22	8.4	
Not established	11	4.1	
Total	33	12.2	
Organ Pipe Cactus National Monument	47	8.5	Bowers, 1980; Felger, 1990
Gran Desierto dunes and Sierra del Rosario	3	2	Felger, 1980
All of northwestern Sonora (including urban and agricultural areas)	74	16	Felger, unpublished
Tumamoc Hill, Tucson	52	15	Bowers and Turner, 1985; Burgess <i>et al.</i> , 1991
Arizona, 1987	ca. 330	10	T. L. Burgess, personal communication, 1990
Sonoran Desert (pre-1964)	145	5.7+	Felger, 1980; Wiggins, 1964



Figure 9 Quitobaquito, looking northeast, while the pond was being deepened. Photo by Warren F. Steenbergh, January 1962, courtesy Organ Pipe Cactus National Monument (photo file W-34C)

begin growing as early as mid-September. (2) Summer ephemerals usually germinate with the first substantial thunderstorms during hot weather. Some may also grow with early fall rains (such as hurricane-fringe storms) while the soil and air temperatures are still high, allowing quick maturity. (3) Non-seasonal ephemerals, e.g., *Aristida adscensionis* and *Muhlenbergia microsperma*, grow with sufficient soil moisture at any time of the year. In addition, some species, e.g., *Machaeranthera coulteri*, may respond as ephemerals (annuals) or perennials, depending upon soil moisture.

Herbarium specimens are cited at the end of each specific or intraspecific entry. This flora is documented by collections housed

at the following herbaria: University of Arizona, Tucson (ARIZ), Arizona State University, Tempe (ASU), Desert Botanical Garden, Phoenix (DFS), Dudley Herbarium, San Francisco (DS), Field Museum, Chicago (F), Pomona College, Claremont (POM), San Diego Natural History Museum, San Diego (SD), University of California, Berkeley (UC), United States National Herbarium, Washington, D.C. (US), and Organ Pipe Cactus National Monument (ORP). Specimens cited below are in ARIZ unless otherwise indicated. When more than one collector is listed on a label, usually only the first collector is listed here. Specimens cited by collection number only are Felger's. Unless otherwise noted, we have seen all



Figure 10. Aerial view of Quitobaquito pond (after the pond was modified, see Fig. 9) and parking lot, looking northwest. This parking lot was discontinued and is now revegetated. Sahuaros (*Carnegiea gigantea*) in foreground. The riparian trees and large shrubs surrounding the pond include cottonwood (*Populus fremontii*), mesquite (*Prosopis juliflora*), and willow (*Salix gooddingii*). Photo by Richard Begeman, April 1968; courtesy Organ Pipe Cactus National Monument (photo file W-46).

specimens cited. Specimens lacking a collector's number are indicated by "x n.," which signifies "sine numero," or "without number."

A preliminary checklist for Quitobaquito was assembled by Adams (1971), and Bowers (1980) prepared the first in-depth treatment of the flora of the entire Monument. For more detailed floristic information see Benson and Darrow (1982), Correll and Correll (1972), Cronquist *et al.* (1977, 1984), Ezeurra *et al.* (1988), Felger (1980), Kearney and Peebles (1960), and Wiggins (1964). Nomenclature used here results from Felger's long-term studies of the regional flora, especially that of northwestern Sonora. Synonyms

are given in a few cases to avoid confusion, such as when the nomenclature differs from standard modern references and in cases of recent taxonomic revisions.

FERNS AND FERN RELATIVES

Adiantaceae Maiden-hair Family

Cheilanthes deserti Mickel California Cloak-Fern
Perennial herb; known at Quitobaquito only from a small popu-

TABLE 3. Quitobaquito botanical collectors.

Arthur Carl Victor Schott, 1855 (Field Museum, see <i>Jatropha cinerea</i>)
Edgar A. Mearns, 1894 (US)
Daniel Trembly MacDougal, 1907 (US)
A. A. Nichol, 1938, 1939 (ARIZ, ORPI)
C. F. Harbison, 1939 (SD, ARIZ)
Lyman Benson, 1940 (ARIZ)
Robert H. Peebles, 1940 (ARIZ)
W. B. McDougall, 1941 (ARIZ, ORPI)
Ora M. Clark, Ajo High School Herbarium, 1944 (ORPI)
Robert A. Darrow, 1945 (ARIZ)
Frank W. Gould, 1945 (ARIZ), with R. A. Darrow and H. S. Haskell
C. L. Fouts, 1949, 1952 (ORPI, ARIZ)
William R. Supermaugh, 1949, 1950 (ORPI, ARIZ)
James Blakley, 1951 (DES)
Kitty F. Parker, 1952 (ARIZ)
A. H. Anderson, 1955 (ARIZ)
Charles T. Mason, Jr., 1958, 1959 (ARIZ, ORPI), with Walter S. Phillips
Richard Hevly, 1960 (ARIZ), with F. Drouet
Marda L. West, 1961, 1962 (ARIZ)
Ray C. Jackson and R. Roy Johnson, 1962 (ARIZ)
Warren F. Steenberg, 1962 (ORPI)
F. V. Ranzoni, 1962, 1965 (ORPI)
Richard Felger, 1963–1992 (ARIZ, ORPI, MEXU, RSA, SD, TEX), some with Kim Clifton, Charles Conner, Kevin Dahl, Mark Dimmitt, Dennis Fenn, Floyd Flores, Lisa Flores, Linda Leigh, Rigoberto López Estudillo, Carol Shumaker, Barbara Straub, Ken Van Houten, Carl Wachtmeister, Peter Warren, and Allan Zimmerman
Ray Jackson, 1964 (ORPI)
Elinor Lehto, 1965, 1972 (ASU)
Donald Pinkava, 1965, 1972 (ARIZ, ASU, ORPI, DES)
Wes F. Niles, 1965, 1966 (ARIZ, ORPI), with E. F. Hasse, and J. A. Reese
Al Hesselberg, 1966 (ARIZ)
W. B. (Burnetta) Adams, 1971 (ORPI)
Schmitt, 1973 (ORPI), with Dakan
Peter Warren, 1975, 1976, 1983, 1987 (ARIZ, ORPI), with Susan Anderson, Paul Fugate, and R. Roy Johnson
Jan Bowers, 1977–1979 (ORPI, ARIZ), some with C. A. Yff
Mike Fay, 1978 (ARIZ)
Wendy Hodgson, 1974, 1978 (DES)
Gary P. Nabhan, 1982 (ARIZ), with Amadeo Rea
Amadeo Rea, 1982 (SD), with Gary P. Nabhan
R. Roy Johnson, 1984 (ARIZ)
Thomas R. Van Devender, 1978, 1984–1986 (ARIZ, ORPI), many with Rebecca Van Devender
Don Beale and Daphne Beale, 1986–1988 (ORPI)
Margaret Galiano, 1986, 1987 (ORPI, ARIZ)
Caroline Wilson, 1988 (ARIZ)
Marc A. Baker, 1988–1992 (ASU), some with Bob Johnson, George Ruffner, and Nichole Trushell.

lation on a north-facing rocky hill northeast of the pond, near the base of the slope and immediately below the zone of the locally more common and widespread *C. standleyi*. The two species occur adjacent to each other but are not intermixed.

92-259 (13 Mar 1992).

Cheilanthes standleyi (Maxon) Mickel Rock Fern

Notholaena standleyi Maxon

Perennial herb; locally common among rocks on north-facing slopes.

Darrow 2421 (17 Mar 1945); 88-135 (29 Mar 1988).

Selaginellaceae Spike-Moss Family

Selaginella eremophila Maxon Desert Spike-Moss

TABLE 4. Sizes of local and regional Sonoran Desert floras.

Region	Number of species	Area (km ²)
Sonoran Desert ^a	ca. 2500	300,000
Pinacate/NW Sonora ^b	560 ca.	10,000
Gran Desierto	145	4,578
Dunes	75	4,500
Sierra del Rosario	105	78
Organ Pipe Cactus National Monument ^c	ca. 550	134
Quitobaquito region	271	3+

^aFrom Wiggins (1964).

^bFelger, unpublished.

^cFelger (1980).

^dBased on Bowers (1980), Pinkava *et al.* (1992), and Felger (unpublished).

TABLE 5. Statistical summary of the flora of the Quitobaquito area.

Number of genera (and species) in the largest families	
Asteraceae 37 (48)	Boraginaceae 5 (11)
Poaceae 25 (35)	Chenopodiaceae 6 (10)
Fabaceae 12 (16)	Solanaceae 6 (10)
Cactaceae 8 (18)	Brassicaceae 8 (8)
Euphorbiaceae 6 (12)	Nyctaginaceae 4 (6)
Number of species in the largest genera	
<i>Opuntia</i> 7 (plus 1 variety)	<i>Boerhavia</i> 3 (plus 1 variety)
<i>Atriplex</i> 5 (plus 1 subspecies)	<i>Bromus</i> 3
<i>Chamaesyce</i> 5	<i>Eriogonum</i> 3
<i>Ambrosia</i> 4	<i>Eriocactus</i> 3
<i>Cryptantha</i> 4	<i>Juncus</i> 3
<i>Lycium</i> 4	<i>Pectocarya</i> 3
<i>Aristida</i> 3	<i>Prosopis</i> 3

Perennial herb; in our area known from only two relatively extensive colonies on steep north-facing granitic slopes. The colonies form dense, nearly continuous mats on thin gravelly soil over rock substrate. Although not known elsewhere in the Monument, this species is expected in similar habitats in nearby granitic ranges. The closely related *S. arizonica* Maxon is widespread in the Ajo Mountains.

88-113 (29 Mar 1988), 90-40 (22 Feb 1990).

DICOTS

Acanthaceae Acanthus Family

Carlwrightia arizonica A. Gray

Suffrutescent perennial; locally common on north-facing slopes of Quitobaquito Hills, often associated with *Jamisia gracilis* and *Viguiera parishii*, and rare in Agua Jita Wash; flowers white, warmer months.

88-266 (6 Apr 1988), 88-427 (14 Sep 1988), 90-480 (24 Oct 1990).

Aizoaceae Aizoon Family

Trianthema portulacastrum L. Horse Purslane; *verdolaga de cochit*; *kaşyañ*

Summer ephemeral; scattered in moist and disturbed areas, mostly in washes, low places in flats, alkaline flats, old fields, and near the springs and pond.

88-431, 88-440 (14 Sep 1988); Van Devender *s.n.* (30 Aug 1978, ARIZ, ORPI); Warren and Anderson 87-109 (24 Oct 1987, ARIZ, ORPI).



Figure 11. Williams Spring, looking north. Cattail (*Typha domingensis*) at spring; organpipe (*Stenocereus thurberi*), sahuaro (*Carnegiea gigantea*), and foothill palo verde (*Cercidium microphyllum*) on hillsides. Note that the spring is fenced and that the wetland plants cover it completely. The surrounding dry land is nearly barren, indicating grazing or other disturbance. Today there is a dense cover of screwbean (*Prosopis pubescens*) and arrow-weed (*Pluchea sericea*). Photo by William Supernaugh, 9 December 1950; courtesy Organ Pipe Cactus National Monument (photo file W-8).

Amaranthaceae Amaranthus Family

Amaranthus limbratus (Torr.) Benth. Fringed Pigweed; *bledo*, *queltillo*; *cuhukkia i:vaki*

Summer ephemeral; common, washes and floodplains; flowers white with green.

88-416 (14 Sep 1988), 90-411 (11 Aug 1990).

Amaranthus palmeri S. Wats. Careless Weed, Pigweed; *quelite de las aguas*; *cuhukkia*

Summer ephemeral; scattered to abundant, mostly in roadsides, disturbed areas, and sandy washes; widespread during favorable years. Seeds and herbage ("desert spinach") edible (Nabhan *et al.*, 1982).

88-441 (14 Sep 1988).

Tidestromia lanuginosa (Nutt.) Standl. *Herba ceniza*

Summer ephemeral; sometimes seasonally common to abundant on flats, washes, old fields, and rocky slopes.

88-408 (14 Sep 1988)

Apiaceae (Umbelliferae) Carrot or Parsley Family

Bowlesia incana Ruiz & Pav.

Winter–spring ephemeral; locally infrequent to abundant beneath shrubs in washes and expected on north-facing rocky slopes; flowers green, February to April. Perhaps native to South America and adventive in North America (Mathias and Constance, 1965).

86-101 (9 Apr 1986).

Daucus pusillus Michx. Wild Carrot

Winter–spring ephemeral; infrequent to common in washes, on rocky, mostly north-facing slopes, and in open areas in old fields; flowers white.

88-137 (29 Mar 1988).

Aristolochiaceae Birthwort Family

Aristolochia watsonii Woot. & Standl. Indian-root; *hierba del indio*



Figure 12. Upper, view southwest across Burro Spring from above the spring source. The thicket on the right is arrow-weed (*Pluchea sericea*), and the arroyo bed is covered with closely cropped Bermuda grass (*Cynodon dactylon*). The spring has been heavily trampled by livestock. Photo by Peter Warren and Susan Anderson, April 1976. Lower, same view as above. The person is standing on the same place as the bare mound at left center in the 1976 photo. The spring has become clogged with 100% cover of bulrush (*Scirpus americanus*), arrow-weed (*Pluchea sericea*), jackass clover (*Wislizenia refracta*), and reedgrass (*Phragmites australis*). The hillside in the background appears relatively unchanged with the exception of an increase in brittlebush (*Uncaria farnosa*). Photo by Peter Warren and Susan Anderson, April 1984.

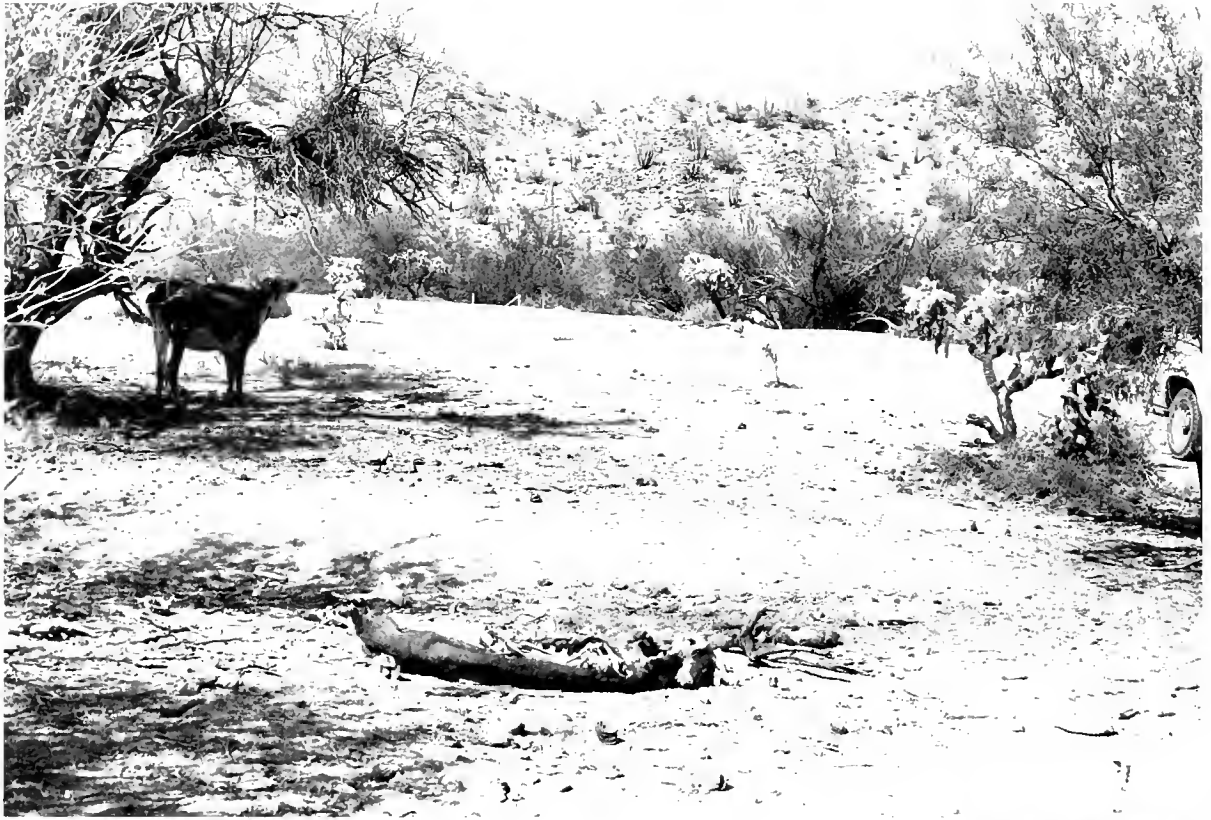


Figure 13. Upper, view north from 20 m southwest of Williams Spring. A fence in the middle background encloses the spring source and excludes livestock from an area of approximately 15 by 15 m. Water was piped from inside the fenced area to a trough (not visible) approximately 20–25 m downstream. The ground is severely trampled, particularly under mesquites, where livestock seek shade. Mesquite (*Prosopis velutina*) and jumping cholla (*Opuntia fulgida*) in foreground. Photo by Peter Warren and Susan Anderson, April 1976. Lower, same view as above. The luxuriant growth in the foreground is mostly seepweed (*Suaeda moquama*), with some *Muhlenbergia coultteri* on the right. The vegetation on the hill in the background has not changed noticeably, and many of the same individual plants are recognizable in both photographs. Photo by Peter Warren and Susan Anderson, April 1984.

A. brevipes Benth. var. *acuminata* S. Wats., not *A. acuminata* Lam.,
A. porphyrophylla H. Pfeifer

Herbaceous perennial from a thickened root, often vining on small shrubs, including *Ambrosia ambrosioides*; locally common along floodplain of Aguajita Wash; flowers purplish maroon, spring and summer–fall. Used as medicine (Philip Salcido).

86-275 (13 Sep 1986), 86-325 (14 Sep 1986), 88-267 (6 Apr 1988).

Asclepiadaceae Milkweed Family

Asclepias subulata Decne. Reedstem Milkweed; *mata candehilla*
Succulent reed-stemmed semi-shrub to 1.1 m, perennial but apparently often short-lived; rare or occasional, or absent in dry years, in sandy soils along roadsides, rarely on flats and floodplains. Apparently not well established in the Quitobaquito area, the plants seem to come and go, and depend on immigration of seeds from adjacent areas for colonization. Flowers cream white, April to October.

Junction of Bates Well Rd. and Puerto Blanco Loop Dr., 1250 ft., rare,
Bowers 1538 (13 Sep 1978, ORPI).

Sarcostemma cynanchoides Decne. subsp. **hartwegii** (Vail) R. Holmgr. Climbing Milkweed; *huirote*; vi'ibam

Perennial vine, aerial parts seasonal; fairly common in washes, sometimes sprawling across ground, mostly growing in trees and shrubs, less common on nearby flats, also in old fields; flowers whitish and purplish maroon, warmer months of year. Milky sap squeezed into hand, put in a container over a fire, and boiled into chewing gum (Philip Salcido, Delores Lewis).

Beale s.n. (28 Mar 1987, ORPI); *Bowers 1390* (25 Jul 1978, ORPI); 88-308 (6 Apr 1988), 88-453 (14 Sep 1988).

Asteraceae (Compositae) Composite or Sunflower Family

Adenophyllum porophylloides (A. Gray) Strother

Dyssodia porophyllodes A. Gray

Perennial subshrub ca. 80 cm tall; rare, localized along bottom of small rocky arroyo in granitic hills immediately west of pond; flowers orange–yellow, apparently at various seasons.

88-447 (14 Sep 1988).

Ambrosia ambrosioides (Cav.) Payne Canyon Ragweed; *chicura*; ñuñui je j

Shrub to 1.5 m; abundant along washes, especially at Aguajita and Quitobaquito; flowers green or yellow, inconspicuous, March to May. Used as medicine for arthritis: make a bed of coals on cleared earth, scrape off coals, put down a layer of this ragweed, then lay the patient over the heated ragweed, and cover the patient with a blanket: it is like a dryland sweat lodge (Philip Salcido, Delores Lewis).

Clark 11476 (25 Mar 1944, ORPI); *Mearns 2736* (27 Jan 1894, US).

Ambrosia confertiflora DC. Slim-leaf Bursage; *estafiate*; mo'ostalk

Perennial herb; scattered to locally abundant along larger washes, roadsides, and in old fields and other disturbed areas; flowers greenish or yellowish, inconspicuous, April to October.

88-271 (6 Apr 1988).

Ambrosia deltoidea (Torr.) Payne Triangle-leaf Bursage; *chamizo forrajero*; taḍsaḍ, va:gita

Shrub to 0.5 m; abundant and widespread on gravelly bajadas, flats, old fields, floodplains of larger washes, and rocky, mostly lower, slopes; flowers green or yellow, inconspicuous, fall to spring. The branches are used as a utility brush (Philip Salcido).

88-425 (14 Sep 1988); *Nichol s.n.* (3 Mar 1939, ORPI).

Ambrosia dumosa (A. Gray) Payne White Bursage; *chamizo*; taḍsaḍ

Shrub to 0.7 m; common to abundant and widespread on rocky slopes and flats including old fields; flowers green or yellow, inconspicuous, fall to spring.

Mearns 2751 (30 Jun 1894, US); *Nichol s.n.* (3 Mar 1939, ORPI); 50 Mile Drive near Quitobaquito Springs, *Ranzon s.n.* (26 Mar 1965, ORPI).

Aster intricatus (A. Gray) S. F. Blake Alkali Aster

Aster carnosus A. Gray, 1881, not Gilbert, 1781, *Bigelovia intricata* A. Gray, 1882; *Leucosyrinx carnosus* (A. Gray) E. L. Greene, 1897; *Machaeranthera carnosus* (A. Gray) Nesom, 1990

Perennial, herbaceous to subshrubby, to 0.3 m tall, sometimes dying back to ground during drought, commonly spreading by rhizomes; localized on alkaline soils at Quitobaquito, near springs, locally common in partially barren flats and along wash west of pond; flowers yellow, May to October.

Not known elsewhere in the Monument; the next nearest populations are in northwestern Sonora at Quitovac and the pozos near Bahía Adair (*Ezcurra et al.*, 1988).

86-219 (23 Jul 1986); *Nabhan and Rea 278* (17 May 1982); *Pinkava 10004* (25 Nov 1972, ARIZ, ASU, ORPI); *Warren and Anderson 87-113* (24 Oct 1987).

Baccharis salicifolia (Ruiz & Pav.) Pers. Seep-Willow; *batamote*; suḡk kuagsig

Shrub, mostly 2–2.5 m tall; locally abundant in permanently damp to wet soil near springs, along streams, and at edge of Quitobaquito pond, also common in old fields, especially dense at Aguajita Spring; flowers whitish, March to December.

5723 (1 Jan 1963), 20602 (9 Mar 1973); *Nichol s.n.* (28 Apr 1939, ARIZ, ORPI); *Van Devender s.n.* (30 Aug 1978, ORPI).

Baccharis sarothroides A. Gray Desert Broom; *romerillo*; suḡk kuagt, suḡk kuagsig

Shrub, ca. 2–2.5 m; infrequent to locally common, near pond at Quitobaquito and especially along ditch from spring to pond, in old fields, and in wash at Aguajita Spring.

Used as roofing for ramadas, to decorate church altars, placed in the manger "to stand for (in place of) hay," and to make Christmas and Easter wreaths—used for wreaths because the nearly leafless stems are green all year (Philip Salcido, Delores Lewis).

87-269 (23 Oct 1987), 87-294 (10 Nov 1987); *Mearns 2775* (5 Feb 1894, US).

Baileya pleniradiata Harv. & Gray Desert Marigold; *tecomblate*

Non-seasonal ephemeral but seen mostly in spring; sandy soil of lower bajadas; flowers yellow.

Quitobaquito, desert flats at border, 7681 (14 Apr 1963).

Bebbia juncea (Benth.) Greene var. *aspera* Greene Sweet-Bush; hauk 'u'us

Shrub to 1.5 m; locally common to abundant, open areas of washes, especially common along floodplain of Aguajita Wash; flowers yellow, at various seasons.

88-272 (6 Apr 1988); *Van Devender s.n.* (30 Aug 1978, ORPI).

***Carthamus tinctorius** L. Safflower; *cartamo*

Annual, responding here more or less as a late-spring ephemeral; rare and not established, in old fields near international border fence at Quitobaquito and near the pond, spreading from occasional temporarily established roadside plants along nearby Mexico Highway 2.

Bowers 1717 (10 May 1979, ARIZ, ORPI).

***Centaurea melitensis** L. Yellow Star-thistle

Spring ephemerals to 1.3 m, seasonally abundant and apparently well-established among pomegranates in mesquite grove in



Figure 14— Aguaqita Spring, looking north. Mesquite (*Prosopis velutina*), catclaw (*Acacia greggii*), and gray thorn (*Ziziphus obtusifolia*) are visible. Note alluvium, water flowing at surface, and absence of wetland plants because of excessive livestock grazing. Photo by William R. Supernauth, 9 December 1950, courtesy Organ Pipe Cactus National Monument (photo file W-6).

old fields below Quitobaquito pond; flowers yellow. Not seen elsewhere in the Monument.

89-251 (19 Jun 1989, ARIZ, ORPI)

Chaenactis carphoclinia A. Gray var. **carphoclinia**—Pebbly Pincushion

Spring ephemeral; seasonally common in washes, especially along the floodplain of Aguaqita Wash, and probably more widespread; flowers white.

Beale *s.n.* (8 Apr 1988, ORPI); 86-113 (9 Apr 1986).

Chaenactis stevioides Hook. & Arn.—Desert Pincushion

Spring ephemeral; scattered on sandy flats, gravelly bajadas, and rocky slopes; flowers white.

Clark *s.n.* (25 Mar 1944, ORPI); Ranzoni *s.n.* (26 Mar 1965, ORPI).

***Coryza coulteri** A. Gray—Horse Weed; *cola de caballo*

Laemcea coulteri (A. Gray) Nesom, *Phytologia* 68:217, 1990

Warm-weather annual in wet soil at Quitobaquito, infrequent and probably not well established; a very common agricultural weed in the nearby Sonoyta Valley; flowers whitish.

87-291 (10 Nov 1987).

Dyssodia, see *Adenophyllum* and *Thymophylla*

Eclipta prostrata (L.) Mart.—False Daisy; *chile de agua*, *hierba del tajo*

E. alba (L.) Hassk., *E. erecta* L.

Non-seasonal annual, flowering during warm weather, but may be dormant in winter; in moist soil near spring and ditches leading from spring to pond; flowers white, March to October.

Hesselberg *s.n.* (16 Oct 1966); Hevly *s.n.* (8 Oct 1960); Lehto 5504 (24 Oct 1965, ASU); Niles 724 (27 Mar 1966, ARIZ, ORPI); Ranzoni *s.n.* (13 Jul 1962, ORPI).

Encelia farinosa A. Gray—Brittlebush; *incienso*, *rama blanca*, *hierba del vaso*, *hierba ceniza*; tohaves

Shrub to about 1 m; abundant, rocky slopes, upper bajadas, old fields, and localized in floodplains of washes; flowering facultatively mostly in spring and fall. Two varieties are present: var. **farinosa** with flower heads all yellow and var. **phenicodonta** (Blake) I. M. Johnston with a brownish-purple disk and yellow rays.



Figure 15. Aguajita Spring, looking north; approximately same view as in Figure 14. Mesquite (*Prosopis velutina*) overhead, seep willow (*Baccharis salicifolia*) in immediate foreground, and cattail (*Typha domingensis*) in center. Note the bedrock exposed by the scouring flood of 20 August 1988. Photo by Peter Bennett, 11 December 1988.

When soft the gum was used as chewing gum; when hard it was used a bow resin for fiddles (Philip Salcido).

Var. *phemicodonta*: 92-265 (13 Mar 1992); var. *farnosa*: 92-266 (13 Mar 1992).

Encelia frutescens A. Gray

Perennial, probably about 1 m tall, known in our area from only a single collection; flowers yellow.

Quitobaquito, along water course, *Clark 11477* (25 Mar 1944, ORPI).

Erigeron lobatus A. Nels. Desert Fleabane

Non-seasonal ephemeral; scattered and infrequent, sometimes common, in washes, old fields, flats, and near pond, apparently requiring at least temporarily moist or wet soil; flowers pale lavender and yellow, spring and summer rainy seasons.

86-182 (10 Apr 1986); *Ransom s.n.* (26 Mar 1965, ORPI).

Eriophyllum lanosum (A. Gray) A. Gray

Diminutive spring ephemeral; common and widespread during years of favorable winter-spring rainfall, especially on open, exposed slopes and ridges, sandy flats, and floodplains; flowers white and yellow.

92-263 (3 Mar 1992).

Filago arizonica A. Gray Arizona Fluffweed

Diminutive spring ephemeral; seasonally common in sandy gravelly soils, mostly along washes and on floodplains, often growing with *F. californica*.

86-186A (10 Apr 1986), 88-274 (6 Apr 1988).

Filago californica Nutt. California Fluffweed

Diminutive winter-spring ephemeral; widespread and often very common in sandy to rocky soils of bajadas, in open areas in washes and old fields, and on rocky slopes, especially north-facing ones.

86-105 (9 Apr 1986), 86-177, 86-186B (10 Apr 1986), 88-128 (29 Mar 1988).

Geraea canescens Torr. & Gray Desert Sunflower, Desert Gold

Winter-spring ephemeral; common on gravelly bajadas and sandy flats; flowers yellow.

Clark 11469 (25 Mar 1944, ORPI); *Ransom s.n.* (26 Mar 1965, ORPI).

Hymenoclea monogyra Torr. & Gray Slender Burro Bush; *jécota*; *ʾivadhōd*

Shrub reaching 2–2.5 m tall, common at Aguajita, along the wash, floodplain, and at the spring; flowering in fall, mostly October. The branches were used as roofing material for ramadas.

87-261 (23 Oct 1987).

Hymenoclea salsola Torr. & Gray Burro Bush; *ʾivadhōd*

Globose shrub ca. 1–1.5 m tall; abundant on floodplain of Aguajita Wash and adjacent sandy flat, also at Quitobaquito in old fields and on sandy flats; March and April.

Beale s.n. (28 Mar 1987, ORPI); 88-302 (6 Apr 1988); *Mearns 2768* (3 Feb 1894, US); *Nichols s.n.* (3 Mar 1939, ORPI); *Ransom s.n.* (26 Mar 1965, ORPI).

Hymenothrix wislizenii A. Gray

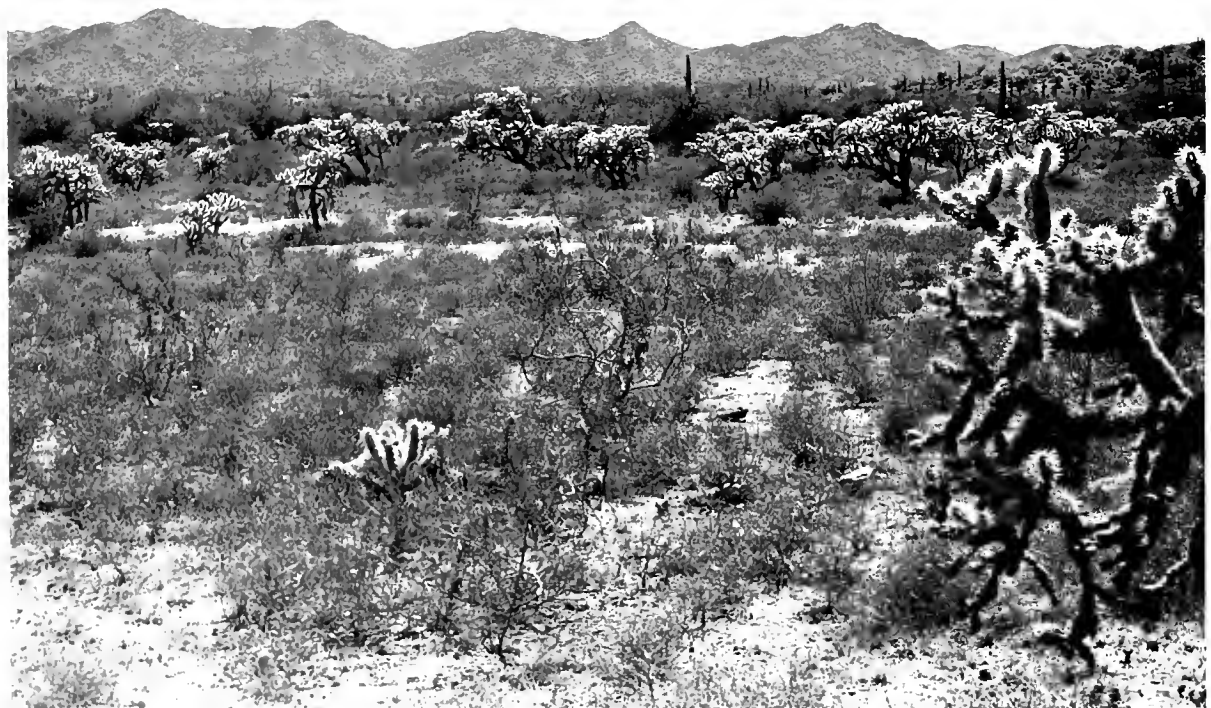
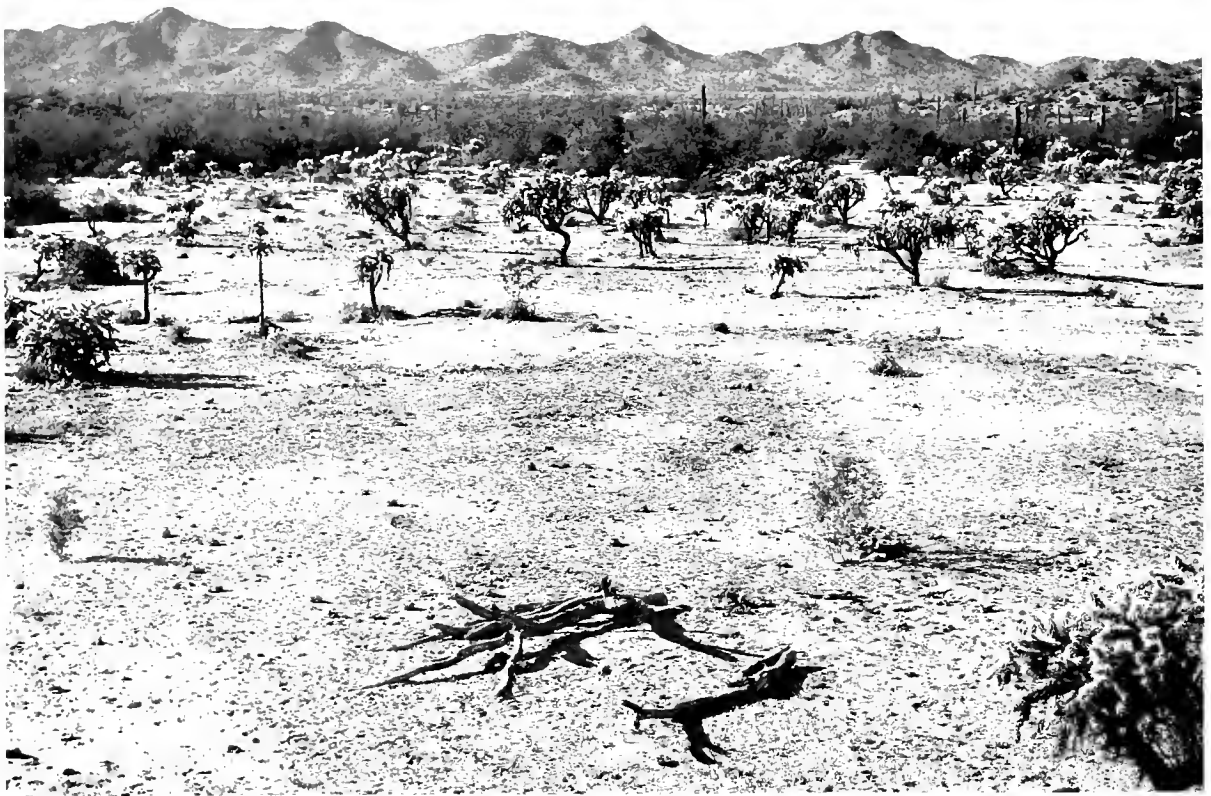


Figure 16—Upper, view to the southwest from the rise 40 m west of the Williams Springs cement trough. Jumping cholla (*Opuntia fulgida*), a few small creosotebushes (*Larrea divaricata*), and saltbushes (*Atriplex polycarpa*) are visible; herbaceous plants are lacking and the ground is heavily trampled. Photo by Peter Warren and Susan Anderson, April 1976. Lower, same view as above. The chollas and saltbushes have increased in size. The greatest change is in the rather dense ground cover of annuals, mostly *Muhlenbergia coultteri* and jackass clover (*Wislizenia refracta*). Photo by Peter Warren and Susan Anderson, April 1984.

Annual to weakly perennial in our region; rare to infrequent in gravelly soils along the wash and floodplain at Aguajita; flowers bright yellow. April and September–December.

Beale s.n. (8 Apr 1988, ORPI); 87-266 (23 Oct 1987), 88-273 (6 Apr 1988).

Iocoma acradenia (Greene) Greene var. **acradenia** Alkali Goldenbush

Haplopappus acradeniis (Greene) S.F. Blake

Small shrub; locally abundant and widespread in sandy and alkaline soil near springs and on alkaline flats, bajadas, old fields, and washes; flowers yellow, mostly late summer and fall, and also in spring.

Adams s.n. (18 Jun 1971, ORPI); *Bowers 903* (16 Oct 1977, ORPI); 5724 (1 Jan 1963), 87-272 (23 Oct 1987); *Lehto 5494* (24 Oct 1965, ASU); *Nichol s.n.* (28 Apr 1939).

Machaeranthera coulteri (Gray) Turner & Horne var. **arida** (Turner & Horne) B. L. Turner

M. arizonica Jackson & Johnson, *M. arida* Turner & Horne

Non-seasonal ephemeral to short-lived perennial herb; common to abundant in washes, flats, alkaline flats, alkaline soils near springs, and roadsides; flowers violet and yellow, flowering almost throughout the year. *Machaeranthera arizonica* was described from Quitobaquito.

Beale s.n. (8 Apr 1988, ORPI); 86-181 (10 Apr 1986), 87-275 (23 Oct 1987); *Harbison s.n.* (27 Nov 1939); low, rocky hillsides and sandy soil around Quitobaquito Springs, $n = 5$, *Jackson and Johnson 3043-2* (31 Mar 1962, isotype of *M. arizonica*); *Nichol s.n.* (28 Apr 1939, ORPI); *Parker 7994* (17 Apr 1952); *Peebles 14560* (5 Mar 1940).

Machaeranthera pinnatifida (Hook.) Shinnery var. **gooddingii** (A. Nels.) Turner & Horne Spiny Goldenweed

Haplopappus spinulosus (Pursh) DC. subsp. *gooddingii* (A. Nels.) Hall

Non-seasonal ephemeral to short-lived herbaceous perennial; common, mostly on rocky slopes and flats; flowers yellow, non-seasonal.

Ranzoni s.n. (26 Mar 1965, ORPI); *Rea 187* (17 May 1982, SD).

Malacothrix glabrata (A. Gray) A. Gray

Spring ephemeral; rare to infrequent, rocky slopes and expected in other desert habitats; flowers cream-colored and yellow.

92-263 (3 Mar 1992).

Monoptilon bellioides (A. Gray) Hall Desert Star

Spring ephemeral; seasonally common, mostly along larger washes and flats, also on rocky slopes and open areas of old field; flowers with rays white, fading to lavender, the disk yellow.

Beale s.n. (8 Apr 1988, ORPI).

Palafoxia arida Turner & Morris var. **arida** Spanish Needles

Spring ephemeral, sometimes growing with summer rains; infrequent, flats, washes, and roadsides; flowers pinkish white.

88-406 (14 Sep 1988).

Pectis papposa Harv. & Gray var. **papposa**

Chinch-weed; *manzanilla del coyote*; ban manzani:ya

Summer ephemeral; often abundant and widespread, flats, washes, and rocky slopes; flowers yellow.

86-290 (13 Sep 1986), 87-304 (10 Nov 1987).

Perityle emoryi Torr. Desert Rock-Daisy

Cool-weather ephemeral; widespread and common to abundant, rocky slopes, flats, old fields, and washes; flowers white and yellow, November to April. One of the most widespread and common cool-season ephemerals in the region.

Beale s.n. (8 Apr 1988, ORPI).

Pluchea odorata (L.) Cass. Alkali Camphor-weed

P. purpurascens (Sw.) DC.; *P. camphorata* of various authors, not *P. camphorata* (L.) DC.

Annual or perhaps perennial herb, 1–1.5 m; abundant in wet or moist soil on banks of Quitobaquito pond, at Williams and other springs, and along ditches with flowing water; flowers pinkish to lavender, September and October.

Anderson 4 (24 Nov 1955); *Bowers 902* (16 Oct 1977); 86-204 (23 Jul 1986); *Hevly s.n.* (8 Oct 1960); *Lehto 5502* (24 Oct 1965, ASU); *Van Devender s.n.* (30 Aug 1978); *West 98* (30 Sep 1961); *Wilson 195* (18 Sep 1988).

Pluchea sericea (Nutt.) Cov. Arrow-weed; *cachantilla*; komagi 'u'us, 'u'us kokomak

Tessaria sericea (Nutt.) Shinnery

Shrub to 2.5 m tall; locally abundant in moist soil near Burro, Quitobaquito, and Williams springs and Quitobaquito pond, infrequent colonies in old fields and on alkaline flats; flowers pinkish, flowering at least March to June. Used for round-house construction; stems of right thickness made into arrows for hunting bighorn sheep (Philip Salcido).

Bowers 1315 (4 May 1978); *Mason 1672* (10 Apr 1958); *Nichol s.n.* (28 Apr 1939); *Ranzoni s.n.* (13 Jul 1962, ORPI); *Van Devender s.n.* (30 Aug 1978, ORPI).

Porophyllum gracile Benth. *Herba del venado*

Suffrutescent perennial to 0.5 m tall; infrequent on rocky slopes and along gravelly bajadas and sometimes along larger washes; flowers pinkish white, non-seasonal.

Beale s.n. (8 Apr 1988, ORPI); 88-118 (29 Mar 1988), 88-463 (14 Sep 1988).

Prenanthes exigua (A. Gray) Rydb.

Lygodesma exigua A. Gray

Winter–spring ephemeral; infrequent to common, rocky slopes, mostly north-facing; flowers white, inconspicuous.

Gould 2990 (18 Mar 1945).

Rafinesquia neomexicana A. Gray Desert Chicory

Winter–spring ephemeral; infrequent to common during years of favorable winter–spring rains, floodplain of Aguajita Wash, rocky and especially north-facing slopes, and sometimes on flats and in old fields; flowers white. Often growing through *Ambrosia deltoidea* or other small shrubs.

92-101 (3 Mar 1992); 244 (13 Mar 1992).

Senecio mohavensis A. Gray Mohave Groundsel

Spring ephemeral; rocky north-facing slopes, often beneath shrubs; flowers yellow.

88-114 (29 Mar 1988); *Gould 2995* (18 Mar 1945).

***Sonchus asper** (L.) Garsult. Spiny Sow-thistle; *chinita*; hoi'idkam 'i:vaki

Annual or winter–spring ephemeral, often reaching 1.8 m tall in wet places; infrequent in washes, common in wet soil near pond and springs, less common in old fields and on sandy flats; Aguajita and Quitobaquito; flowers yellow, February to August; an Old World weed.

Adams s.n. (18 Jun 1971, ORPI); *Bowers 1608* (30 Mar 1979, ORPI); 7661 (14 Apr 1963), 86-100A (9 Apr 1986).

***Sonchus oleraceus** L. Common Sow-thistle; *chinita*; hauwi hehewo

Cool-weather ephemeral; infrequent, growing with *S. asper*; flowers yellow, March to September; an Old World weed.

7654 (14 Apr 1963), 86-100B (9 Apr 1986).

Stephanomeria pauciflora (Torr.) Nutt. Desert Straw

Perennial subshrub; common to abundant, mostly in washes, floodplains, and on sandy flats; flowers pale lavender-pink, non-seasonal.

86-293 (13 Sep 1986); *Rea* 187 (17 May 1982, SD).

Stylocline micropoides A. Gray Desert Nest-straw

Diminutive spring ephemeral; widespread and common, rocky slopes, flats, open areas of old fields, and washes.

86-116 (9 Apr 1986), 86-184 (10 Apr 1986), 88-115 (29 Mar 1988).

Thymophylla concinna (A. Gray) Strother Dogweed; *manzanilla del coyote*; ban manzani:ya

Dyssodia concinna (A. Gray) Robins.

Winter–spring ephemeral; common, sandy or gravelly soils of washes, flats, and rocky slopes; flowers white and yellow. The plant was boiled and the tea was drunk as a medicine for colds and by women right after childbirth (Philip Salcido, Delores Lewis, *in* Zepeda, 1985:54).

7662 (14 Apr 1963), 88-119 (29 Mar 1988); *Gould* 2989 (18 Mar 1945).

Trichoptilium incisum (A. Gray) A. Gray Yellow-head

Spring ephemeral, occasionally surviving as a long-lived annual; infrequent to common in favorable years, rocky slopes; flowers yellow.

Trixis californica Kell. var. *californica*

Small shrub; infrequent to common, mostly on rocky slopes, less often on upper bajadas and elsewhere; flowers yellow, non-seasonal.

MacDougal 16 (11 Nov 1907, US, not seen by us); *Nichol* s.n. (28 Apr 1939, ORPI).

Viguiera parishii Greene

V. deltoidea A. Gray var. *parishii* (Greene) Vasey & Rose

Small shrub or subshrub; localized on north-facing slopes in the Quitobaquito Hills; flowers yellow, apparently non-seasonal, at least March–May and October.

90-479 (24 Oct 1990).

Boraginaceae Borage Family**Amsinckia intermedia** Fisch. & Mey. var. *echinata* (A. Gray) Wigg. Devil's Lettuce, Fiddleneck; cetkom

Winter–spring ephemeral to 1 m tall; seasonally common in larger washes, floodplains, and sandy flats; flowers orange-yellow.

Beale s.n. (8 Apr 1988, ORPI); 88-305 (6 Apr 1988), 86-103 (9 Apr 1986).

Amsinckia tessellata A. Gray Fiddleneck; cetkom

Winter–spring ephemeral; apparently uncommon, larger washes and sandy flats; flowers orange-yellow.

Beale s.n. (8 Apr 1988, ORPI); 92-248 (13 Mar 1992).

Cryptantha angustifolia (Torr.) Greene Desert Cryptantha

Winter–spring ephemeral; often abundant and widespread in washes, flats, old fields, bajadas, and expected on rocky slopes, especially common in Aguajita Wash; flowers white.

92-139 (3 Mar 1992); 92-251 (13 Mar 1992).

Cryptantha barbiger (A. Gray) Greene

Winter–spring ephemeral; seasonally common and widespread on rocky slopes, gravelly flats, washes and old fields; flowers white. The plants are sometimes sterile with abnormal growth apparently caused by an infestation of mites.

Beale s.n. (8 Apr 1988, ORPI, ARIZ); 88-121 (29 Mar 1988), 88-268 (6 Apr 1988).

Cryptantha maritima Greene

Winter–spring ephemeral; seasonally infrequent to common, in washes, floodplains, and often scattered on rocky slopes, expected elsewhere; flowers white, February to April. As with *C. barbiger*, the plants are sometimes deformed, apparently by mite infestations.

Beale s.n. (8 Apr 1988, ORPI); 88-269 (6 Apr 1988).

Cryptantha pterocarya (Torr.) Greene var. *cycloptera* (Greene) Macbr. Wing-nut Cryptantha

Winter–spring ephemeral; locally common on rocky slopes, often with north exposures, and in larger washes; flowers white.

88-122 (29 Mar 1988), 88-304 (6 Apr 1988).

Heliotropium curassavicum L. var. *oculatum* (Heller) I. M. Johnston Alkali Heliotrope; *hierba del sapo*; barbād 'i:vaki

Semi-succulent perennial herb, occasionally a facultative annual; occasional to locally common in moist soil of alkaline flats and washes, sometimes common near springs; flower white with yellow center. Used as medicine for coughs and sore throat (Nabhan *et al.*, 1982).

Beale s.n. (9 Mar 1986, ORPI); *Clark* s.n. (25 Mar 1944, ORPI); 86-175 (10 Apr 1986), 87-298 (10 Nov 1987), 88-276 (6 Apr 1988); *Nichol* s.n. (28 Apr 1939, ORPI); *Van Devender* s.n. (30 Aug 1978, ORPI).

Lappula redowskii (Hornem.) Greene Stickseed

Spring ephemeral; common and widespread, often among mesquites, mostly in old fields, washes, adjacent flats, and disturbed areas such as Quitobaquito parking area; flowers pale blue.

86-178 (10 Apr 1986); *Parker* 7990, 7990A (17 Apr 1952).

Pectocarya heterocarpa (I. M. Johnston) I. M. Johnston Mixed-nut Comb-bur

Spring ephemeral; common in sandy gravelly soils of washes, flats, and old fields; flowers white.

Beale s.n. (8 Apr 1988, ORPI); 86-183 (10 Apr 1986), 88-270 (6 Apr 1988).

Pectocarya platycarpa Munz & Johnston Broad-winged Comb-bur

Spring ephemeral; locally common on rocky slopes, flats, washes, and probably elsewhere; flowers white.

Beale s.n. (8 Apr 1988, ORPI); 20597 (9 Mar 1973), 88-127 (29 Mar 1988).

Pectocarya recurvata I. M. Johnston Arched Comb-bur

Spring ephemeral; widespread and common on upper bajadas and probably elsewhere.

88-126 (29 Mar 1988).

Brassicaceae (Cruciferae) Mustard Family***Brassica tournefortii** Gouan Wild Turnip; mo:stas

Winter–spring ephemeral; seasonally infrequent to common in washes, flats, old fields, and less common on rocky slopes, also along roadsides and at Quitobaquito parking lot; flowers yellow; Old World weed present in Arizona since 1950.

Bowers 1083 (28 Feb 1978); 88-136 (29 Mar 1988).

Caulanthus lasiophyllus (Hook. & Arn.) Payson

Thelypodium lasiophyllus (Hook. & Arn.) Greene

Winter–spring ephemeral; infrequent to common, rocky slopes, flats, and washes; flowers whitish.

Bowers 1045 (11 Feb 1978); 7673 (14 Apr 1963), 7658A (14 Apr 1963), 88-133 (29 Mar 1988).

Descurainia pinnata (Walt.) Britton Tansy Mustard; šu'uvad

Spring ephemeral; widespread and common in washes and on flats and rocky slopes; flowers white. Seeds used as food and eye

medicine (Delores Lewis) or put in water and drunk for stomach trouble (Philip Salcido).

92-133 (3 Mar 1992).

Draba cuneifolia Nutt. var **integrifolia** S. Wats. Wedge-leaf Draba
Winter–spring ephemeral; seasonally common, rocky slopes, flats, washes, and old fields; flowers white, inconspicuous.

Nichol s.n. (10 Mar 1939, ARIZ, ORPI); 88-123A (29 Mar 1988).

Lepidium lasiocarpum Nutt. Sand Peppergrass

Spring ephemeral; common and widespread, mostly in washes and flats, and less common on rocky slopes; flowers white, inconspicuous.

Beale s.n. (8 Apr 1988, ORPI); 7679 (14 Apr 1963), 20598 (9 Mar 1973).

Lesquerella tenella A. Nels.

Winter–spring ephemeral; fairly common during years of favorable winter–spring rains, floodplain and margins of Aguajita Wash and sporadically elsewhere in desert habitats with non-alkaline soils; flowers bright yellow. Often growing through small shrubs such as *Ambrosia deltoidea*.

92-109 (3 Mar 1992); 92-245 (13 Mar 1992).

Lyrocarpa coulteri Hook. & Harv. var. **coulteri** Lyre-pod; ban cenasañi

Perennial herb; often under trees and shrubs in washes and on gravelly bajadas; flowers yellowish to brownish, flowering at any time of year with sufficient soil moisture. There is a tale about *ban cenasañi* being the coyote's razor for shaving—but it didn't work (Chico Suni).

86-284 (13 Sep 1986), 88-277 (6 Apr 1988).

***Nasturtium officinale** L. Watercress; *berro*

Rorripa nasturtium-aquaticum (L.) Schinz & Thell.

Perennial herb; probably emergent from shallow water. Bobby Gray (*in Hoy*, 1970) reported that in the late nineteenth century watercress grew at Williams Spring.

***Sisymbrium irio** L. London Rocket; *pamita*; ban cinşañi

Winter–spring ephemeral; common to locally abundant in washes, old fields, near Quitobaquito pond, roadsides, and other disturbed habitats; flowers yellow.

7673 (14 Apr 1963), 88-278 (6 Apr 1988).

Cactaceae Cactus Family

Carnegiea gigantea (Engelm.) Britt. & Rose Sahuaro; *sahuaro*; ha:şañ

Cereus giganteus Engelm.

Columnar cactus to 15 m tall; common on rocky slopes and gravelly bajadas; flowers white, late April and May. In the late 1980s young plants, 50–60 cm tall, were common in the old fields, mostly growing through fallen brush and spiny twigs of leguminous shrubs.

Fruits eaten fresh or made into wine for ceremonial use; stem ribs used for construction material (Chico Suni; Bell *et al.*, 1980:58; Nabhan *et al.*, 1982). Lumholtz (1912:331) mentioned that Hia Ced O'odham "used to come as far as Quitobaquito and Santo Domingo to gather mezquite beans . . . and eat sahuaro and pitahaya." (Santo Domingo was an hacienda nearby along the Río Sonoyta.)

Echinocereus engelmannii (Parry ex Engelm.) Rümpler var. **acicularis** L. Bens. Hedgehog Cactus; 'isvig

Stem succulent to about 40 cm tall; scattered on rocky slopes,

flats, and open areas in old fields; rare in floodplain of Aguajita Wash; flowers purplish, February to April, the fruit ripening from late May to mid-June. In the late 1980s juvenile plants were fairly common in places in the western part of the old fields, where the plants were colonizing along with other cacti.

Quitobaquito, sandy gravelly bajada, 88-112 (29 Mar 1988); rocky slope 0.5 km N of Aguajita Spring, 88-321 (6 Apr 1988); near Quitobaquito, *Peebles* 14555 (5 Mar 1940).

Echinocereus nicholii (L. Bens.) Parfitt Golden Hedgehog Cactus

Stem succulent to 80 cm tall; common mostly on north-facing steep granitic slopes of the Quitobaquito Hills, mostly above ca. 380 m; flowers pinkish, March. Readily distinguished by its monochromatic yellow spines.

90-39 (22 Feb 1990).

Ferocactus cylindraceus (Engelm.) Orcutt Mountain Barrel Cactus; *biznaga*; *jiavuli*

F. acanthodes (Lem.) Britt. & Rose

Barrel cactus, reaching 0.8–1.5 m; fairly common on rocky granitic slopes of the Quitobaquito Hills along the northern margin of our region, on various slope exposures but most common on west- and south-facing slopes; juvenile plants common. Absent to very rare on the smaller, lower hills. Flowers yellow, warmer times of year. Barrel cacti, probably this species or *F. wislizeni*, were roasted in a pit, and the "meat" was sliced and eaten (Zepeda, 1985:47).

88-456 (14 Sep 1988), 90-41 (22 Feb 1990).

Ferocactus emoryi (Engelm.) Orcutt Barrel Cactus; *biznaga*; *jiavuli*

F. covillei Britt. & Rose

Barrel cactus, often 0.6–1 m tall; scattered on rocky slopes and rare on lower bajadas and in open, western part of old fields; infrequent to common on upper floodplain of Aguajita Wash and sandy flats from Aguajita eastward; flowers red, mostly August to mid-September. Larger plants, ca. 65 cm tall or more, are often undermined by erosion and eventually topple over, apparently the most common means of their demise in our region.

Nichol s.n. (28 Apr 1939, ORPI).

Ferocactus wislizeni (Engelm.) Britt. & Rose var. **wislizeni** Desert Barrel Cactus; *biznaga*; *jiavuli*

Barrel cactus, to 70 cm tall; rare and widely scattered on sandy gravelly soils of lower alluvial flats, lower bajadas, dissected pediments, and old fields. Locally infrequent just west of the first low hills west of the pond. Flowers orange-red to reddish, August and September. Most of the plants in our area are less than 45 cm tall. The plants often grow along the margin of small washes, and erosion of the soil causes many of them to topple over and ultimately perish.

88-306 (6 Apr 1988), 88-444 (14 Sep 1988).

Lophocereus schottii (Engelm.) Britt. & Rose var. **schottii** Senita; *simita*, *sina*; ce:mí

Cereus schottii Engelm.

Columnar cactus; once rare, now probably extirpated; flowers whitish to pinkish, flowering and fruiting mostly through the hotter months. In 1951 the species was recorded as rare just east of Quitobaquito. In the late 1980s we were unable to locate these plants. The senita is fairly common in nearby areas of the Monument and in adjacent Sonora. It is a frost-sensitive species, and its local demise may have been due to winter freezing (see Felger and Lowe, 1967; Nobel, 1982).

1 mi. E of Quitobaquito, S slope, gravelly silt, few, *Blakley* 323 (2 Jun 1951, DES).

Mammillaria grahamii Engelm. Fishhook Cactus; *cabeza de viejo*; ha:ban ha-'isvig, ban cekida

M. microcarpa (Engelm.) Britt. & Rose

Small stem-succulent, sometimes reaching 20–30 cm tall; scattered on rocky slopes, bajadas, and open areas of old fields, infrequent to common; flowers pink, flowering sporadically in pulses following rainfall from April to September.

86-173 (10 Apr 1986), 88-129 (29 Mar 1988).

Mammillaria thornberi Orcutt Fishhook Cactus; *cabeza de viejo*; ban ha-mauppa

M. fasciculata of authors, not Engelm.

Small stem-succulent to 20 cm tall; fairly common although localized at Quitobaquito on lower bajada including partly alkaline soils and old fields, often under *Ambrosia deltoidea* and *Atriplex polycarpa*; flowers pinkish, at least in August. Locally growing with *M. grahamii*.

86-174 (10 Apr 1986).

Opuntia acanthocarpa Engelm. & Bigel. Buckhorn Cholla; *cholla*; ciolim

Stem-succulent to ca. 1.5 m tall. Widespread and common on rocky slopes, on flats, and in open areas of old fields; infrequent or rare in floodplain of Aguajita Wash; flowers (inner tepals) orange-brown to dull golden yellow, the filaments reddish, April and May. Many of the plants in the Quitobaquito–Sonoyta Region are intermediate in spination between var. *coloradensis* L. Bens. and var. *major* (Engelm. & Bigel.) L. Bens.

88-323 (6 Apr 1988).

Opuntia arbuscula Engelm. Pencil Cholla; *siviri*; vipinoi

Shrub with woody trunk, to ca. 2 m tall; in our area known only from two plants; flowers yellowish, April and early May.

Rocky slope 0.5 km N of Aguajita Spring, 88-321 (6 Apr 1988).

Opuntia bigelovii Engelm. Teddybear Cholla; *cholla güera*; haḡsadkam

Stem-succulent reaching 1.5 m tall; abundant on rocky slopes; flowers silvery whitish-green to whitish, May and June. Anthers often without pollen.

Opuntia engelmannii Salm-Dyck var. *engelmannii* Desert Prickly-pear; *nopal*; naw, i:ḡhai

O. phaeacantha Engelm. var. *discata* (Griff.) Bens. & Walk.

Prickly pear, reaching 1–1.8 m tall, the larger colonies ca. 4 m across; infrequent, scattered on lower bajadas, open areas of old fields, and rocky slopes (e.g., northeast of pond); flowers yellow, April and May. Fruit eaten by people, the pads eaten by javelinás (Chico Suni).

Quitobaquito, old fields, 90-430 (11 Aug 1990).

Opuntia engelmannii var. *flavispina* (L. Bens.) Pinkava & Parfitt Similar to var. *engelmannii* but differing in having bright yellow and fewer spines. Growing intermixed with var. *engelmannii* in the old fields and sandy saline flats to the east of the pond.

Quitobaquito; *Baker* 8788 (19 Mar 1992, ASU, ORPL, *n* = 33), springs, *Baker* 7625 (17 Aug 1988, ASU); old fields, 90-431 (11 Aug 1990).

Opuntia fulgida Engelm. var. *fulgida* Jumping Cholla; *cholla*; hanam, ha:namí

Stem-succulent, the largest ones 2–3(–4) m tall, occasionally developing a trunk ca. 30 cm in diameter; widespread and common

on flats, along margins of large washes, and in old fields (recolonizing the more open, western part), less common on rocky slopes, and infrequent on alkaline flats; flowers pinkish purple, June to September.

87-264 (23 Oct 1987), 88-130 (29 Mar 1988).

Opuntia kunzei Rose Desert Club Cholla

Opuntia stanlyi Engelm. var. *kunzei* (Rose) L. Bens.

Thick-stemmed cholla, forming sprawling colonies often reaching 1–3.5 m wide and 30–57 cm tall; common on sandy flats from the vicinity of Aguajita east and also west from the southwestern portion of our region; flowers yellow, May. (Concerning Nichol's 1939 record, see Doubtful and Excluded Plants, below.)

Baker 7613 (13 May 1988, ASU, *n* = 22); *Benson* 9937 (5 Mar 1940, POM); 87-265 (23 Oct 1987), 88-324 (6 Apr 1988), 90-37 (22 Feb 1990); *Harbison s.n.* (27 Nov 1939), *s.n.* (28 Nov 1939); *Mearns* 2735 (27 Jan 1894, DS); *Peebles* 14561 (5 Mar 1940).

Opuntia leptocaulis DC. Desert Christmas Cholla; *tasajillo*; 'aci' vipinoi, ce'ecem vipinoi

Slender-stemmed cholla to 1 m tall; infrequent, scattered in sandy soil along washes and on rocky slopes; flowers whitish, May and June. Fruits eaten fresh (Chico Suni).

88-470 (14 Sep 1988).

Peniocereus greggii (Engelm.) Britt. & Rose var. *transmontanus* (Engelm.) Backeb. Desert Night-blooming Cereus; *reina de la noche*; ho'ok wa'o

Cereus greggii Engelm. var. *transmontanus* Engelm.

Slender-stemmed cactus with a large tuberous root; six plants known from the vicinity of Aguajita Wash, the largest with several stems, reaching 1.5 m tall, growing beneath *Capparis atamisquea*. Flowers white, probably June or July. The tuberous root used medicinally for diabetes and respiratory ailments; the fruits eaten fresh.

90-574 (3 Dec 1990).

Stenocereus thurberi (Engelm.) Buxb. Organpipe; *pitaya*, *pitaya dulce*; cucuvis

Cereus thurberi Engelm., *Lemaireocereus thurberi* (Engelm.) Britt. & Rose

Columnar cactus to 7 m tall; common on rocky slopes, gravelly bajadas, sandy flats, and open areas of old fields, where small plants were common in the late 1980s; flowers white to pinkish, mostly May to July, some flowering through August, fruiting mostly in July and early August and sometimes again in September. Plants of all age classes present.

Lumholtz (1912:331) mentioned that the Hia C-ed O'odham "used to come as far as Quitovaquito and Santo Domingo to gather mezquite beans . . . and eat sahuaro and pitahaya." The fruit continues to be a major wild crop for Sonoran O'odham at Quitovac. In July and August 1991, they harvested 1200 kg of fruit for making jam, drying, and eating fresh, and they commonly use the stem ribs (woody vascular bundles) in house and fence construction.

Hodgson 14 (14 Sep 1974, ASU).

Campanulaceae Bellflower Family

Nemacladus glanduliferus Jeps. var. *orientalis* McVaugh Threadstem

Spring ephemeral; seasonally common in Aguajita Wash and probably elsewhere in our area; flowers white and maroon.

92-126, (3 Mar 1992); El Papalote, 86-119 (9 Apr 1986).

Capparaceae Caper Family

Capparis atamisquea Kuntze*Atamisquea emarginata* Miers

Shrubs to 2 m tall common on sandy gravelly flats immediately east of Aguajita Spring, rare to ca. 6 km north of Aguajita Spring; shrubs or small trees to 4 m tall with several trunks, each up to 15 cm diameter near base, as well as small plants infrequent in dense mesquite thicket near Aguajita Spring in the immediate vicinity of the international fence on both sides of the border; two large shrubs in dense brush in old fields south of Quitobaquito pond; one large shrub among mesquite at north end of pond. Flowers cream-white, flowering profusely in May and June; visited by the honeybee, native bees, the large orange-winged tarantula hawk (*Hemipepsis ustulata*), and other insects. Fruiting in August, the seeds embedded in a fleshy, red aril.

This species is not known elsewhere in the United States, although it is common along old floodplains of the nearby Río Sonoyta and southward in western Sonora, disjunctly in Argentina. It is the only food for larvae of the pierid butterfly *Ascia howarthi* (Bailowitz, 1988).

Aguajita Spring: *Bowers 1335* (13 Jun 1978, ARIZ, ORPI); 87-267 (23 Oct 1987), 89-232 (19 Jun 1989) 0.4 mi E of Quitobaquito turnout, *Mason 1679* (29 May 1959, ARIZ, ORPI). 1 mi. NE of Quitobaquito Springs, *Engard 784* (23 Aug 1975, DES), 4 mi. N of Quitobaquito Springs on connecting road between Bates Well Rd. and Puerto Blanco Loop Dr., *Atriplex, Prosopis, Lycium, Olneya* association, one only, shrub 3+ m wide and 2 m tall, dense, *Engard 543* (7 Jun 1975, DES). 350 m E of Aguajita Wash: *Atriplex* flat, *Baker 7612* (13 May 1988, ASU), *Baker 7622* (17 Aug 1988, ASU). Quitobaquito: old fields, two shrubs, climbing into mesquite to ca. 3.6 and 4 m in height, *88-310* (6 Apr 1988); *Harbison s.n.* (27 Nov 1939). Sonora, 1.6 km SSW of Quitobaquito, old floodplain of Río Sonoyta, *88-12* (10 Feb 1989).

Wislizenia refracta Engelm. subsp. **refracta** Jackass-clover

Annual herbs or nonseasonal ephemerals, sometimes persisting as short-lived perennials; scattered to locally common in sandy soil, often in washes and along roadsides; Aguajita Wash and at Quitobaquito; flowers yellow, at almost any time of year, often flowering during dry seasons when few other plants are blooming. Three specimens (*Benson 9935*, *Gould 2988*, and *Pebbles 14558*) are unusual in having some fruits with three or four instead of the usual two carpels.

Benson 9935 (5 Mar 1940); *Bowers 900* (16 Oct 1977, ORPI); *Fay 742* (18 Feb 1978); *Gould 2988* (18 Mar 1945); *Harbison s.n.* (27 Nov 1939, SD); *McDougall 33* (25 Mar 1941, ARIZ, ORPI); *Pebbles 14558* (5 Mar 1940); *Warren & Fugate s.n.* (31 Jan 1976).

Caryophyllaceae Pink Family

Achyronychia cooperi A. Gray Frost Mat

Winter-spring ephemeral; infrequent to locally fairly common, sandy-gravelly soil of Aguajita Wash and its floodplain, infrequent elsewhere on sandy soils; flowers white, minute.

Chenopodiaceae Goosefoot Family

Atriplex elegans (Moq.) D. Dietr. Wheel-Scale Orach; *chamizo cenizo*; 'onk 'i:vaki

Warm-weather ephemeral, spring to fall; scattered along roadsides and in disturbed areas such as the partially barren flats west of the pond and the parking lot near Quitobaquito, often in alkaline soils; flowers green, inconspicuous, at various seasons including spring, summer, and early fall. Two infraspecific taxa occur in our area. Are they worthy of taxonomic distinction?

Subsp. **elegans**: *86-271* (13 Sep 1986), *88-449* (14 Sep 1988). Subsp. **fasciculata** (S. Wats.) Hall & Clements: *Bowers 1331* (13 Jun 1978, ORPI);

Nichol s.n. (28 Apr 1939).

Atriplex lentiformis (Torr.) S. Wats. subsp. **lentiformis** Quail Bush, Lens-Scale, *chamizo*

Shrub to 2 m tall; scattered to abundant on moist or dry saline soil in flats at Quitobaquito; flowers greenish, spring.

Nichol s.n. (28 Apr 1939, ORPI).

Atriplex linearis S. Wats. Narrow-leaf Saltbush

A. canescens (Pursh) Nutt. var. *linearis* Hall & Clem.

Shrub to ca. 1 m; common to abundant on alkaline flats and semi-alkaline soils of lower bajadas, locally on upper bajadas and in old fields; flowers green, inconspicuous, various seasons.

88-450 (14 Sep 1988); *Nichol s.n.* (10 Mar 1939, ORPI).

Atriplex pacifica A. Nels. Pacific Orach

Winter-spring and early summer ephemeral; infrequent to sometimes locally common on alkaline flats, open areas of old fields, and open disturbed places near Quitobaquito pond; flowers greenish, inconspicuous. In Arizona known only from Organ Pipe Cactus National Monument and Cabeza Prieta Game Refuge.

Puerto Blanco Drive, 7-10 mi. W of Ariz. Hwy. 85, *Bowers 1721* (10 May 1979); 8.6 mi. W of Ariz. Hwy. 85 on road to Quitobaquito, *Van Devender 85-9* (2 Mar 1985).

Atriplex polycarpa (Torr.) S. Wats. Desert Saltbush; *chamizo, cenizo*; 'onk 'i:vaki

Shrub 1-1.5 m; scattered to abundant, washes, alkaline flats, bajadas, and rocky slopes; flowers greenish, inconspicuous, various seasons.

Adams s.n. (18 Jun 1971, ORPI); *Bowers 905* (16 Oct 1977, ORPI); 87-268 (23 Oct 1987); *Nichol s.n.* (10 Mar 1938, ORPI).

***Chenopodium murale** L. Net-leaf Goosefoot; *chual, choal*; 'onk 'i:vaki

Ephemeral, mostly winter-spring; seasonally common, mostly along washes in wet soil and disturbed areas near Quitobaquito pond and parking lot and beneath the cottonwoods, in old fields, and on alkaline flats; flowers greenish, inconspicuous. Sometimes persisting through the summer in shade beneath the cottonwoods at Quitobaquito. Herbage washed and cooked as greens (Nabhan *et al.*, 1982).

86-208 (23 Jul 1986), *86-269* (13 Sep 1986); *Nichol s.n.* (28 Apr 1939, ORPI).

Monolepis nuttalliana (Schult.) Greene Poverty Weed; *patata*; 'opon

Winter-spring ephemeral; gravelly or sandy flats and larger, broad washes; flowers green, inconspicuous.

Sonora, El Papalote, *86-157* (10 Apr 1986).

Nitrophila occidentalis (Moq.) S. Wats. Alkali Weed

Perennial succulent herb; locally common to abundant in moist alkaline soil near springs and seeps and on alkaline flats; flowers pinkish, April to May. Not known elsewhere in the Monument; formerly along the nearby Río Sonoyta. The nearest present-day populations are at Quitovac and near the Río Colorado (Ezcurra *et al.*, 1988).

Adams s.n. (18 Jun 1971, ORPI); *Bowers 1333* (13 Jun 1978, ORPI); *Clark s.n.* (25 Mar 1944, ORPI); *Nichol s.n.* (28 Apr 1939); *Supernaugh s.n.* (1 Jun 1949, ORPI).

***Salsola australis** R. Br. Russian Thistle, Tumbleweed; *chamizo volador*; hejel 'e'esadam

Hot-weather annual; infrequent along roadsides and larger washes, in old fields, and on lower bajadas; probably repeatedly immigrating from disturbed habitats in adjacent Sonora.

88-407 (14 Sep 1988), 89-240 (19 Jun 1989).

Suaeda moquinii (Torr.) Greene Desert Seepweed; *quelite salado*; s-cuk onk

S. torreyana S. Wats. of authors.

Succulent shrub to 1.5 m; common to abundant on alkaline flats and in alkaline soils near springs and Quitobaquito Pond, also on sandy flats, in Aguajita Wash, and at Williams Spring; flowers green, inconspicuous, July to October.

Adams s.n. (18 Jun 1971, ORPI); 91-130 (18 Nov 1991); *Nichols s.n.* (3 Mar 1939, ORPI; 28 Apr 1939, ORPI); *Van Devender s.n.* (30 Aug 1978, ORPI).

Crassulaceae Stonecrop Family

Crassula connata (Ruiz & Pav.) Berg. var. **eremica** (Jeps.) Bywater & Wickens

Diminutive winter-spring succulent ephemeral; widespread, common, and sometimes abundant during years of favorable rain-fall in desert habitats with non-alkaline soils, especially in places where water temporarily accumulates, old fields, hillsides, flats, washes, and floodplains; flowers minute and inconspicuous.

92-137 (3 Mar 1992); 92-242 (13 Mar 1992).

Cucurbitaceae Gourd Family

Brandegea bigelovii (S. Wats.) Cogn.

Annual vine, fall to spring; locally common, at least in wash near Aguajita Spring and nearby smaller washes, especially common in dense brushy vegetation on the Sonora side of the fence at Aguajita Spring (between Mexico Highway 2 and the international fence); flowers white. Often climbing into mesquite trees and forming leafy green "curtains."

Baker 7714 (2 Mar 1989, ASU); 86-332 (14 Sep 1986); *Peebles 14556A* (5 Mar 1940).

Cucurbita digitata A. Gray Coyote Gourd; *calabacilla*, *chichi coyote*; 'adavi, 'ad

Perennial vine from a tuberous root; rare to locally common in larger washes (common on the Sonora side of fence at Aguajita), infrequent on sandy flats and in old fields, and rare elsewhere; flowers yellow, warmer months. The roots were used as a medicine to treat dandruff and were mashed in water for use as soap and bleach for fabric (Betty Melvin, in Bell *et al.*, 1980:96).

86-329 (14 Sep 1986).

Cuscutaceae Dodder Family

Cuscuta salina Engelm. Dodder; *vepegi vasai*

Warm-weather annual vine, parasitic on *Suaeda moquinii*; localized but forming dense colonies at Quitobaquito and Aguajita; flowers white, June to December (summer and fall).

89-241 (19 Jun 1989); *Harbison s.n.* (29 Nov 1939, ARIZ, SD); "On *Atriplex* and *Haplopappus*," *Hevly s.n.* (8 Oct 1960; this specimen is on *Suaeda moquinii*, not *Atriplex* or *Haplopappus*).

Cuscuta sp. Dodder; *vepegi vasai*

Warm-weather vining ephemeral, locally common in the floodplain at Aguajita, parasitic on *Tidestromia lamuginosa*, or occasional on *Leptochloa filiformis*; flowers white.

88-414 (14 Sep 1988).

Euphorbiaceae Spurge Family

Acalypha californica Benth. California Copperleaf

Perennial, subshrub; rare, in our region known from only one small population in rocky gravelly soil in Aguajita Wash; flowers

reddish, warmer months with sufficient soil moisture. Its distribution in the Monument and in adjacent Sonora is largely limited by winter freezing; the Aguajita plants are repeatedly frozen to the ground.

88-275 (6 Apr 1988).

Chamaesyce abramsiana (Wheeler) Koutnik *Golondrina*

Euphorbia abramsiana Wheeler

Non-seasonal ephemeral; common in Aguajita Wash; "flowers" maroon and white.

86-277 (13 Sep 1986), 86-322 (14 Sep 1986), 88-417 (14 Sep 1988).

Chamaesyce micromera (Boiss.) Woot. & Standl. *Golondrina*

Euphorbia micromera Boiss.

Non-seasonal ephemeral; floodplain and wash at Aguajita and probably elsewhere; "flowers" maroon and white.

86-294 (13 Sep 1986), 88-418 (14 Sep 1988).

Chamaesyce pediculifera (Engelm.) Rose & Standl. var. **pediculifera** Louse Spurge; *golondrina*

Euphorbia pediculifera Engelm. var. *pediculifera*

Non-seasonal ephemeral; common, usually in sandy gravelly washes and on floodplains and lower slopes; "flowers" maroon and white.

86-278 (13 Sep 1986, ARIZ, ORPI), 88-426 (14 Sep 1988); *MacDougal 17* (11 Nov 1907, US, not seen by us); *Mearns 2746* (US).

Chamaesyce polycarpa (Benth.) Millsp. var. **polycarpa** Common Desert Spurge; *golondrina*; *vi'ibgam*

Euphorbia polycarpa Benth.

Non-seasonal ephemeral to perennial herb (the perennial plants usually on rocky slopes); common in larger washes and on flats and rocky slopes; "flowers" maroon and white. This is the most common of the several species of small euphorbias in our region. The various species were used as medicine (Chico Suni).

88-404, 88-418, 88-459 (14 Sep 1988); *Gould 2992* (18 Mar 1945); *Harbison s.n.* (27 Nov 1939).

Chamaesyce setiloba (Engelm.) Millsp. Fringed Spurge; *golondrina*

Euphorbia setiloba Engelm.

Non-seasonal but mostly a summer-fall ephemeral, often freeze-killed in winter; common, sandy gravelly washes; "flowers" reddish and white.

86-276 (13 Sep 1986), 87-271 (23 Oct 1987).

Ditaxis lanceolata Benth.

Argythamnia lanceolata (Benth.) Muell. Arg.

Suffrutescent, short-lived perennial; common, mostly on rocky slopes, occasional along washes; flowers white and green, inconspicuous, warmer months.

88-458 (14 Sep 1988); *Gould 2998* (18 Mar 1945).

Ditaxis neomexicana (Muell. Arg.) Heller

Argythamnia neomexicana (Torr.) Muell. Arg.

Non-seasonal ephemeral to short-lived perennial; infrequent to common, mostly in washes and on rocky slopes; flowers white and green, inconspicuous.

86-291 (13 Sep 1986), 88-429 (14 Sep 1988).

Euphorbia eriantha Benth.

Non-seasonal ephemeral, mostly in spring; infrequent to common, washes and flats.

88-430 (14 Sep 1988).

Jatropha cinerea (Ort.) Muell. Arg. Ashy Limberbush; *sangrengado*; komagi vas

Shrub, often 1–1.5 m tall, frost-sensitive and often freezing back severely; locally common in sandy soils of bajadas, mostly along margins of washes, about 1.5 km west of Quitobaquito pond at the western margin of our area. Flowers whitish to pink, usually with the summer rains, the fruits ripening in the same season.

Used as medicine. For sores: boil it in water and put water on sore, also to take away pain of a toothache. Tender stems slit and used in baskets for coiling around leaves of cattail (*Typha*) or beargrass (*Nolina microcarpa*, which occurs farther east in southern Arizona and northern Sonora) (Philip Salcido, Delores Lewis; Nabhan *et al.*, 1982).

88-465 (14 Sep 1988); *Nichol s.n.* (28 Apr 1939, ARIZ, ORPI); 2 mi. W of Quitobaquito, *Supernaugh 435* (29 Jul 1950); near Quitobaquito, *Schott* (1855, F, not seen by us, cited by McVaugh, 1945, also see Torrey, 1857–1859).

Jatropha cuneata Wiggins & Rollins Limberbush; *sangrengado*; vas

Shrub, often 1–1.5 m tall; abundant on rocky slopes; flowers pinkish white, summer. Stems freeze-damaged during severe winters. Used as a red dye.

86-217 (23 Jul 1986), 88-462 (14 Sep 1988); *Nichol s.n.* (3 Mar 1939, ARIZ, ORPI); *Pinkava 2364* (1 Oct 1965).

Sapium biloculare (S. Wats.) Pax *Hierba de la flecha*; ^ˈina hitá

Shrub; rare, in sandy soil of Aguajita Wash; these plants, observed in October, 1987, had sprouted from the ground, the rest of the shrubs having frozen to the ground in the previous one or two winters. This species is common immediately south of the border fence at Aguajita and nearby on upper bajadas and low hills outside our area. Winter freezing seems to be a major limiting factor at Quitobaquito.

Said to be poisonous: “poison, it will kill you” (Chico Suni). Used as medicine for sores (Nabhan *et al.*, 1982). This shrub is known by O’odham to be the host plant for cocoons of the large native silk moths (*Rothschildia cineta* or *Eupacardia calleta*). The cocoons were collected off these plants for O’odham pascola rattles, and this plant’s name refers to a pascola dance step (Chico Suni).

Quitobaquito; “not elsewhere,” *Hodgson 209* (6 Dec 1978, DES); *Nichol s.n.* (8 Apr 1939); El Papalote, broad gravelly sandy wash immediately south of Aguajita Spring, shrub ca. 2.5 m tall, floodplain adjacent to wash, 86-333 (14 Sep 1986); *Meams 2753* (30 Jun 1894, US).

Fabaceae (Leguminosae) Legume Family

Acacia greggii A. Gray var. **arizonica** Isely Catclaw; ^ˈuñá de gato; ^ˈu:paḍ

Large shrub to small tree, 2–6 m tall; common along washes, fairly common in old fields, and infrequent on rocky slopes; flowers yellowish, mostly in spring, the pods ripening in June.

88-282 (6 Apr 1988, ORPI), 89-246 (19 Jun 1989).

Calliandra eriophylla Benth. Fairy Duster; *huajillo*

Dwarf woody shrub; locally common on rocky, often north-facing slopes; flowers pinkish, February and March.

Nichol s.n. (3 Mar 1939, ORPI).

Cercidium floridum Benth. subsp. **floridum** Blue Palo Verde; *palo verde*; ko’okomak, kalisp

Tree, often to 7 m; scattered to abundant along major washes in sandy soil, sparse in old fields; flowers yellow, peak flowering late March and April. Seeds used as food, the wood for fuel (Chico Suni).

Cercidium microphyllum (Torr.) Rose & Johnst. Foothill Palo Verde; *palo verde*; kek cehedagi

Tree usually to 4 m (exceptionally 5–7 m tall); infrequent to common in washes and on rocky slopes; flowers pale yellow and white, peak flowering in April and early May.

Seeds parched, ground into flour, and eaten as *atole* or gruel (Felger, unpublished notes).

Dalea mollis Benth. Silky Dalea

Winter–spring ephemeral; infrequent to common on gravelly flats and rocky slopes and probably elsewhere; flowers white and purple, February to April.

Ranzoni s.n. (26 Mar 1965, ORPI); *Warren s.n.* (10 Nov 1983).

Lotus salsuginosus Greene subsp. **brevivexillus** Ottley

Spring ephemeral; common, at least on flats and in larger washes; flowers yellow.

Beale s.n. (8 Apr 1988, ORPI); 86-113A (9 Apr 1986), 88-283A (6 Apr 1988).

Lotus strigosus (Nutt.) Greene var. **lomentellus** (Greene) Isely

Spring ephemeral; common, washes and flats; flowers yellow.

Beale s.n. (8 Apr 1988, ORPI); 88-283 (6 Apr 1988).

Lupinus arizonicus S. Wats. Arizona Lupine; *lupino*; taḥ mahag

Winter–spring ephemeral; often common, broad sandy washes, gravelly bajadas, and along roadsides, less common on rocky slopes; flowers pinkish blue.

Beale s.n. (8 Apr 1988, ORPI); *Clark s.n.* (25 Mar 1944, ORPI); 88-284 (6 Apr 1988); *Niles 525* (16 Mar 1965, ARIZ, ORPI).

Marina parryi (Torr. & Gray) Barneby

Dalea parryi Torr. & Gray

Non-seasonal ephemeral, usually seen in winter and spring, sometimes surviving as a short-lived perennial; infrequent to common, washes and rocky slopes; flowers dark blue.

86-286 (13 Sep 1986), 88-461 (14 Sep 1988).

***Melilotus indica** (L.) Allioni Yellow Sweet-clover; *trébol agrio*; pu:w1

Non-seasonal ephemeral; infrequent to locally common, old fields, especially along old irrigation ditches and in moist soil around Quitobaquito Pond, infrequent in washes; flowers yellow.

Bowers 1607 (30 Mar 1979, ORPI); *Clark s.n.* (25 Mar 1944, ORPI); 7659 (14 Apr 1963).

Olneya tesota A. Gray Ironwood; *palo fierro*; hoi’idkam

Large shrubs or small trees to 8.5 m tall; common along washes, infrequent and usually smaller on rocky slopes; flowers pinkish lavender, usually late April and May.

Used for fence posts and firewood (Chico Suni, 1989) and in construction of round houses (Delores Lewis, Philip Salcido). Seeds edible: “The beans of the palo fierro were toasted, ground, and consumed as pinole” (Lumholtz, 1912:331).

Adams s.n. (18 Jun 1971, ORPI); *Nichol s.n.* (28 Apr 1939, ORPI).

Phaseolus filiformis A. Gray Desert Bean; ban bavi, cepuliñ bavi

Non-seasonal ephemeral, mostly in spring; infrequent to common on rocky slopes and along washes, especially small arroyos and drainageways; flowers pink, March to May. The immature pods were eaten fresh, and the dry seeds were boiled and eaten like lentils (Nabhan, 1985).

Peebles 14554A (5 Mar 1940).

Prosopis glandulosa Torr. var. **torreyana** (L. Bens.) M.C. Johnst. Western Honey Mesquite; *mezquite*; kui

P. juliflora (Sw.) DC. var. *torreyana* L. Bens.

Small trees; infrequent in old fields. Apparently intermediate

with *P. velutina*: differs from *P. velutina* by having larger, longer, and more widely spaced leaflets on jugate rather than bijugate leaves, but resembles *P. velutina* in having pubescent herbage. See *P. velutina* for uses.

Aguajita Spring, *Bowers 1337* (13 Jun 1978); Quitobaquito, old fields below pond, small tree ca. 4 m tall, *88-451* (14 Sep 1988).

Prosopis pubescens Benth. Screwbean; *tornillo*; kujul

Large shrub or small tree to 5 m tall; localized small populations in wet soil and washes near springs and Quitobaquito Pond; flowers yellow, mostly May and June.

Adams s.n. (18 Jun 1971, ORPI); *86-327* (14 Sep 1986); *Galiano s.n.* (29 Aug 1986, ORPI); *Lehto 5492* (24 Oct 1965, ASU); *Mearns 2738* (28 Jan 1894, US, not seen by us); *Nichol s.n.* (28 Apr 1939, ORPI); *Van Devender s.n.* (30 Aug 1978, ORPI).

Prosopis velutina Woot. Velvet Mesquite; *mezquite*; kui

P. pubiflora (Sw.) DC. var. *velutina* (Woot.) Sarg.

Large shrub or small tree to ca. 8 m tall with pubescent herbage and jugate and bijugate leaves; common to abundant along washes and in old fields, scattered elsewhere, as on flats and rocky slopes; flowers yellow, mostly April to June. Forms locally dense groves among the pomegranates and figs in the old fields. Two large mesquite trees, next to the dwellings in the 1940s and 1950s, at the north end of the pond, were still standing but dead in the late 1980s (Figs. 5, 7, 8).

The pods were used for food and the wood was used as fuel. Lumholtz (1912:331) mentioned that the Hia C-ed O'odham "used to come as far as Quitobaquito and Santo Domingo to gather mezquite beans (called by the Mexicans *pechita*)." The sap was boiled to make black hair dye. The trunks and larger limbs were used for house construction and for corrals. The corral at Aguajita, still standing in 1992, was made from mesquite (Bobby Gray, *in Hoy*, 1970b; also see Bell and Castetter, 1937).

Adams s.n. (18 Jun 1971, ORPI); *86-179* (10 Apr 1986), *88-285* (6 Apr 1988); *Lehto 5493* (24 Oct 1965, ASU); *Ranzoni s.n.* (12 Jul 1962, ORPI).

Psoralea spinosa (A. Gray) Barneby Smoke Tree

Dalea spinosa A. Gray

Shrub or small tree to ca. 3 m; scattered along Aguajita Wash in sandy soil; flowers dark blue, May and June.

Darrow 2398 (18 Mar 1945); *Lehto 5488* (24 Oct 1965, ASU); *Nichol s.n.* (3 Mar 1939, ARIZ, ORPI).

Fouquieriaceae Ocotillo Family

Fouquieria splendens Engelm. subsp. *splendens* Ocotillo; *ocotillo*; melhog

Spiny shrub; common on rocky slopes and upper gravelly bajadas; flowering in March and April, flowers red-orange.

The stems are used for fences and house-building (Chico Suni), and the flowers are used in Easter ceremonies (Philip Salcido, Delores Lewis). The flowers are picked and the sweet nectar is sucked from the base of the flower.

88-132 (29 Mar 1988).

Gentianaceae Gentian Family

Centaurium calycosum (Buckl.) Fern. Centaury

Warm-weather annual; locally abundant in alkaline wet soil at seeps and springs from Quitobaquito to Williams Spring; flowers pink, rarely white, March to November. Not known elsewhere in Organ Pipe Cactus National Monument and not known from northwestern Sonora.

Adams s.n. (18 Jun 1971, ORPI); *Bowers 1308* (4 May 1978, ORPI); *86-212* (23 Jul 1986), *86-272* (13 Sep 1986); *Fouts* (15 Jun 1949, ORPI); *West*

s.n. (26 May 1962).

Eustoma exaltatum (L.) Satisb. ex G. Don forma *albiflorum* Benke Catchfly Gentian

Perennial herbs (facultatively annual?); locally abundant in alkaline wet soil at Quitobaquito and Williams springs; flowers showy, cream-white, June to September. Not known from elsewhere in the Monument or northwestern Sonora.

Adams s.n. (18 Jun 1971, ORPI); *Baker 7623* (17 Aug 1988, ASU); *Clark s.n.* (25 Mar 1944, ORPI); *86-213* (23 Jul 1986), *86-268* (13 Sep 1987); *Galiano s.n.* (29 Aug 1986, ORPI); *Harbison s.n.* (27 Nov 1939, SD); *Lehto 5497* (24 Oct 1965, ASU); *Mearns* (7 Feb 1894, US); *Ranzoni s.n.* (13 Jul 1962, ORPI); *Van Devender s.n.* (30 Aug 1978, ORPI).

Geraniaceae Geranium Family

***Erodium cicutarium** (L.) L'Her. Filaree, Stork-Bill; *alfilerillo*; hohoi 'ipad

Winter-spring ephemeral; seasonally common to abundant, washes, gravelly flats, and rocky slopes, and often along roadsides and other disturbed habitats; flowers pinkish lavender. In the exceptionally wet spring of 1973 some plants reached widths of ca. 2 m.

Beale s.n. (8 Apr 1988, ORPI); *20599* (9 Mar 1973), *88-279* (6 Apr 1988).

Erodium texanum A. Gray False Filaree, Desert Stork-bill

Winter-spring ephemeral; seasonally common, washes, flats, old fields, and rocky slopes; flowers pinkish lavender, February to April.

Hydrophyllaceae Waterleaf Family

Eucrypta chrysanthemifolia (Benth.) Greene var. *pinnatifida* (Torr.) Constance

Winter-spring ephemeral; often common on rocky slopes, especially north-facing, and in washes, less common on flats and in open areas of old fields, frequently under trees and shrubs and at base of rocks; flowers pale blue, February to April.

88-134 (29 Mar 1988).

Eucrypta micrantha (Torr.) Heller *Peluda*

Winter-spring ephemeral; commonly growing with *E. chrysanthemifolia*; flowers pale blue.

Nabhan and Reichhardt s.n. (18 Feb 1983).

Nama hispidum A. Gray *Flor morada*

Spring ephemeral; common, washes and sandy flats; flowers lavender, February to April.

7682 (14 Apr 1963).

Phacelia ambigua M.E. Jones Desert Heliotrope

P. crenulata Torr. var. *ambigua* (M.E. Jones) J.F. Macbride

Spring ephemeral; common, washes and flats; flowers lavender, February to April.

86-102 (9 Apr 1986), *88-280* (6 Apr 1988).

Phacelia distans Benth. Fern-leaf Phacelia

Spring ephemeral; usually infrequent, sometimes locally common, washes and flats; flowers lavender.

Beale s.n. (8 Apr 1988, ORPI); *86-102* (9 Apr 1986).

Krameriaceae Ratany Family

Krameria erecta Willd. Range Ratany

K. parvifolia Benth.

Shrub ca. 0.5 m tall, 1 m across; generally infrequent but locally common on sandy plain at southwestern corner of our area; flowers purple, following rains during warmer months.

88-468 (14 Sep 1988).

Krameria grayi Rose & Painter White Ratany; *cósahui*; 'edho, he:d

Shrub to 0.7 m tall, 1.5 m across; common and widespread, rocky hills and flats; flowers purple, mostly following rains during warmer months.

The roots were used as a source of reddish dye for basketry and fabric, as a cosmetic, and as a tanning agent for deer hides; this plant also was used as a medicine (Delores Lewis, Philip Salcido, Chico Suni).

88-446 (14 Sep 1988).

Lamiaceae (Labiatae) Mint Family

Hyptis emoryi Torr. var. **emoryi** Desert Lavender; *salvia*

Shrub to 2 m tall; locally common at east end of Quitobaquito Hills near ridge crest; flowers blue, non-seasonal. The plants are frost-sensitive.

90-483 (24 Oct 1990).

Salvia columbariae Benth. Chia; *dapk*

Winter-spring ephemeral; common, usually on gravelly soils of washes, bajadas, and flats; flowers blue, March to April. Seeds used as a medicine to treat eye irritants, and also in a beverage (Philip Salcido, Delores Lewis; also see Lumholtz 1912:331).

Beale s.n. (8 Apr 1988, ORPI); *Clark s.n.* (25 Mar 1944, ORPI); 88-281 (6 Apr 1988)

Loasaceae Stickleaf Family

Mentzelia affinis Greene Triangle-seed Blazing Star; *pega pega*

Spring ephemeral; infrequent to common, sandy soils in washes and on flats; flowers yellow, February to April.

Clark s.n. (25 Mar 1944, ORPI); 88-287 (6 Apr 1988), 86-108 (9 Apr 1986).

Mentzelia involucreta S. Wats. Stickleaf; *pega pega*

Spring ephemeral; infrequent in sandy soil of Aguajita Wash; flowers whitish yellow, February to April.

Clark s.n. (25 Mar 1944).

Petalonyx thurberi A. Gray var. **thurberi** Sandpaper Plant; *hadşadkam*

Shrubby perennial ca. 0.5–1 m tall; common along Aguajita Wash; flowers white, late spring to fall.

86-288 (6 Apr 1988, ARIZ, ORPI).

Malpighiaceae Malpighia Family

Janusia gracilis A. Gray *Fermina*

Vining perennial, sometimes reaching a height of 3 m when climbing in shrubs; infrequent to common, rocky slopes; flowers yellow, non-seasonal.

88-125 (29 Mar 1988), 88-445 (14 Sep 1988).

Malvaceae Mallow Family

Hibiscus denudatus Benth. var. **denudatus** Rock Hibiscus

Suffrutescent perennial to 0.7 m; scattered on rocky slopes; flowers whitish to pink with large maroon spots, flowering non-seasonal.

Beale s.n. (23 Feb 1986, ORPI); *Warren s.n.* (10 Nov 1983).

Horsfordia newberryi (S. Wats.) A. Gray Orange Velvet-Mallow

Spindly shrub to ca. 3 m; infrequent to locally common, south-facing rocky slopes and ridge crest of the higher hills; flowers bright yellow-orange, flowering non-seasonally except during cold-weather.

Darrow 2411 (18 Mar 1945); 90-482 (24 Oct 1990).

***Malva parvifolia** L. Cheeseweed; *malva, quesito*; *tasmahak*, *hadam cuikam*

Winter-spring ephemeral; old fields and near pond, often in temporarily wet soil; flowers whitish.

7663 (14 Apr 1963).

Sphaeralcea couleri (S. Wats.) A. Gray subsp. **couleri** Annual Globe Mallow; *mal de ojo*; *hadam tadk, ñiatum*

Spring ephemeral; seasonally abundant in wet years, mostly in old fields and washes and on floodplains, sandy flats, and lower bajadas. Highly variable in size depending on soil moisture.

Beale s.n. (8 Apr 1988, ORPI); 7650 (4 Apr 1963); *Mearns 2774* (7 Feb 1894, G. DS, not seen by us).

Sphaeralcea emoryi Torr. *Mal de ojo*

Non-seasonal ephemeral to short-lived perennial subshrub, to 1.5 m; scattered to abundant on sandy flats and washes, often in disturbed areas such as roadsides and especially common to abundant around the cottonwoods at Quitobaquito; flowers reddish orange, non-seasonal.

Bowers 1719 (10 May 1979, ORPI); 7649 (14 Apr 1963), 86-176 (10 Apr 1986), 86-206 (23 Jul 1986); *Pebbles 14556* (5 Mar 1940); *Van Devender s.n.* (30 Aug 1978).

Martyniaceae Sesame Family

Proboscidea altheaeifolia (Benth.) Decne. Devil's claw; *gato, uña de gato, torito*; *han 'ihug-ga*

Perennial, herbaceous from a large tuberous root; scattered in sandy soil, flats and washes; flowers yellowish, July to September. The claws are used for baskets (a strip of black fiber in each claw) "when the regular kind" (wild or domesticated *P. parviflora*, found widely elsewhere in Arizona) is not available (Delores Lewis, Philip Salcido).

Bowers 1387 (25 Jul 1978).

Molluginaceae Carpetweed Family

Mollugo cerviana Sér. Thread-stem Carpetweed, Indian Chickweed

Diminutive warm-weather ephemeral; seasonally abundant in sandy soil, on flats, and in washes and floodplains.

88-419 (14 Sep 1988).

Moraceae Mulberry Family

***Ficus carica** L. Fig; *higuera*; *suma*

A small orchard remains in old fields along old irrigation ditches below the pond at Quitobaquito. It consists of shrubs and trees to 5 m tall. Although many of the trees were still alive in 1989, they had been sadly neglected for many years (see *Punica*, *Punicaceae*). These trees are said to have been cultivated by O'odham from Spanish introductions. Hoy (1970a:48) reported that Andrew Dorsey planted fig trees ca. 1860. Although there probably has been more than one planting, these figs are likely to be the same "mission fig" variety that Eusebio Kino introduced into the region in the late 1700s. Propagation is clonal from cuttings. In the early 1960s the double row of fig and pomegranate shrubs straggled across the international fence into Sonora, although most of these plants were dead or dying.

88-452 (14 Sep 1988), 89-243 (19 Jun 1989); *Galiano s.n.* (27 May 1987, ORPI).

Nyctaginaceae Four-O'Clock Family

Allionia incarnata L. Trailing Four-O'Clock

Short-lived perennial or facultative annual or ephemeral; common on gravelly floodplains and flats and on rocky slopes; flowers violet rose. April to November.

88-403 (14 Sep 1988).

***Boerhavia erecta** L. var. **erecta** Spiderling

Summer ephemeral; rare, only several plants seen along Aguajita Wash; flowers pinkish. Probably an agricultural weed entering from the Sonoyta Valley. The plants are noticeably more robust than var. *intermedia*, with longer, larger fruits.

88-424 (14 Sep 1988).

Boerhavia erecta var. **intermedia** (M. E. Jones) Kearney & Peebles Spiderling; makkom ha-jeved

Summer ephemeral; common, washes and floodplains, and especially abundant at Aguajita; flowers pink.

88-413 (14 Sep 1988).

Boerhavia spicata Choisy var. **palmeri** S. Wats. Spiderling

B. coulteri (Hook. f.) S. Wats.

Summer ephemeral; common, washes and floodplains; flowers white to pale pink.

88-415 (14 Sep 1988).

Boerhavia wrightii A. Gray Spiderling

Summer ephemeral; common, washes and floodplains; flowers pale pink.

88-412 (14 Sep 1988).

Commicarpus scandens L.

Perennial, scarcely woody at base; rare to sometimes seasonally infrequent, along major washes; flowers greenish yellow, responding to hot weather.

Quitobaquito: *Harbison s.n.* (27 Sep 1939, SD 26179); *Nabhan s.n.* (17 May 1982). Aguajita Wash, only one flowering plant seen, edge of wash, ca. 60 cm high, plus few widely scattered seedlings, 88-401 (14 Sep 1988).

Mirabilis bigelovii A. Gray Desert Four-O'Clock

Perennial herb; infrequent, on rocky slopes and in washes; flowers white to pale pink, March to November.

86-180 (10 Apr 1986), 88-286 (6 Apr 1988).

Onagraceae Evening Primrose Family

Camissonia californica (Torr. & Gray) Raven

Winter-spring ephemeral; seasonally common during favorable years, gravelly washes and probably elsewhere in years of higher rainfall; flowers yellow.

88-312 (6 Apr 1988).

Camissonia chamaenerioides (A. Gray) Raven

Winter-spring ephemeral; locally infrequent to common during favorable years, gravelly sandy washes and probably elsewhere in years of higher rainfall; flowers whitish.

88-298 (6 Apr 1988).

Gaura parviflora Hook. Lizard-Tail

Warm-weather ephemeral or annual; infrequent, occasionally locally common, temporarily wet soil in old fields, washes, and fairly open areas; flowers pinkish red during day (probably white when first open at night).

86-174A (10 Apr 1986).

Oenothera primaverais A. Gray

Winter-spring ephemeral; infrequent, mostly along the floodplain and margins of Aguajita Wash, usually in low-lying pockets of silty soil with mesquite leaf-litter; flowers yellow.

92-250 (13 Mar 1992).

Orobanchaceae Broomrape Family

Orobanche cooperi (A. Gray) Heller Desert Broomrape; mo'otadk

Root parasite on *Ambrosia deltoidea* and *A. dumosa*; locally common on sandy flats, in sandy gravelly washes, and on floodplains; flowers white and purplish, spring.

7650 (14 Apr 1963), 88-300 (6 Apr 1988).

Papaveraceae Poppy Family

Eschscholzia minutiflora S. Wats.

Spring ephemeral; common in larger washes; flowers yellow orange.

Beale s.n. (22 Mar 1986, ARIZ, ORPI); 88-290 (6 Apr 1988).

Plantaginaceae Plantain Family

Plantago insularis Eastw. var. **fastigiata** (Morris) Jeps. Woolly Plantain, Indian Wheat; munša

Winter-spring ephemeral; widespread, common to abundant in favorable years; washes, old fields, flats, bajadas, and rocky slopes; January to April.

20595 (9 Mar 1973), 89-261 (19 Jun 1989, ORPI).

Polemoniaceae Phlox Family

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

Winter-spring ephemeral; widespread and common, washes and flats; flowers blue.

Beale s.n. (8 Apr 1988, ORPI); *Clark 11483* (25 Mar 1944, ORPI); 88-293 (6 Apr 1988).

Gilia stellata Heller Star Gilia

Spring ephemeral; infrequent to common in washes and on bajadas and rocky slopes; flowers lavender and yellow.

Beale s.n. (8 Apr 1988, ORPI); 88-294 (6 Apr 1988); *Gould 2993* (18 Mar 1945).

Linanthus bigelovii (A. Gray) Greene

Spring ephemeral; seasonally common on floodplains, flats, and rocky slopes; flowers white.

Polygonaceae Buckwheat Family

Chorizanthe brevicornu Torr. subsp. **brevicornu** Short-horn Spine-flower

Spring ephemeral; widespread and common, washes, flats, and rocky slopes; flowers white, minute, February to April.

Beale s.n. (8 Apr 1988, ORPI).

Chorizanthe rigida (Torr.) Torr. & Gray Rigid Spine-flower

Winter-spring ephemeral; common and widespread, flats, rocky slopes, bajadas, and broader gravelly washes; plants drying to a spiny skeleton; flowers white, minute, February to April.

Beale s.n. (8 Apr 1988, ORPI); *Schmitt & Dakan s.n.* (23 Feb 1973, ORPI).

Eriogonum deflexum Torr. var. **deflexum** Skeleton-Weed Buckwheat

Ephemeral, non-seasonal but found mostly in late spring and early summer, sometimes persisting through summer and also flowering in fall; scattered to common, washes, gravelly flats, and old fields; flowers pinkish.

Beale s.n. (8 Apr 1988, ARIZ, ORPI); 86-216 (23 Jul 1986), 86-283 (13 Sep 1986, ORPI), 87-273 (23 Oct 1987); *Warren and Anderson 87-111* (24 Oct 1987).

Eriogonum inflatum Torr. & Frém. Desert Trumpet

Perennial herb; common on rocky slopes, rare to infrequent on bajadas and floodplains of larger washes; flowers yellowish, mostly flowering in spring.

88-291 (6 Apr 1988), 88-460 (14 Sep 1988).

Eriogonum thomasi Torr.

Spring ephemeral; often seasonally common to abundant, open gravelly sandy areas of rocky slopes, bajadas, and washes; flowers pinkish.

88-123 (29 Mar 1988), 88-292 (6 Apr 1988).

Portulacaceae Portulaca Family

***Portulaca oleracea** L. var. **oleracea** Purslane; *verdolaga*; ku'ukpalk

Summer ephemeral; seasonally common in washes and floodplains; flowers yellow.

88-432 (14 Sep 1988).

Portulaca halimoides L. Dwarf Portulaca

P. parvula A. Gray

Summer ephemeral; seasonally common or even abundant on lower bajadas and floodplains; sepals reddish pink, the petals, anthers, and stigma golden yellow.

88-433 (14 Sep 1988).

Punicaceae Pomegranate Family

***Punica granatum** L. Pomegranate; *granada*; galnayu

Shrubs to 3 m tall; long ago planted along irrigation ditches below the pond at Quitobaquito (old fields); flowers bright red-orange, March and April and sporadically through summer; fruits ripening in late summer and early fall, the ripe fruits with the skin pale yellowish with a pinkish blush near apex, the fleshy pulp translucent white, the taste refreshing and moderately sweet.

When the Orozco family lived at Quitobaquito the pomegranate orchard extended across the international fence into Mexico, and the dead remains of these shrubs were still present in the late 1970s. Although many of the pomegranates on the Arizona side of the fence were still alive and a few were thriving in 1989, they had been neglected for many years and most were in poor condition. In late 1989 the Park Service began irrigating the plants, and by summer 1990 the surviving plants had recovered remarkably. These heirloom plants are now being propagated for cultivation at other sites to safeguard the genetic stock.

Pomegranates are readily propagated by cuttings, and this grove probably represents a single clone. Perhaps there have been multiple plantings, including those by Andrew Dorsey in about the 1860s (Hoy, 1970a:48) and later by José Juan Orozco (Nabhan, unpublished notes; Zepeda, 1985). Did these pomegranates originate from introductions by Padre Eusebio Kino? The most likely source of the Quitobaquito plants is Quitovac or perhaps Sonoita (see *Ficus*, Moraceae).

86-205 (23 Jul 1986), 88-309 (6 Apr 1988); *Van Devender s.n.* (31 Aug 1978, ORPI).

Ranunculaceae Ranunculus Family

Myosurus minimus L. Dwarf Mouse-tail

Spring annual. Presumably extirpated, it was found at Quitobaquito in 1945 growing with other small herbaceous plants also requiring open wetland habitats (e.g., *Juncus bufonius*, *Poa annua*, and *Veronica peregrina*). No other collections of this species are known from the Monument or northwestern Sonora.

Quitobaquito, with *Poa annua* in marshy area bordering alkaline pool, *Gould* 2986 (18 Mar 1945).

Resedaceae Mignonette Family

Oligomeris linifolia (Vahl) Macbr. Slender-leaf Cambess

Ephemeral, probably non-seasonal, but common at least from October to May; sandy flats, alkaline flats, washes, and old fields; flowers whitish green, inconspicuous.

Fay 740 (18 Feb 1978); 86-185 (10 Apr 1986), 88-295 (6 Apr 1988); *Gould* 2984 (18 Mar 1945); *Nichol s.n.* (28 Apr 1939, ORPI); *Niles* 524 (ARIZ, ORPI, 16 Mar 1965); *Parker* 7993 (17 Apr 1952).

Rhamnaceae Buckthorn Family

Condalia globosa J. M. Johnston var. **pubescens** J. M. Johnston Kauk kuavuli

Shrub 1.5–5 m tall; infrequent to common in washes and old fields and beneath and near cottonwoods at Quitobaquito; flowers yellowish green, flowering at least in spring. The shrubs are especially common and large near Aguajita Spring.

Bowers 1046 (11 Feb 1978, ORPI); 87-274 (23 Oct 1987); *Peebles* 14557 (5 Mar 1940).

Ziziphus obtusifolia (Hook. ex Gray) A. Gray var. **canescens** (A. Gray) M. C. Johnst. Gray Thorn; *abrojo*; 'uspad, 'us jevedpad

Condalia lycioides (Gray) Weberb. var. *canescens* (A. Gray) Trel., *Condaliopsis lycioides* (A. Gray) Suess, var. *canescens* (A. Gray) Suess.

Shrub 2 to 3 m tall, occasionally to 5 m when growing into mesquite (*Prosopis velutina*); common, mostly along washes, in old fields, on bajadas near springs, and in brushy areas surrounding Quitobaquito pond; flowers greenish, appearing at least May to September, visited by the honeybee, native bees, the large orange-winged tarantula hawk (*Hemipepsis ustulata*), and other insects. The fruits are eaten (Chico Suni).

Adams s.n. (18 Jun 1971, ORPI); *Bowers* 1336 (13 Jun 1978, ORPI); 7666 (14 Apr 1963), 86-186A (10 Apr 1986); *Mason* 1671 (10 Apr 1958).

Salicaceae Willow Family

Populus fremontii S. Wats. subsp. **fremontii** Frémont Cottonwood; *alamo*; 'auppa

Five trees, to 13 m, at the margin of the pond at Quitobaquito and near its north end, occasionally producing root sprouts. Flowers greenish yellow, in late February. These trees, all of which are pistillate, were probably planted from cuttings taken from nearby Sonoita, where the trees are common. (Cottonwoods are readily propagated from cuttings made in winter.) In his field notes of Sonoita, Mearns (1892–1893) wrote "it is exclusively planted along acequias here, and said to be the cottonwood of the Gila River near Gila Bend." Bryan (1925:427) reported that "the pond, which with its fringing cottonwoods, makes a refreshing green spot in the desert."

Adams s.n. (18 Jun 1971, ORPI); *Benson s.n.* (5 Mar 1940); *Clark* 11509 (25 Mar 1944, ORPI); 5721 (1 Jan 1963), 87-303 (10 Nov 1987), 90-43 (22 Feb 1990); *Peebles* 14563 (5 Mar 1940); *Ranzoni s.n.* (13 Jul 1962, ORPI).

Salix gooddingii Ball Goodding Willow; *sauce*, *sauz*; ce'ul

Large shrubs or trees to ca. 10 m; locally common along edge of pond at Quitobaquito.

Adams s.n. (18 Jun 1971, ORPI); *Benson s.n.* (5 Mar 1940); *Clark s.n.* (25 Mar 1944, ORPI); *Darrow* 2396 (17 Mar 1945); *Peebles* 14562 (5 Mar 1940).

Saururaceae Lizard-tail Family

Anemopsis californica (Nutt.) Hook. & Arn. *Hierba del manso*; va'vis

Perennial herb; abundant in wet, often alkaline soils near springs and around the pond at Quitobaquito; "flowers" (floral bracts)

white, warmer months of the year. Formerly along banks of irrigation ditches in old fields with mesquites and willows.

This is one of the more important medicinal herbs in the Sonoran Desert region (e.g., Lumbholtz, 1912; Felger and Moser, 1985). Used for cold, flu, and impetigo (Juan Joe Cipriano). It "makes you hot inside and that's what takes care of the sickness" (Delores Lewis).

Adams s.n. (18 Jun 1971, ORPI); *Bowers 1307* (4 May 1978, ORPI); *86-209* (23 Jul 1986); *Lehto 5495* (24 Oct 1965, ASU); *Mason 1771* (29 May 1959); *Mearns 2786* (7 Feb 1894, US); *Parker 7996* (17 Apr 1952); *Steenbergh s.n.* (19 May 1962, ORPI); *Warren s.n.* (12 Aug 1975).

Scrophulariaceae Snapdragon Family

Antirrhinum cyathiferum Benth. Desert Snapdragon

Non-seasonal ephemeral; widespread, infrequent to sometimes common in non-wetland habitats; flowers purplish blue.

Harbison s.n. (27 Nov 1939, SD).

Antirrhinum filipes A. Gray Climbing Snapdragon

Winter-spring ephemeral, climbing on shrubs; infrequent, along washes and on rocky slopes; flowers yellow, February to April.

88-124 (29 Mar 1988); *Van Devender s.n.* (10 Mar 1978, ORPI).

Penstemon parryi A. Gray Desert Penstemon; hevel 'e'es

Spring ephemerals here (perhaps sometimes becoming short-lived perennials); infrequent, possibly more common during favorable years, in washes and old fields; flowers rose-pink, February to April. Flowers thrown as confetti in Easter ceremonies (Delores Lewis, Philip Salcido).

86-115 (9 Apr 1986), *88-296* (6 Apr 1988); *Harbison s.n.* (30 Nov 1939, ARIZ, SD).

Veronica peregrina L. subsp. *xalapensis* (H.B.K.) Penn. Purslane Speedwell, Necklace-Weed

Winter-spring ephemeral; formerly bordering pond at Quitobaquito, apparently now extirpated, but persisting at scattered permanently or temporarily wet habitats in northwestern Sonora (Felger, unpublished); flowers minute, white to pale bluish.

Quitobaquito, with *Poa annua* and *Myosurus* in marshy area bordering alkaline pool, *Gould 2987* (18 Mar 1945).

Solanaceae Potato or Nightshade Family

**Calibrachoa parviflora* (Juss.) D'Arcy

Peumia parviflora Juss.

Annual, plants spreading-prostrate, rooting at nodes, reaching 1 m across; rare (six plants only) in nearly barren moist soil of alkaline flat ca. 100 m northwest of pond at Quitobaquito; flowers purple. Apparently native to South America and naturalized in North America.

88-317 (6 Apr 1988).

Datura discolor Bernh. Desert Thorn-apple; *toloache*; kotadopi

Non-seasonal ephemeral; scattered in sandy disturbed soil usually along washes, especially at Aguajita; flowers white, spring and summer-fall. Narcotic; "young people would use it to make them crazy" (Philip Salcido). "If you drink or eat too much of it, it will kill you" (Delores Lewis).

86-282 (13 Sep 1986), *88-434* (14 Sep 1988).

Lycium andersonii A. Gray Desert Wolfberry; *salicieso*; s-toa kuavuli

Shrub, 1.2–2.4 m tall; common, scattered in many habitats, mostly along washes and on rocky slopes; flowers lavender, mostly February to April, also from late summer to winter. Fruits eaten (Chico Suni).

90-47 (23 Feb 1990).

Lycium fremontii A. Gray var. *fremontii* Frémont Wolfberry; *tomatillo*; kuavuli

Shrub, 1.5–2.5 m tall, reaching 4 m where it grows through mesquite at Aguajita Spring; locally common to abundant in washes, old fields, sandy flats, and especially near the pond; flowers lavender, mostly February to March, sometimes also in late summer or fall. The fruits were eaten (Chico Suni).

Benson 9944 (5 Mar 1940); *Bowers 1047* (11 Feb 1978); *Engard 664* (7 Jun 1975, DES); *5726* (1 Jan 1963), *90-44* (23 Feb 1990); *Nichol s.n.* (28 Mar 1939, ARIZ, ORPI).

Lycium macrodon A. Gray var. *macrodon* S-cuk kuavuli

Shrub, 1.2–2 m tall; locally common within a few meters of international fence on Sonora side of Aguajita Spring and infrequent in old fields and on sandy flats at Quitobaquito; flowers cream color, February to April.

88-311 (6 Apr 1988); *Mearns 2740* (28 Jan 1894, DS).

Lycium parishii A. Gray var. *parishii* Parish Wolfberry; *salicieso*

Shrub, 1–2 m tall; infrequent to common on rocky slopes, bajadas, and sandy flats near Aguajita, in old fields, and near small washes; flowers lavender, February and March, sometimes also in late summer and fall or occasionally at other seasons.

87-292 (10 Nov 1987), *90-36* (22 Feb 1990), *90-45* (23 Feb 1990); *Hodgson 217* (6 Dec 1978, DES).

Nicotiana clevelandii A. Gray Desert Tobacco

Spring ephemeral; scattered in open sandy gravelly soils of washes and sometimes on sandy flats; flowers white, February to April.

Bowers 1044 (11 Feb 1978, ORPI).

Nicotiana trigonophylla Dunal Coyote Tobacco, Desert Tobacco; *tabaquillo de coyote*; O'odham ha-vivga, ban viv

Perennial herb; infrequent to common, mostly along sandy washes, sometimes in wet soil near springs; flowers white, non-seasonal. The leaves were smoked as tobacco (Betty Melvin, *in* Zepeda, 1985:55).

87-293 (10 Nov 1987); *Jackson s.n.* (13 Dec 1964, ORPI); *Mearns 2744* (30 Jan 1894, DS).

Physalis crassifolia Benth. Desert Ground Cherry; *tomatillo del desierto*

Facultative spring and warm-weather ephemeral at Quitobaquito, apparently frost-sensitive; rare, scattered along Aguajita Wash and its floodplain, often beneath shrubs; flowers pale yellow. Common and usually perennial in nearby regions; at Quitobaquito probably only a waif growing from extralimital seed sources and seldom reproducing or surviving more than the first season.

92-107 (3 Mar 1992).

Solanum americanum Mill. Black Nightshade; *cuvi vupui*

S. nothflorum Jacq.

Annual, or possibly perennial; rare to infrequent, in moist soil under shrubs and trees, especially along ditch leading from springs to the pond; flowers white, mostly May to November.

Bowers 1329 (13 Jun 1978); *Nabhan s.n.* (16 May 1982); *Van Devender s.n.* (30 Apr 1978, ORPI); *Warren s.n.* (10 Nov 1983).

Sterculiaceae Cacao Family

Ayenia filiformis S. Wats.

Suffrutescent perennial; rare to infrequent among rocks on north-facing slopes and along small rocky arroyos in the hills northeast of the pond; flowers maroon, minute, probably flowering during warmer months depending on soil moisture.

92-275 (13 Mar 1992)

Tamaricaceae Tamarisk Family

***Tamarix ramosissima** Ledeb. Salt-cedar. Tamarisk: *salado*, *pino salado*; 'onk 'u'us

Shrub, often 2–4 m tall; abundant in wet soil around Quitobaquito pond, at the springs, near water sources in washes, and in old fields; flowers pinkish-white to pink, flowering nearly all year, especially in spring. Seedlings especially abundant in open areas with wet soil.

Bowers 1391 (25 Jul 1978); *5722* (1 Jan 1963), *20600* (9 Mar 1973); *West 96* (30 Sep 1961).

Urticaceae Nettle Family

Parietaria floridana Nutt. Desert Pellitory

P. hespera Hinton var. *hespera*

Winter–spring ephemeral; locally infrequent to common in washes, often beneath spiny shrubs or trees; flowers green, inconspicuous.

86-106 (9 Apr 1986), *88-298* (6 Apr 1988).

Verbenaceae Vervain Family

Verbena officinalis L. subsp. *halei* (Small) S. Barber

Perennial or facultative annual; rare, localized colony beneath mesquite in old fields just below pond at Quitobaquito; flowers blue, non-seasonal.

88-454 (14 Sep 1988).

Viscaceae Mistletoe Family

Phoradendron californicum Nutt. Desert Mistletoe; *tóji*; *hakovad*, *to:ki*

Perennial, parasitic on *Acacia*, *Cercidium*, and *Prosopis*; common where hosts are present, especially in washes; flowers yellow-green, flowering late winter and early spring, sporadically other seasons.

Adams s.n. (18 Jun 1971, ORPI); *88-299* (6 Apr 1988); *Mearns 2742* (30 Jan 1894, US).

Zygophyllaceae Caltrop Family

Fagonia californica Benth. subsp. *longipes* (Standl.) Felger & Lowe

Perennial subshrub to facultative ephemeral; common on rocky slopes; flowers lavender-pink, non-seasonal.

88-131 (29 Mar 1988).

Kallstroemia californica (S. Wats.) Vail *Mal de ojo*

Summer ephemeral; seasonally common, mostly on floodplains and bajadas; flowers yellow to yellow-orange.

88-411 (14 Sep 1988).

Larrea divaricata Cav. subsp. *tridentata* (DC.) Felger & Lowe
Creosote bush; *hediondilla*, *gobernadora*; *segaí*, *segoi*

Shrub to 2 m tall; abundant and widespread, most abundant on flats and rocky slopes; flowers yellow, non-seasonal.

Used for wall and roofing in round-house construction (Zepeda, 1985:23). Leafy branches boiled in water and the tea drunk as medicine for stomach trouble, a cold, diarrhea, or used topically as a salve for sores (Delores Lewis, Philip Salcido). "The greasewood is our drugstore" (Laura Kermen, *in* Nabhan, 1985:17). Boiled in water and the liquid used to wash a newborn child; the sticks used to curl hair (Bell, 1980:101).

88-467 (14 Sep 1988).

MONOCOTS

Cyperaceae Sedge Family

Cyperus laevigatus L. Flat Sedge

Small perennial herb, flowering in first season; rare to locally common, emergent from very shallow water and in alkaline wet soil; flowering and fruiting much of the year. It was apparently abundant in wet soil at least at Williams and Quitobaquito springs and around the pond at Quitobaquito until the cattle were removed and the larger wetland plants became too dense for it to compete for light. Between 1980 and 1990 it was rather rare and restricted to the few open wetland microhabitats in ditches and at seeps and springs at Quitobaquito and Burro springs. During the wet spring of 1973 it extended along a temporary small stream that trickled across the border fence at Quitobaquito. In 1984 it was found at Aguajita Spring, but it was not found there again until after the flood of 21 August 1988; by June 1989 it was common along the trickling stream between Aguajita Spring and the international border fence. Apparently its local distribution waxes and wanes with fluctuations in rainfall and density of vegetation cover.

Bowers and Warren 1314 (4 May 1978, ARIZ. ORPI); *20603* (9 Mar 1973), *87-302* (10 Nov 1987); *Fouts 449* (10 Apr 1952); *Gould 2983* (18 Mar 1945); *Johnson s.n.* (20 Apr 1984); *McDougall 34* (25 Mar 1941, ORPI).

Cyperus squarrosus L. Dwarf Sedge

C. aristatus Rottb.

Diminutive ephemeral; reported on earlier lists as abundant in moist soil near pond at Quitobaquito (Bowers, 1980). We have not found it there and have not located herbarium vouchers. However, it is common in comparable habitats in open places along the nearby Río Sonoyta in Sonora in wet sandy soil. More than likely it has been extirpated from our area since modification of the pond or since the livestock were removed and open ground in wetland habitats has filled with *Scirpus*.

Eleocharis caribaea (Rottb.) Blake Spikerush

Annual herb; wet soil. Formerly reported as abundant in moist soil near pond and springs at Quitobaquito, in the late 1980s it was locally infrequent to rare. This small spikerush apparently requires open wetland habitat (see comments for previous species).

Darrow 2403, 2404 (17 Mar 1945); *87-297* (10 Nov 1987); *Lehto 5505* (24 Oct 1965, ASU).

Eleocharis rostellata (Torr.) Torr. Traveling Spikerush

Perennial herb, perhaps also rarely facultatively annual, with tough rootstocks, forms dense grass-like mounds reaching about 1 m in height; stem tips producing plantlets. Expansive colonies completely cover localized areas of alkaline wet soil at Quitobaquito above the pond and extend into the springs and ditches. During the wet spring of 1973 the species spread to a temporary small stream crossing the border fence below Quitobaquito.

Surprisingly there are no earlier collections, although a 1963 photograph (by Hal Coss, 23 Aug 1963, ORPI negative W-37) shows *E. rostellata* in abundance along the spring ditch. It also occurs at the La Salina oasis at Bahía Adair (Ezcurra *et al.*, 1988) and along the margins of the lower Río Colorado but is unknown elsewhere in nearby Arizona and northwestern Sonora.

20591 (9 Mar 1973), *87-296* (10 Nov 1987), *88-319* (6 Apr 1988).

Scirpus americanus Pers. Bulrush; *tule*; *vack*

S. olneyi A. Gray, not *S. americanus* of western authors.

Large perennial herb often reaching 1.5–2 m; abundant in wet soil and emergent from shallow water ringing the pond at Quitobaquito and at Aguajita, Burro, and Williams springs, often

forming near pure stands of 100% coverage; also along irrigation ditches below springs. In the 1980s it totally clogged the spring at Aguajita. Flowers from March to October.

This large robust sedge has obviously thrived and increased since removal of the cattle, apparently leading to the local extirpation of various smaller wetland plants, e.g., *Cyperus squarrosus*, *C. laevigatus*, *Juncus bufonius*, *Myosurus minimus*, and *Poa annua*.

Bowers 904 (16 Oct 1977); *86-104* (9 Apr 1986); *Gould 2985* (18 Mar 1945); *Lehto 5499* (24 Oct 1965, ASU); *Peebles 14564* (5 Mar 1940).

Juncaceae Rush Family

Juncus balticus Willd. var. **mexicanus** (Willd.) Kuntze Wire Rush

Rhizomatous perennial; locally abundant in alkaline wet or damp soil at springs and seeps at Quitobaquito, often growing with *Distichlis spicata*. This is the first record for this species in the Monument. It seems strange that there are no earlier collections. There are no records for this species in northwestern Sonora or in nearby Arizona.

86-211 (23 Jul 1986), *87-287* (10 Nov 1987), *88-315* (6 Apr 1988); *Reichhardt, et al. 69* (22 Aug 1981).

Juncus bufonius L. Toad Rush

Annual; in our area known only from a 1944 collection at the edge of Quitobaquito pond; now extinct in the region. Its demise probably was due to lack of open wetland because sedges and other larger wetland plants have become so dense since the removal of cattle and dredging of the pond. There are no records for this species in northwestern Sonora or in nearby Arizona.

Clark 11501 (25 Mar 1944, ORPI).

Juncus cooperi Engelm. Spike Rush

Perennial; infrequent to common in damp to wet soil on alkaline flats between Quitobaquito and Burro Spring and below springs at Quitobaquito, often growing with *Sporobolus airoides*.

Bowers 1309 (4 May 1978, ORPI); *86-211* (4 May 1978), *87-300* (10 Nov 1987); *Warren and Anderson s.n.* (24 Oct 1987).

Najadaceae Water-nymph Family

Najas marina L. Holly-leaved Water-nymph

Submerged aquatic herb, presumably annual; formerly abundant in Quitobaquito Pond and stream below spring. Not recorded at Quitobaquito since 1965. The nearest known extant population is at the Colorado River.

Lehto 5501 (24 Oct 1965, ASU); *Mason 1677* (10 Apr 1958); *Pinkava 2363* (1 Oct 1965, ASU).

Poaceae (Gramineae) Grass Family

Aristida adscensionis L. Six-weeks Three-awn; *zacate tres barbas*

A. bromoides H.B.K.

Non-seasonal ephemeral; common and widespread in non-wetland habitats, rocky slopes, flats, old fields, and washes.

87-299 (10 Nov 1987); *MacDougal in 1907* (US, not seen by us, cited by Hitchcock, 1913); *Nichol s.n.* (10 Mar 1939, ORPI).

Aristida parishii Hitchc.

Perennial; rare, Aguajita Wash, mostly among boulders; flowering at least in spring, the flowering response probably non-seasonal. As with *Physalis crassifolia*, these plants are probably waifs sprouting from floodwater-transported disseminules.

92-102 (3 Mar 1992).

Aristida purpurea Nutt. var. **nealleyi** (Vasey) Allred

A. stricta var. *nealleyi* Vasey, *A. glauca* (Nees) Walpers, *A. purpurea* var. *glauca* (Nees) A. Holmgr. & N. Holmgr.

Perennial; common on granitic slopes of the Quitobaquito Hills; flowering response non-seasonal.

Granitic hill between Quitobaquito and Aguajita, locally common, *90-49* (23 Feb 1990).

Bouteloua aristidoides (H.B.K.) Griseb. Six-weeks Needle Grama; *navajita*

Summer ephemeral; seasonally common to abundant and widespread, flats, old fields, washes, and rocky slopes.

86-280 (13 Sep 1986, ARIZ, ORPI), *88-437* (14 Sep 1988).

Bouteloua barbata Lag. Six-weeks Grama; *navajita*; *cuk mudaggam*

Summer ephemeral; seasonally widespread and often abundant on flats, old fields, washes, and rocky slopes.

86-279 (13 Sep 1986, ORPI), *88-421* (14 Sep 1988).

Bromus carinatus Hook. & Arn. var. **arizonicus** Shear Arizona Brome

B. arizonicus (Shear) Stebbins

Winter-spring ephemeral; gravelly washes. Apparently not established in our region; known locally from only a single collection during a wet year.

Quitobaquito, U.S.–Mexico fence line, *7676* (14 Apr 1963).

***Bromus rubens** L. Foxtail Brome

Winter–spring ephemeral; several plants found during the wet spring of 1992 in the sandy–gravelly wash near the international fence just below Aguajita Spring; probably not reproducing within the confines of our region. Since the 1980s this species has become a common roadside weed along nearby Mexico Highway 2.

92-123 (3 Mar 1992, ORPI); *El Papalote, 88-25* (20 Feb 1988).

***Bromus tectorum** L. Downy Chess

Winter–spring ephemeral; not established in the region, known locally from a single collection.

El Papalote, large gravelly arroyo bed, ca. 15 m S of U.S. border (just S of Aguajita Spring), 86-133 (9 Apr 1986).

***Chloris virgata** Sw. Feather Fingergrass, *zacate lagunero*

Warm-weather ephemeral; rare, in silty depression at old parking lot southeast of pond, amid a dense stand of *Muhlenbergia microsperma*; a common weed in disturbed habitats in the Sonoyta Valley; probably not native to the region.

90-487 (24 Oct 1990).

***Cynodon dactylon** (L.) Pers. var. **dactylon** Bermuda Grass; *zacate ingles*

Perennial; abundant in moist to wet alkaline and disturbed areas, near springs, along ditches below springs, and in ditches in old fields; at Quitobaquito from the springs to the border fence, also at Aguajita, Burro, and Williams springs; flowering during warmer months.

Adams s.n. (18 Jun 1971, ORPI); *Clark 11478* (25 Mar 1944, ORPI); *7665* (14 Apr 1963); *McDougal 36* (25 Mar 1941).

***Dactyloctenium aegyptium** (L.) P. Beauv. Crowfoot Grass; *zacate de cuervo*

Summer ephemeral; rare, localized in wet soil beneath cottonwood trees at Quitobaquito; a common weed in agricultural fields of the nearby Sonoyta Valley (Felger, 1990).

87-289 (10 Nov 1987).

Digitaria californica (Benth.) Henr. Cottontop; *zacate punta blanca*

Trichachne californica (Benth.) Chase

Perennial; highly localized among granitic rocks at ridge crest at east end of Quitobaquito Hills with *Horsfordia newberryi* and *Hyptis emoryi*; September and probably also in spring.

90-484 (24 Oct 1990).

Distichlis spicata (L.) Greene Saltgrass; *zacate salado*; *ʔonk*, *vašai*

Perennial; abundant on moist to wet soils of alkaline flats, ditches below springs, and open places at springs; especially abundant around Quitobaquito, Aguajita, and Williams springs; May to October.

When cattle were being grazed at Aguajita the wash near the spring was open and there was a perennial flow. Since the cattle were removed there has been a decline in diversity as *Distichlis* increased and crowded out other plants, and the scenario is similar at other springs and seeps.

Adams s.n. (18 Jun 1971, ORPI); *Clark 11-478* (25 Mar 1944, ORPI); *86-274* (13 Sep 1986); *Lehto 5496* (24 Oct 1965, ASU); *Nichol s.n.* (28 Apr 1939, ORPI); *Pinkava 10002* (25 Nov 1972, ASU).

****Echinochloa colonum*** (L.) Link Jungle-Rice, Leopard Grass; *zacate pinto*, *zacate rayado*

Summer ephemeral; infrequent to common, in moist soil near Williams Spring and undoubtedly more widespread in low, temporarily wet soils during favorable years.

Van Devender s.n. (31 Aug 1978, ORPI).

****Eragrostis cilianensis*** (All.) Vign. Lut. Stinking Lovegrass; *zacate apestoso*

Summer ephemeral; known from Aguajita Wash and undoubtedly more widespread in favorable years, probably in low places such as other washes, old fields, and lower bajadas.

86-287 (13 Sep 1986), 88-436 (14 Sep 1988).

Erioneuron pulchellum (H.B.K.) Tateoka Fluff-Grass; *zacate borreguero*

Perennial; common on rocky slopes and rocky and gravelly upper bajadas; non-seasonal.

87-290 (10 Nov 1987).

Heteropogon contortus L. Tanglehead

Perennial; known in our region only from the one collection, although it occurs at nearby localities.

Mearns 2752 (30 Jan 1894, US).

Hilaria rigida, see *Pleuraphis rigida*

****Hordeum murinum*** L. subsp. **glaucum** (Stead.) Tzvel. Wild Barley

Winter-spring ephemeral; common weed in nearby disturbed habitats in adjacent Sonora including agricultural lands and expected in low-lying places in our region such as old fields, washes, and lower bajadas. The 1939 record indicates that it has long been in the region.

Nichol s.n. (28 Apr 1939, ARIZ, ORPI).

Leptochloa filiformis (Lam.) P. Beauv. Red Sprangletop; *desparramo rojo*

Summer ephemeral; sometimes common along washes and floodplains.

88-402 (14 Sep 1988).

Leptochloa uninervia (Presl) Hitchc. & Chase Mexican Sprangletop

Warm-weather annual; infrequent in alkaline wet soils such as near Williams Spring and in flowing ditches in old fields.

20594 (9 Mar 1973); *Van Devender s.n.* (30 Aug 1978, ORPI).

Muhlenbergia microsperma (DC.) Kunth Littleseed Muhly

Non-seasonal ephemeral; common to abundant in washes, on low silty places in flats, on rocky, especially north-facing slopes, and in shaded places, spreading onto open desert during favorable times.

86-281 (13 Sep 1986, ORPI), 88-422 (14 Sep 1988); *Nichol s.n.* (10 Mar 1939, ORPI).

Panicum hirticaule Presl

Summer ephemeral; infrequent to common in larger washes, especially at Aguajita.

88-428 (14 Sep 1988).

****Pennisetum ciliare*** (L.) Link Buffelgrass; *zacate buffel*

Perennial, often flowering and fruiting in first season; scattered, mostly along small washes west of pond, in lower bajada, and rarely in small arroyos in low hills. Well-established along Mexico Highway 2 in the 1970s, and first found along border fence in 1986 (Felger, 1990). In fall 1988, scattered small colonies were established along the southern and western margins of our area.

86-326 (14 Sep 1986), 88-448 (14 Sep 1988).

Phragmites australis (Cav.) Trin. ex Steud. Common Reed. Reedgrass; *carrizo*; *vapk*

Bamboo-like perennial, reaching 3 m in height; since at least the 1970s restricted to a single well-established colony in wet soil at Burro Spring; July to October.

Bowers 1316 (4 May 1978, ORPI); *86-214* (23 Jul 1986); *Warren and Anderson 87-110* (24 Oct 1987).

Pleuraphis rigida Thurb. Galleta; *toboso*

Hilaria rigida (Thurb.) Benth.

Perennial; locally common, mostly in sandy soils along washes in bajada at the western margin of our area; non-seasonal. This distinctive species was originally described as *Pleuraphis* and is so listed by Hitchcock (1913). The genus seems adequately distinct from *Hilaria* and to treat it as *Pleuraphis* is more in line with current generic concepts among the grasses (J. R. Reeder, personal communication 1992).

88-466 (14 Sep 1988).

****Poa annua*** L. Annual Bluegrass, Wintergrass; *pastito de invierno*

Winter-spring ephemeral, collected at Quitobaquito in 1945 when the site was inhabited and not recorded there since. It grew in the marsh around the pond with *Myosurus* and *Veronica* (see *V. peregrina*). The local demise of this water-loving weedy little grass is probably a result of the increase in vegetative cover since the livestock were removed and Quitobaquito has been uninhabited. It currently occurs as a winter lawn weed in the nearby town of Sonoyta (Felger, 1990).

Darrow 2405 (17 Mar 1945).

Poa bigelovii Vasey & Scribn.

Winter-spring ephemeral; several plants found during the wet spring of 1992 in the sandy-gravelly wash near the international fence just below Aguajita Spring; probably not reproducing in our region.

92-111 (3 Mar 1992).

****Polypogon monspeliensis*** (L.) Desf. Rabbitfoot Grass; *zacate cola de zorra*

Non-seasonal ephemeral, mostly in spring; common in moist to wet, often in alkaline soil near springs and seeps; Burro and Williams springs and at Quitobaquito; April to October.

Bowers 1310 (4 May 1978, ORPI); 7677 (14 Apr 1963), 86-215B (23 Jul 1986); *Nichol s.n.* (28 Apr 1939, ORPI).

***Polypogon viridis** (Gouan) Breistr. Water Bentgrass

Agrostis semiverticillata (Forsk.) C. Christ.

Perennial; localized dense colonies in wet mud at periphery of *Phragmites* colony at Burro Spring and in wet mud and shallow running water at spring and ditch leading into Quitobaquito Pond; probably formerly also at Quitobaquito Pond; flowering at least from March to October. It seems to be losing ground at Burro Spring, probably because of lack of open ground, but may be increasing at Quitobaquito, where it seems to be competing successfully with *Cynodon dactylon* and *Distichlis spicata* in ditches with running water. The nearest known population is at Quitovaic in northwestern Sonora.

Bowers 1311 (4 May 1978, ARIZ, ORPI); *Darrow 2409* (17 Mar 1945); *86-215* (23 Jul 1986), *88-318* (6 Apr 1988); *Supernaugh* (15 Jan 1949, ORPI).

***Schismus barbatus** (L.) Thell. Mediterranean Grass

Winter-spring ephemeral; seasonally common to abundant, flats, washes, old fields, and rocky slopes.

The closely related *S. arabicus* Nees is common and widespread elsewhere in the Monument and in adjacent Sonora and can be expected in the Quitobaquito region.

Bowers 1043 (11 Feb 1978); *88-301* (6 Apr 1988).

Sporobolus airoides Torr. Alkali Sacaton; *zacatón alcalino*

Large perennial clumping grass; abundant on alkaline flats, often in moist sandy soil, between Quitobaquito and Williams Spring; flowering in summer and fall. Sometimes forming clonal "fairy rings" to 2 m wide.

Bowers 1805 (9 Aug 1979, ARIZ, ORPI); *86-223* (23 Jul 1986), *86-273* (13 Sep 1986, ORPI), *87-288* (10 Nov 1987); *Van Devender s.n.* (31 Aug 1978, ARIZ, ORPI).

Sporobolus cryptandrus (Torr.) A. Gray Sand Dropseed

Small to medium perennial clumping grass; locally common along old irrigation ditches with running water in sandy soil in old fields; flowering in summer and fall.

90-474 (24 Oct 1990).

Sporobolus pyramidatus (Lam.) Hitchc. Whorled Dropseed; *zacate piramide*

S. pyramidatus Swallen

Summer ephemeral; seasonally abundant and widespread on floodplains of Aguajita Wash, on sandy lower bajada flats, along irrigation ditches in old fields, and in moist soil of alkaline flats.

88-420 (14 Sep 1988); *Van Devender s.n.* (30 Aug 1978, ARIZ, ORPI).

Tridens muticus Torr. A. Gray var. **muticus** Slim Tridens

Perennial; infrequent on north-facing, mostly higher, rocky slopes.

88-117 (29 Mar 1988).

Vulpia octoflora (Walt.) Rydb. Six-weeks Fescue

Diminutive winter-spring ephemeral; widespread and seasonally common, rocky slopes, flats, washes, and old fields.

88-116 (29 Mar 1988), *88-265* (6 Apr 1988).

Potamogetonaceae Pondweed Family**Potamogeton pectinatus** Pers. Slender Pondweed

Submerged aquatic in Quitobaquito Pond, seemingly perennial; locally abundant, forming tangled masses; flowering and fruiting during warmer months.

86-270 (13 Sep 1986), *87-295* (10 Nov 1987), *88-455* (14 Sep 1988).

Ruppiaceae Ditch-Grass Family**Ruppia maritima** L. Ditch-Grass

Submerged aquatic in the pond at Quitobaquito; locally abundant during hotter months of the year, probably annual. The peduncles are coiled, aligning the population with *R. cirrhosa* (Petag.) Grande, the inland form in western North America.

86-222 (23 Jul 1986).

Typhaceae Cattail Family**Typha domingensis** Pers. Cattail; *tule*; *uduvad*

Perennial herb to 2 m tall; formerly locally abundant at Williams Spring and Quitobaquito near the pond and springs. After the cattle were excluded and ultimately removed, *Typha* declined and *Scirpus* increased spectacularly.

In 1987 a few small colonies, apparently not reproducing, were observed in alkaline wet soil at seeps above Quitobaquito, and in summer 1989 a well-established colony was found along a ditch below the springs and to the northwest of the pond. In September 1988 a single colony, obviously a number of years old, was found at Aguajita Spring; we did not see it earlier in the year. There was a mass of large, old, and gnarled rhizomes, about 1 m across, and a number of fresh new shoots. These rhizomes had been exposed by the scouring flood of 21 August 1988. Apparently these rhizomes had remained dormant beneath the sand and gravel and a dense cover of *Baccharis salicifolia* and *Scirpus*. By December these cattails had reached nearly adult size. By spring 1990 the colony was thriving but had not spread. Used as foundation material for baskets (see *Jatropha cinerea*).

89-235 (19 Jun 1989).

Zannichelliaceae Horned Pondweed Family**Zannichellia palustris** L. Horned Pondweed

Probably annual; submerged aquatic at Quitobaquito Pond, forming tangled masses in shallow water and sometimes extending into streams and ditches.

Benson 9939 (5 Mar 1940); *20591* (9 Mar 1973), *86-270* (13 Sep 1987); *Mason 1676* (10 Apr 1958); *Peebles 14566* (5 Mar 1940).

DOUBTFUL AND EXCLUDED PLANTS

Adams (1971) listed more than a dozen species for Quitobaquito that we have not located in the field or in herbaria. Some may have been incorrectly identified, others may have been based on incorrect information (see below), and others might actually have been present.

Cactaceae*Opuntia parishii* Orcutt

O. stanlyi var. *parishii* (Orcutt) L. Bens.; *O. stanlyi* Engelm. var. *peeblesiana* L. Bens., as to type.

A specimen labeled "Quitobaquito" (*Nichol s.n.*, 27 Apr 1939, ORPI) resembles *O. parishii* rather than *O. kunzei* (Allan Zimmerman, personal communication, 1988). The specimen lacks reproductive structures, so it might actually be an immature specimen of *O. kunzei*, but we have not seen immature plants of *O. kunzei* in the region. *Opuntia parishii* occurs in the northeastern part of Organ Pipe Cactus National Monument but not near Quitobaquito. Since so many other of Nichol's specimens bear obviously incorrect locality information (Felger and Zimmerman, unpublished), this one too is likely to be in error.

Opuntia santa-rita Griffiths & Hare Purple Prickly-pear; gisoki²⁷

O. violacea Engelm. var. *santa-rita* (Griffiths & Hare) L. Bens.

This species is not known from the Monument or adjacent northwestern Sonora. We presume that Nichol's 1939 collection data are in error or possibly that he collected a cultivated plant. This species is easily grown from cuttings and often is seen as an ornamental plant in southern Arizona and northern Sonora ranches and towns. Benson's (1982:460) mapping of this species in Organ Pipe Cactus National Monument seems to be based on this specimen.

Quitobaquito, Nichol s.n. (27 Apr 1939, ORPI).

Ephedraceae

Ephedra aspera S. Wats. Mormon tea, *camutillo*, ku'ukpalk

Apparently occurring on the north side of the Quitobaquito Hills but not actually in our area.

On "40 mi Drive near Quitobaquito Spring," Ranzoni s.n. (13 Jul 1962, ORPI, as *E. viridis* Cov.).

Euphorbiaceae

Jatropha cardiophylla (Torr.) Muell. Arg. Limberbush; *sangrengado*; vax

Small shrub. This species is common in much of Organ Pipe Cactus National Monument but it does not extend into our area and has not been found in northwestern Sonora west of Sonoita. Nichol's and Ranzoni's collections probably were not made within our area.

On 50 Mile Drive, near Quitobaquito, on hillside, Ranzoni 182 (ORPI); Quitobaquito, Nichol s.n. (3 Mar 1939).

Papaveraceae

Eschscholzia mexicana Greene Mexican Gold Poppy; ho:hoi 'e'es

Spring ephemeral; flowers golden yellow-orange. The only record from our area is Nichol's collection. Since the data accompanying a number of his collections seem to be incorrect, this slightly extralimital record is suspect. This species does occur at slightly higher elevations just east of Lukeville, farther north in the Monument, and south of Sonoita.

Quitobaquito, Nichol s.n. (10 Mar 1939, ORPI).

Poaceae

Echinochloa crusgalli (L.) P. Beauv. Barnyard Grass

The report of *E. crusgalli* at Williams Spring (Bowers 1980:7) was based on robust specimens of *E. colonum* (Van Devender s.n., 31 Aug 1978) that superficially resemble *E. crusgalli*.

Hordeum arizonicum Cov.

The report of this species at Quitobaquito by Bowers (1980:7) apparently was based on a misidentified specimen of *H. murinum* (see species account, above).

Solanaceae

Lycium exsertum A. Gray

Hitchcock (1932:303) and Chiang (1981) reported this species for Quitobaquito on the basis of *McSwain* s.n. (9 Nov 1956, UC), however, we were not able to locate the specimen. This *Lycium* is known from the Ajo Mountains and elsewhere in southern Arizona, but we have not found it in the vicinity of Quitobaquito. *Lycium exsertum* is closely related to *L. fremontii*, and the two are often confused.

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