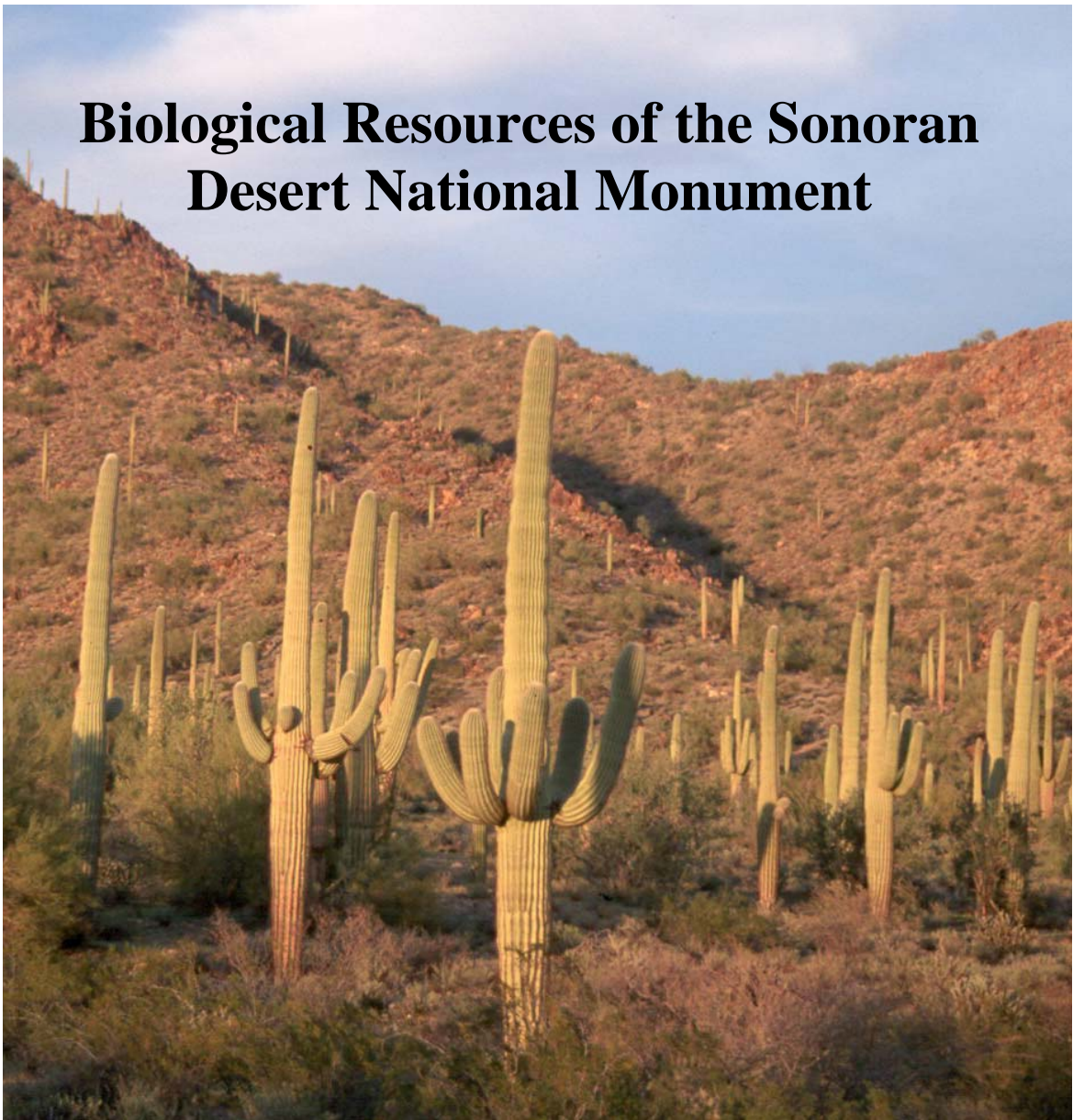


Biological Resources of the Sonoran Desert National Monument



Biological Resources of the Sonoran Desert National Monument, Arizona

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In memory
of
Constantine S. Niarchos

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VOLUME 2: Systems Analysis of the Sonoran Desert National Monument

EXECUTIVE SUMMARY

This report is yet a work in progress. It compiles available information about the biological resources present in Sonoran Desert National Monument, located in south central Arizona. We documented the species richness of the Monument by searching the scientific and agency literature, collecting specimen information from the University of Arizona, interviewing biologists who have done field work in the area, and adding the results of our own research activities. We found that the Monument contains a wealth of plants and animals, including at least 10 amphibian, 36 reptile, 28 mammal, and 159 bird species. We determined the presence of at least five species with current state or federal special status: desert tortoise, cactus ferruginous pygmy-owl, Swainson's thrush, lesser long-nosed bat, Sonoran pronghorn, and the Acuña cactus. In addition to large, well-recognized species such as desert bighorn sheep, the area contains a number of unprotected species endemic to the Sonoran Desert which have relatively limited distributions in the U.S. These include the Sonoran green toad, lowland burrowing treefrog, and Abert's towhee.

The documented flora of Sonoran Desert National Monument is based primarily on collections and explorations since 1994, when botanists began to recognize the unique elements of the flora. Our field work during 2000 and 2001 is the first truly extensive botanical work in the Monument. To date, 402 plant species have been documented, representing 260 genera in 71 families. Given the area yet to be explored, we estimate that the Monument holds approximately 500 species of vascular plants.

The Monument ranges in elevation from about 800 to 4300 feet, and lies on the edge of the Arizona Uplands subdivision of the Sonoran Desert. At lower elevations, to the west and northward is the Lower Colorado subdivision. The higher elevations of the Monument hold relict populations of chaparral vegetation, stranded after the last ice age. Rare or endangered plants include the Acuña cactus (*Echinomastus erectocentrus* var. *acunensis*), Kofa Mountain barberry (*Berberis harrisoniana*), and the milkweed vine *Matelea cordifolia*. There are 20 species of cacti, some of them of special biological interest.

Mountains in the Monument harbor important populations of desert tortoise and desert bighorn sheep. Valleys there support unique assemblages of desert amphibians and form important corridors between naturally isolated populations of montane mammals such as bighorn sheep and mountain lion. Major threats to biological resources in the Monument include livestock overgrazing, off-highway vehicle use, utility corridors, increased road traffic or new roads, and invasive non-native species.

The Monument is adjacent to rapidly expanding large urban areas, and adverse impact threats will likely continue for some time. The remoteness of much of the Monument as well as Wilderness Designation are positive factors for habitat protection. The Monument is vast, diverse, awesomely magnificent, and of great cultural, economic, esthetic, and biological significance. There are significant areas of upland desert habitats and interconnected valley corridors. The Monument is contiguous with six and one half million acres of protected, public lands in southwestern Arizona and northwestern Mexico. The Monument offers strong support for a proposed binational peace park embracing seven million acres.

INTRODUCTION

On a warm spring day the desert breeze is alive with buzzing insects and the smell of yellow palo verde flowers. Climb to the top of a desert wilderness mountain – Sand Tanks, Javelina, Table Top, or the Maricopas – and look out across a vast primordial American desert empire. On just a one-day hike, you may encounter more than 100 species of plants, not bad for a desert. It is not a static place. It is a meeting place, an ecotone, of diverse plant communities, resulting from millenia of comings and goings of dynamic plant communities. The valley floors are seemingly endless stretches of creosotebush and bursage. Depending on which mountain in the Sonoran Desert National Monument you choose, and whether you climb from the north, south, east, west, or go up a hanging canyon, or follow a ridge, you pass different arrays of species in a continuum of change.

Biologists tend to find glory whenever they visit the remaining wildlands on this planet, so it should be no surprise that we are keenly interested in the plant and animal life of the Sonoran Desert National Monument. This piece of Sonoran Desert is like no other. The Monument is something different because it encompasses so many different habitats – from grassy valley-bottom floodplains to the strange woodlands of spinescent elfin trees on the mountaintops. On a larger scale, the region is a biological bridge between the torrid summer-rain lowlands to the south in Sonora, Mexico, the hyper-arid lowlands of the Lower Colorado phytogeographic portion of the Sonoran Desert to the west, and the winter-rain desert and chaparral of Arizona’s Mogollon Rim. In the jargon of biologists, it’s a corridor, for plants and animals and the genes they carry – and hence the future of their species.

Even by itself the Sonoran Desert National Monument is significantly large – a bit less than one half million acres. The half dozen major mountain masses and ranges are complex, each supporting a unique array of plants and animals due to such differences as mass and morphology, elevation, rock and soil type, directional orientation. These differences affect soil moisture – the single overriding limiting factor in the choreography of desert plants and the animal life that depends on them. In addition winter freezing can limit plants of southern or more tropical affinity.

Valley floors are mostly the flats of creosotebush and bursage, an expanse of die-hard shrubs dissected by usually dry watercourses bordered with a trinity of desert legume trees – ironwood, mesquite, and palo verde – and more. These expanses, often considered among the harshest of American desert habitats, have just a few species of long-lived plants (perennials), dominated by creosotebush. Towards the south end of the Monument a vast drainage systems spreads across the wide Vekol Valley, puddling up the valley with deep, poorly draining clay soils. This valley bottom has a unique grassland, and many earthen check dams strewn across the Vekol Wash and its tributaries hold the temporary water for months after the last big rain, or sometimes even the year around. These valley floors explode with life when the summer “monsoon” rains arrive. Desert toads emerge from the soil to breed in the puddles and ponds. On such hot, humid nights the soggy ground is sometimes a solid sea of croaking and breeding frogs and toads. And numerous other desert creatures emerge from their burrows to drink. Swarms of ants and termites fill the air with their nuptial flights.

Here and elsewhere in the Sonoran Desert, the extreme droughts are more ordinary than the times of flowering and greenness. When the unpredictable rains do occur, creosotebush leaves expand and annual plants – the desert wildflowers – spring forth from seed banks in the soil. The desert annuals are called ephemerals, because they complete their life cycles within a single season or less. Each season in each year may bring a different species spectrum: some appear only with summer rains, and others only with cool season rains. A few may grow at any time of the year. The vast majority of species of the valley floors are desert ephemerals or annuals, and you will only see them following sufficient rains. More than 60% of the plant species of these plains and valley floors are desert annuals. And the numbers of annual species are even greater on the rocky upland slopes, canyon bottoms and mountain tops, but in these places there are also many more perennial species than across the desert flats.

Invisible to the casual visitor are the soil surfaces characteristically held in place by cryptogamic crusts of blue-green and green soil algae, bacteria, diatoms, fungi, and lichens, which can contribute significant nitrogen to desert ecosystems. The microphytic crusts are fragile and it is well known that their destruction can be a major factor contributing to global desertification and the great dust storms now spreading across the globe.

Where the groundwater isn't too deep there is an occasional woodland, or *bosque*, of mesquite, seasonally festooned with vines such as desert species of clematis, milkweed, morning glory, and others. In the southern reaches of the Vekol Valley is a dense grassland. The Vekol Valley Grassland Area of Critical Environmental Concern in the southeastern corner of the Monument represents this habitat. The mid-elevations of the Monument are the classic Sonoran Desert Upland landscapes of movie backdrops and calendars. You needn't be a botanist to appreciate the giant cactus forests.

Hike up any of the major mountains in the Monument and you witness a gradual, and then towards the top, an accelerated change in the vegetation. You will find differences between the hot, arid south and west slopes and north-facing slopes where there is longer lingering of soil moisture and seasonally more shade. These mountains, including the Bureau of Land Management (BLM) wilderness areas in the North and South Maricopas and Table Top Mountains, protect islands of complex habitats. Intervening valleys preserve the critical corridors between them.

Botanists have described over thirty distinct plant communities within the Sonoran Desert of Arizona and Mexico, giving them names like the "palo verde-ironwood association." Yet none of these designations describe the strange vegetation at the highest elevations of the Monument, where plants stranded after the last ice age survive just above a mix of species of subtropical origin. Frost-sensitive species like the elephant tree occur on certain south-facing slopes. The canotia crucifixion-thorn, a plant of winter-rain upland desert-margin generally found northward in Arizona is characteristic of the mountain-top vegetation. The highest elevations also harbor relict populations of junipers, oaks, and rosewood typical of cooler mountains, and various rare desert plants such as the Kofa Mountain barberry. This big, glossy-leaved shrub is known from precisely three canyons, and one of them is at the Monument's southern margin in the Sand Tank Mountains. It survives there now not only

because of the peculiar climate, but because of the wilderness. Neither cow nor machine has ever visited the Kofa Mountain barberry.

Wilderness is why you can still find an essentially intact Sonoran Desert ecosystem in the Monument: the giant cactus forests, the forever views across creosote flats, the shockingly luxuriant displays of wildflowers and the hazy green grassy places that show up after a good winter-spring rain. For the last century it has been an accidental wilderness, protected by its distance from population centers, poor roads, and by the permit requirements and no-grazing regulations of the military. Its future will be determined by the deliberate choices of our generation, now made easier by establishment of the Sonoran Desert National Monument.

A brief history of the Sonoran Desert National Monument

The Sonoran Desert National Monument (Figure 1), designated by President Clinton on January 17, 2001, is managed by the Phoenix Field Office of the Bureau of Land Management (BLM). Michael Brown is the Monument's first manager. Creation of the Monument grew out of concern over the disposition of about 75,000 acres of land known as "Area A," controlled and managed by the U.S. Air Force as part of the Barry M. Goldwater Range. This rather unromantic label was hung on the southern and most massive part of the Sand Tank Mountains. By the early part of the year 2000, the military decided to give up Area A. There were immediate concerns for its future conservation and management because it included some of the Sonoran Desert's most magnificent landscapes and natural habitats. The new Monument's southern boundary arbitrarily zig-zags across Area A, leaving about half of the Sand Tank Mountains region with the military and the northeastern half in the new Monument. It is hoped that there will be some minor re-alignment of this boundary to include crucial habitat and populations of animals and plants now just barely excluded from the Monument.

The Sand Tank Mountains of Area A formed the northeastern corner, albeit a large "corner" of the 2.5 million acres of protected lands in southwestern Arizona that many citizens would like see turned into the Sonoran Desert National Park. Most significantly, these lands are contiguous to an additional 4 million acres of protected land in northwestern Mexico (Broyles et al. 2001; Felger and Broyles 1997). The Sand Tank Mountains area includes "upland" desert animals and plants not found elsewhere in this vast linkage of adjacent protected lands.

Many people and organizations contributed to the formation of the new National Monument. The early concept was championed by Dean Bibles and Bill Broyles working with Tom Fry, director of the BLM, as well as Ann Shields and Ken Smith, also of the Department of the Interior (BLM). Bruce Babbitt, Secretary of the Interior, liked the concept and the stage was set. In addition, there were other land issues in large tracts of adjacent BLM lands, much of which was already officially designated as Wilderness (e.g., the Table Top Mountains and the North and South Maricopa Mountains). Following public hearings, Secretary Babbitt set into motion the creation of the Sonoran Desert National Monument, embracing almost one half million acres, nearly all of which were already held by the BLM.

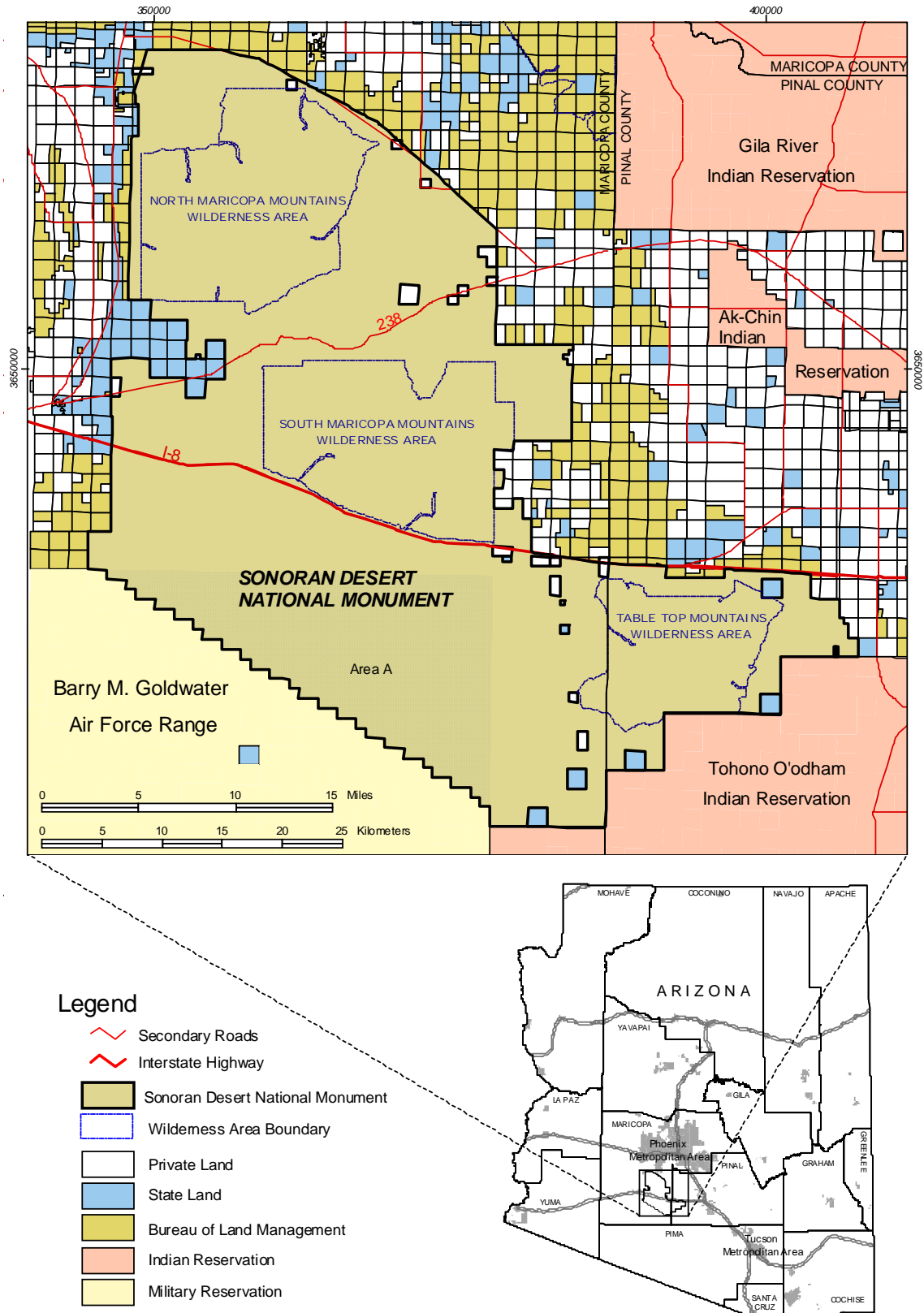


Figure 1. Location and land management status for the vicinity of Sonoran Desert National Monument in Arizona (inset map: with major cities and towns shown in light gray, area of detail is indicated).

A diverse array of conservation organizations championed the popular concept of the Monument: Arizona Archaeological Society, Arizona League of Conservation Voters, Center for Biological Diversity, Defenders of Wildlife, Drylands Institute, Friends of Cabeza Prieta, Hia c'ed O'odham Alliance, Land & Water Fund of the Rockies, National Parks Conservation Association, The Nature Conservancy of Arizona, Sierra Club, Grand Canyon (Arizona) Chapter, Sky Island Alliance, Society for American Archaeology, Sonoran Desert National Park Friends, Sonoran Institute, Southwest Forest Alliance, Tucson Audubon Society, Tucson Herpetological Society, and the Wilderness Society. A preliminary report on the biological resources by Drylands Institute helped provide Secretary Babbitt's office with justification for a Presidential proclamation.

The Sentinel Plain, covering about 25,000 acres to the west of the present Monument, originally was included in the Monument Proposal. There remain strong ecological and archeological reasons to include the Sentinel Plain, but unfortunately this extreme desert plain was, ultimately, omitted. The Sentinel Plain possesses scant potential economic value, but remains an important buffer for training activities on the Goldwater Range. The Monument boundary originally included several thousand acres of Arizona State Trust Lands and it was presumed that these lands would be included in the Monument, but this has not been accomplished to date. Some sections of private land also were removed from inside the Monument. These excluded lands are small in comparison to the total land area of the Monument, but are important to its future integrity.

The significance of the Monument extends far beyond its nearly half million acres. The Monument sits between the southwestern margin of the ever-expanding metropolis of the greater Phoenix area and contiguous millions of acres of protected lands stretching to the south and southwest across the heartland of the Sonoran Desert. The world now has nearly 7 million acres (3 million hectares) of linked preserves. We have the opportunity to create a vast international peace park (Broyles, Felger, and Bowden, 2001). There is nothing like it anywhere else in the world. These lands are yet in near pristine ecological condition – no other desert region in the world can match this ecological wealth.

PHYSICAL LANDSCAPE

Areas within the Monument

Figure 2 illustrates the major physiographic features of Sonoran Desert National Monument, which encompasses 496,337 acres. It includes three distinct mountain ranges – the Maricopa Mountains, the Sand Tank Mountains, and the Table Top Mountains – as well as the Booth Hills and the White Hills. The Sand Tank Mountains are a long and complex series of mountains and hills. Javelina Mountain is a huge, eastern outlier of the Sand Tank Mountains and has its own small foothills. These mountain ranges are separated – and biologically linked – by intervening valleys and desert plains such as the Vekol Valley and the outlying Rainbow Valley, Sauceda Valley, and Gila Plain.

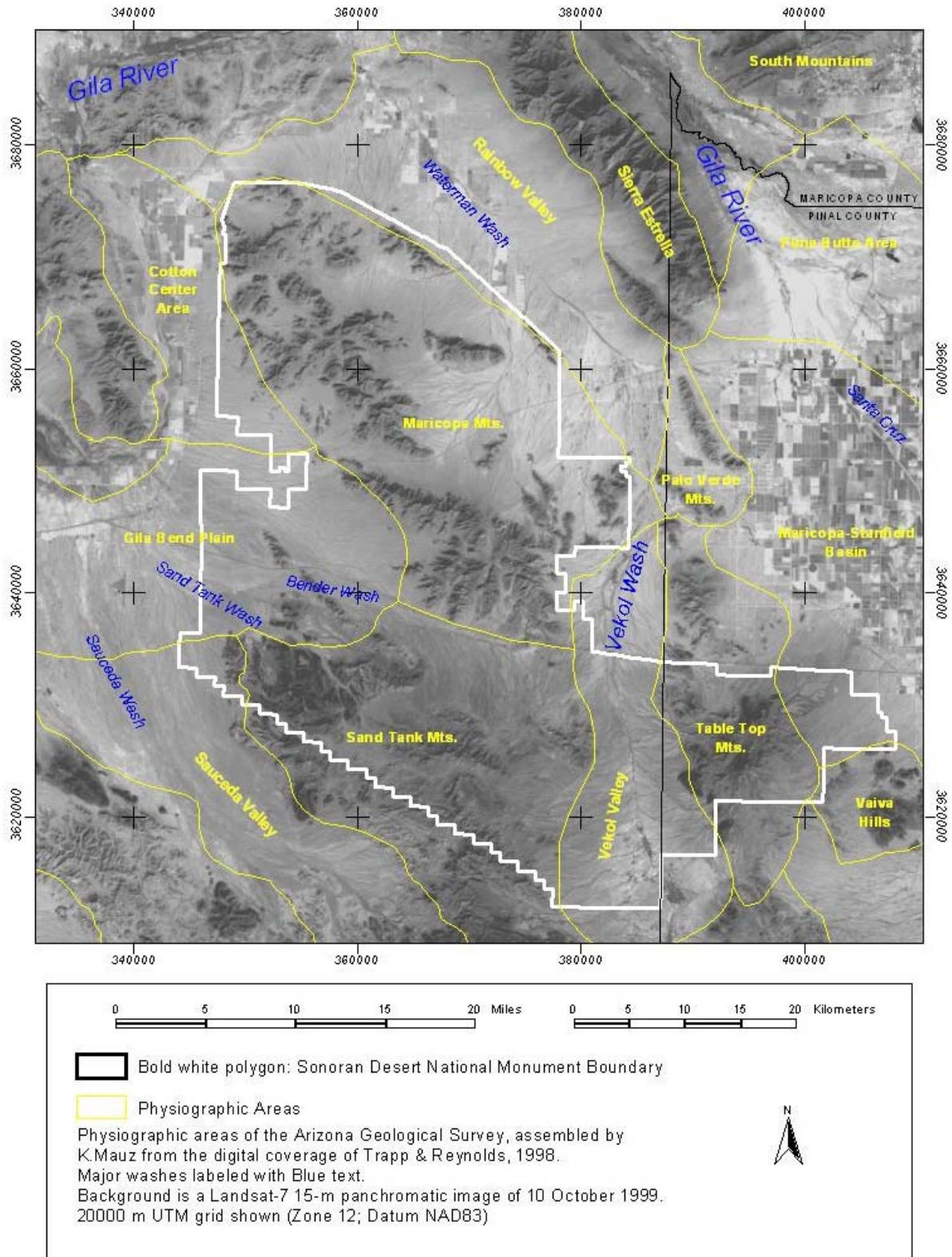


Figure 2. Major physiographic features of the Sonoran Desert National Monument.

Maricopa Mountains

The Maricopa Mountains contain the site of an important ongoing study of desert tortoise mortality and reproduction, which may have important implications for tortoise management throughout the Sonoran Desert (Wirt & Holm 1997; see discussion under Reptiles). The BLM has classified 24,880 acres in the Maricopa Mountains as crucial desert tortoise habitat (BLM 1985).

The Maricopa Mountains support a robust population of desert bighorn sheep, estimated in 1994 to be 200 animals (BLM 1995). It has been used as a source of bighorns for transplanting to other areas (Gene Dahlem, personal communication to Ted Zukoski).

Little Rainbow Valley, Mobile Valley and Espanto Mountain

The alluvial plain of Little Rainbow Valley, east of the Maricopa Mountains, and the inselbergs (small bedrock outcrops) in it, such as Espanto Mountain, have significant biological values. They provide the corridors for wildlife movement between mountain ranges. For example, a mountain lion was observed crossing the low ridge of Espanto Mountain from east to west, apparently traveling from the Sierra Estrella to the Maricopa Mountains (Betsy Wirt, personal communication). Such outcrops may provide “stepping stones” within migration corridors for movement of desert bighorn sheep (Bleich et al. 1990), and may be critical to maintaining a viable bighorn population in the Sierra Estrella, which is otherwise isolated by spreading urbanization from Phoenix.

Espanto Mountain, though small, provides what may be a vital refugium for desert tortoises (Wirt & Holm 1997; see discussion under Reptiles). The Sonoran green toad apparently persists as a breeding population about five miles west of Mobile, Arizona (Sullivan et al. 1996).

Table Top Mountains

Table Top is the biggest and most massive mountain in the region. It has an expansive mesa-like summit over 4,000 ft high, reaching 4373 feet at its highest point. All the other mountains in the region have small footprints, their summits rise sharply to narrow ridges or pinnacle peaks. A campground several miles west of the base of Table Top is at the end of the public-access road. A trail leads through outwash arroyos and canyons across upper bajada and granite foothills, all with alluvium of Pinal Schist – the oldest rock in the region, dating to 1.7 billion years.

The few dark volcanic foothills south of Table Top are spiked with lime green palo verde trees and ocotillos. The varnished rocks on these hills turn a deep, burnished red at sunset and a cold, icy midnight blue under clear nights with a full moon. The low, rounded foothills made of granite are coarse and dry, favored by teddy bear cholla. Palo verdes in the foothills shelter colonies of annual herbs and stands of the perennial *Muhlenbergia porteri* under their canopies, forming hideouts for creatures and forage opportunities for cows. *Croton sonorae* lurks only along a few of the major, lower-elevation washes on the south side of the

mountain. These shrubs are conspicuous only in the winter when they are decorated with leaves fading from green to red at the same time that other shrubs have all lost theirs during the late autumn dry season. These wash margins support a wide array of shrub species that do not occur or are uncommon at higher or lower elevations in the Table Top Mountains, such as desert hackberry, ambrosia, *Ditaxis lanceolata*, and *Abutilon incanum*.

As you approach the base of the mountain, the trail rises steep and fast, switchbacking up the southwest side. A morning hike brings you to the top – a fantasy land strewn with dark basalt boulders, banana yuccas, prickly pears, perennial grasses, misshapen shrubs and an elfin forest of canotia. You really get the feel of being on top of the world, and feeling good because you are no longer climbing up a steep, rock-strewn trail. You have the feeling of a real desert sky island – although it can be argued that you are in the same biome. It is unlike anything else in the Sonoran Desert. You quickly encounter more and more species not seen below. The mesa top ends abruptly in cliffs falling away to the bottom of the mountain. The view out across the desert goes on and on, in all directions, across a quiet desert empire.

Table Top is best known for its isolated tobosa grassland on the 107-acre mesa top. The area also supports populations of desert bighorn sheep and desert tortoise and was proposed as a protected natural area by the Arizona Academy of Science (Smith 1976). Missing on top are saguaros, selaginella, palo verdes, ironwood, mammillarias, etc. Ironwood actually drops out near the base of the mountain, long before agaves begin to appear at about 3200 feet.

The mesa summit is not homogeneous – it is not the same from one end to the other. Parts are level. Another parts dips northward to a narrow saddle atop a big fault, separating the south summit from gradual rise of the north summit. Each change in slope, aspect, and drainage pattern gives a different species spectrum. The saddle and a large part of the north mesa-summit have nearly 100 percent cover of perennial, summer-growing grasses including tobosa (*Pleuraphis mutica*), grama (*Bouteloua curtipendula*, *B. repens*, *B. rothrockii*), bush muhly (*Muhlenbergia porteri*), plains bristlegrass (*Setaria leucopila*), and sand dropseed (*Sporobolus cryptandrus*).

Vekol Valley: the valley named after the color of grass

The fine soils of the valley bottoms in this site support extensive and unmodified examples of the mesquite-annual floodplain association and tobosa grasslands. The Vekol Valley contains one of the Sonoran Desert's largest tobosa grasslands (TNC 2000). Such grasslands may have once stretched along the 40-mile length of Vekol Wash to its confluence with the Santa Cruz River, but they currently occupy only a 300-acre remnant that is now within the area of the Monument (BLM 1988a).

Seasonal wetlands in the Vekol Valley provide vital breeding habitat for a unique assemblage of ten desert toad and frog species. The area was designated a BLM Area of Critical Environmental Concern (ACEC) to protect these biological values (BLM 1988a). Historically, Sonoran pronghorn occupied the Vekol Valley (USFWS 1998), so it may be important for recovery of the species.

It takes about 15 miles to go 300 feet upgradient heading south into the Vekol Valley from Interstate 8. Javelina Mountain is an imposing ridge several miles distant to the west. Table Top looms to the east beyond foothills darkened by a rubble surface of basalt. The nearer White Hills gleam, as their name implies, with the ancient, mica-rich Pinal Schist that holds up these ranges. The dark spine of the Sand Tank Mountains sits flat against the sky to the southwest. To the south, the view is purely vast: the huge bajadas fanning out to become the floor of the Vekol obscure the peaks to the south, which appear only as low knobs roughening the horizon.

The Vekol Wash, a ghost tributary of the Gila River, is a broad, gravel-floored channel strung down the center of the valley. It is the midvein to a network of tributary washes that lie altogether like a skeletonized leaf across the broad piedmonts of the Table Top and Sand Tank Mountains on either side. The Vekol bosque is a dense tangle of tall mesquites, foothills and blue palo verde, ironwood, and desert willow. Its understory is a complicated matter. Shrubs – wolfberry, graythorn, ambrosia – crowd near the wash margins where the canopy is more open. Shade-loving herbaceous plants pack themselves in among the stems and trunks of the woody species. Vines and other clambering plants, including pipevine, spiderling, morning glory, and clematis, twine among and hang from the branches of the overstory.

The first terrace above the channel is alternately occupied by creosotebush and desertscrub. Old saguaros, arms twisted and riddled with woodpecker holes, are widely scattered, as are even more occasional soaptree yucca. Both make preferred perches above the flat for hawks, falcons, and a great horned owl. A wet spring fills the typically scoured interstices with miniature bladderpod mustard plants bearing brilliant yellow flowers. Further toward the mountain fronts, desertscrub prevails and saguaro and palo verde form dense stands, intermixed with ironwood, cholla cacti, ocotillo, and many subshrubs, along the full length of the valley. In May, the bajada glows yellow from a distance with the combined floral displays of thousands of palo verde. Up-close it is just a din of bees and a slow storm of confetti as the flowers fall from their trees in the warmest breezes of the foreshummer.

On a hot afternoon, antelope jackrabbit loll in the dusty, sometimes rutted road down the valley, perhaps one every quarter mile. Rattlesnakes sometimes are lying there, too, and vibrate their tails madly at the intrusion of the passing car. Maybe three fifths of the way to the head of the Vekol, the Vekol Valley dike system begins, a series of barriers to erosion that have fostered growth of mesquite forests and communities of herbs and amazing creatures in the ponds that form in the trough-shaped depressions behind each of the earthworks. Desert pavement at this upper end of the valley is closely-packed and heavily varnished, suggesting long stability of the surface in the places where it remains. Elsewhere, however, headward erosion and rill incision is occurring where ground has been trampled and stripped bare of its protective, fragile vegetation by the long-time activity of cows.

At the upper, southern end of the Vekol, breaking out of the bosque to an expanse of extraordinarily flat bottomland, a streak of silver stretches across the distant foot of melted hills on the Tohono O'odham lands. At first it might appear as a mirage, because it hovers there, in the distance which is always shimmering, just above what appears to be the surface

of the flat. But all around, around one's feet and across the relictual channels amid the silt, there is this tangle of grass, glaring white grass. This is the tobosa grassland of the Vekol Valley, a relict just as much as the Pleistocene woodlands on the highest summits of the Monument. It is isolated in time as well as space; this spot is one of the most removed from everything that the Monument possesses within its borders.

Crickets chirp incessantly from within the bunches of tobosa. Timid, colorful spring herbs peek from within the clumps. Cane cholla grows here, one of the few places it occurs in the valley. Scarred and gnarly koeberlinia – one of the infamous, and most painful, all-thorns – hunker near old stumps of long-gone trees, amid stands of young mesquite that deceptively occupy much of the area of the grassland itself. Heavily browsed bunches of the grass are apparent, though some appear to be thriving. It is only from a vulture's-eye view that the widespread degradation can be appreciated, that on the other side of the barbed wire and the post gate the grass is dense and the mesquite few. In the late afternoon, the silver grass glows even hotter as the surrounding silty flat turns deep orange and the distant hills turn smoky gray. Coyotes yip from their balcony seats on the earthworks. The effect is haunting and inspiring, as much as the history and the future of the valley, its bosque, and its grassland.

Sand Tank Mountains

Biologically, the Sand Tank Mountains are the best-known portion of the Monument, thanks largely to research support from Luke Air Force Base.

The palo verde-mixed cacti association in the Sand Tank Mountains is one of the most structurally complex examples found in the Sonoran Desert, both in terms of species composition and evenness of plant distribution. Among the outstanding features found here are the high density of leguminous trees and cacti and the prominence of grasses, including summer annual grasses (*Bouteloua barbata*), curly mesquite (*H. belangeri*), bush muhly (*Muhlenbergia porteri*), and tobosa grass (*Pleuraphis mutica* [*Hilaria mutica*]). Exceptionally dense stands of saguaros are common. Javelina Mountain supports the northernmost specimens of organ pipe cactus (*Stenocereus thurberi*) (TNC 2000).

An unusual combination of plant species at the higher elevations of the Sand Tank Mountains is rarely found in this ecoregion. The only similar combination of plants occurs at the upper elevations of the Ajo Mountains. Unusual species include *Juniperus coahuilensis*, *Vauquelinia californica* ssp. *sonorensis* (ecoregion endemic), *Yucca baccata* and *Berberis harrisoniana*. The population of *Canotia holocantha* is disjunct from the main body of the species' range in the Mogollon Rim country of central Arizona. Kofa Mountain barberry (*B. harrisoniana*) is found only in the Kofa, Ajo, and Sand Tank Mountains (TNC 2000).

The saguaro forest around the Sand Tank Mountains is used for foraging by the lesser long-nosed bat (Dalton et al. 1994) and nesting by a wide variety of birds, including elf owls and western screech-owls (Hardy 1997). The mountain range contains twelve of The Nature Conservancy's conservation targets for the Sonoran Desert (Marshall et al. 2000).

The Sand Tank Mountains population of desert tortoise was considered sufficiently isolated to serve as a “control” site in a study on the distribution of tortoise diseases and the potential for disease transmission by the release of captive tortoises (Dickinson et al. 1996).

Physiography

The area of the Sonoran Desert National Monument includes three prominent mountain ranges, their inselbergs, and parts of three intervening basins. Mountain summits range from about 2700-2900 feet elevation in the Maricopa Mountains, to just over 4000 feet elevation in the Sand Tank Mountains (Javelina Mountain, 4085 feet), and to 4373 feet elevation on Table Top in the Table Top Mountains. Mountain fronts tend to be highly sinuous and deeply embayed. Pediments and piedmonts flanking these ranges reflect surficial processes and landform evolution of the last two million years, from latest Tertiary to Holocene time (Demsey 1989).

The major valleys within the Monument area range from about 1600 feet to 2000 feet elevation. An extensive tributary drainage system in the Vekol Valley drains the west and north slopes of the Table Top Mountains, the eastern Sand Tank Mountains, and the southeastern Maricopa Mountains. The Vekol Wash turns east, entering Pinal County at the Haley Hills, and joins the Santa Cruz wash network near its confluence with the Gila River east of the Sierra Estrella. The east side of the Table Top Mountains drains to the Santa Rosa Wash which occupies the broad Maricopa-Stanfield Basin.

North of the Vekol Valley, tributaries of the Waterman Wash drain the eastern slopes of the Maricopa Mountains. The axial drainage continues northwest through the Rainbow Valley to join the Gila River just east of the Buckeye Hills. More or less parallel major drainages, including Bender Wash, Sand Tank Wash, and Saucedo Wash, drain the northern and western sides of the Sand Tanks and the western Maricopas, crossing the Gila Plain to the Gila River west of the communities of Bosque and Gila Bend.

Bedrock Geology

Figure 3 illustrates the distribution of rock types and deposits discussed in the text. Lower Proterozoic metasedimentary rocks (principally the Pinal Schist) occur throughout the Table Top Mountains, in the central Sand Tank Mountains (including Javelina Mountain and the White Hills in the western Vekol Valley), and in the southern Maricopa Mountains. These rocks are fine-grained, composed predominantly of muscovite and quartz with minor other and accessory minerals (K. Mauz, personal observation; Peterson et al. 1987). Exposures can range from very steep ridges to rounded hilltops, and slopes generally appear grayish or even silvery from a distance. The schist typically weathers along-foliation, the fragments becoming lozenge-shaped clasts in alluvial settings.

Granitoid rocks of similar (Lower Proterozoic) age, including porphyritic and leucocratic granites, occupy the majority of the Maricopa Mountains. These lithologies form the Margies Peak and Sheep Mountain summits, neighboring Espanto Mountain, and can be seen in the vicinity of Butterfield Pass. Several mylonitic (brittle-shear or cataclastic-shear) zones

occur within this area (Reynolds & Skotnicki 1993; Cunningham et al. 1987). The Middle Proterozoic (1.4 billion-year old) Oracle Granite occurs in limited exposures in the Table Top Mountains and in the Sand Tank Mountains. The Oracle Granite, a pinkish-to-whitish quartz monzonite, forms low, rounded foothills. Texture varies from fine-grained, equigranular, and relatively coherent to coarse-grained and porphyritic (K. Mauz, personal observation; also see Peterson et al. 1987). Exposures of the latter expression disintegrate readily to grus-strewn slopes and coarse alluvium; fragments of the more compact form may persist in alluvial settings as cobble-sized clasts. Regardless of exposure, slopes underlain by this lithology seem to be more xeric than those underlain by the Pinal Schist in similar topographic settings. Small to extensive quartz pegmatites occur within the Oracle Granite in the Table Top Mountains and have contributed to quartz-dominated pavements in some of the piedmonts of this range.

Tertiary-age volcanic rocks of predominantly mafic composition occur in the southern Maricopa Mountains, the Sand Tank Mountains, and the Table Top Mountains. Only in the Sand Tank Mountains are these exposures aerially extensive. Rocks of basaltic composition occur with younger, tuffaceous rocks in the Maricopa Mountains (see Cunningham et al. 1987). Discontinuous, small outcrops of Miocene basaltic andesite occur in the northern Table Top Mountains (Peterson et al. 1987). The conspicuous caprock of the named peaks in the Table Top Mountains – Table Top, Antelope Peak, Indian Butte, and the south face of Black Mountain – is a Miocene-age olivine basalt, typically fine-grained and locally vesicular (K. Mauz, personal observation; also see Peterson et al. 1987). Boulders of this rock cover the middle slopes of Table Top and form a lag on one of the oldest piedmont surfaces in the range. On the south face of Table Top, fine-grained sediment, possibly of eolian origin, has accumulated in the interstices of the basalt boulders and appears to favor plant establishment. On the old fan remnant to the north, the soil intervening among the thickly-varnished basalt boulders is thoroughly covered with cryptobiotic “crust”. The boulder-strewn summit of Table Top is immediately underlain by a petrocalcic horizon.

Sedimentary rocks are uncommon in the Monument. Middle- to upper-Tertiary age conglomerates occur in the southeastern Maricopa Mountains with volcanic rocks of similar age (see Cunningham et al. 1987). A thin, poorly consolidated, Tertiary-age conglomerate underlies the olivine basalt caprock in the Table Top Mountains (Peterson et al. 1987). Small boulders of a fine-grained, dark gray limestone have been observed on the south face of Table Top (Pendall 1994) and embedded within the petrocalcic horizon of a high-standing piedmont surface in the northeast part of the range (K. Mauz, personal observation).

Alluvial Geology

Within the Monument, surficial geology has been mapped in detail in the northern Maricopa Mountains and in the Table Top Mountains. Chronostratigraphic estimates, either relative or absolute, are based upon attributes of the landform – including height above active channels and the morphology and incision of drainage networks developed on the surface of the landform – and attributes of the soil – including the degree of development of the petrocalcic horizon, development of varnish on surface particles, and development of pavement or lags

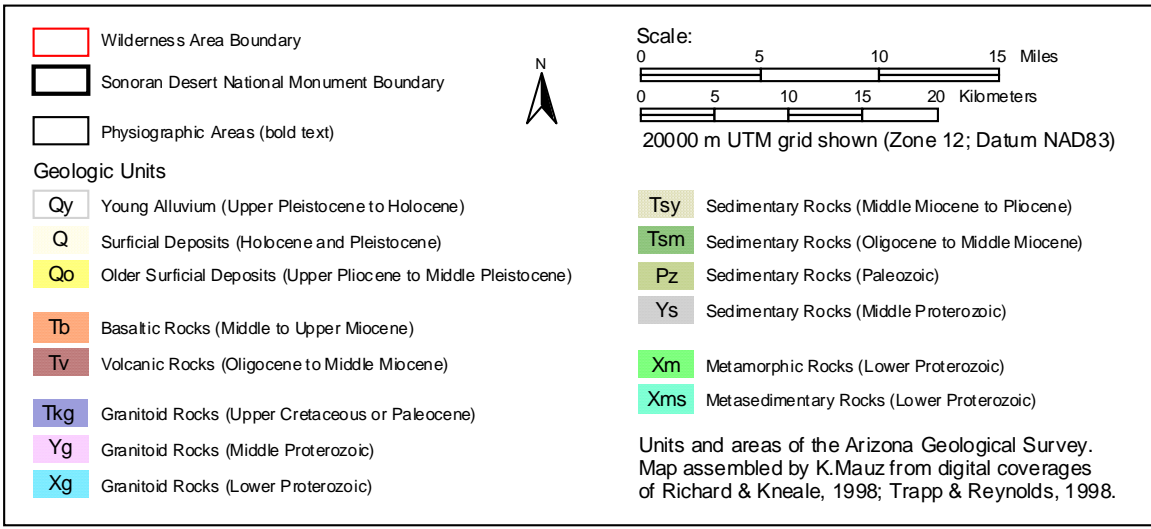
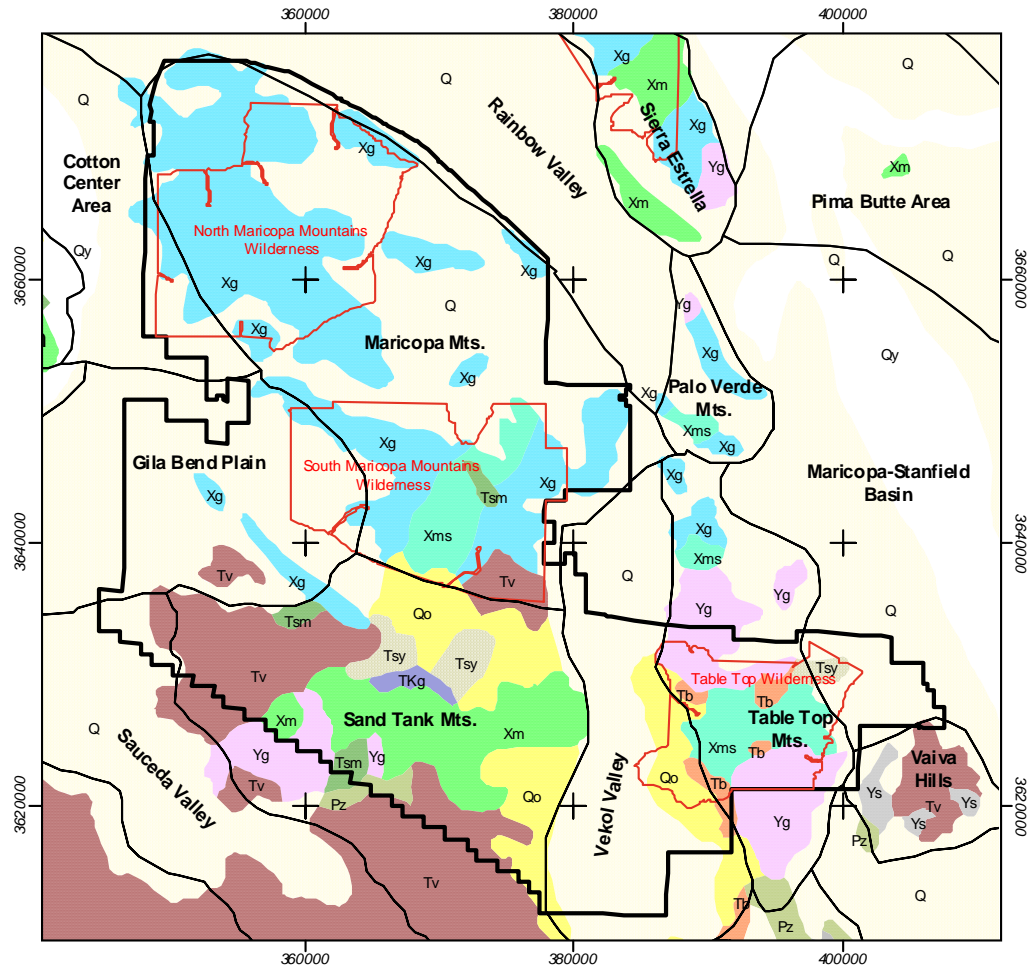


Figure 3. Generalized geologic map of the Sonoran Desert National Monument (see text for description of units and references).

of larger particles on the soil surface. Based upon these criteria, particularly on development of the petrocalcic horizon, and correlation with absolute-dated surfaces elsewhere in the Southwest, geomorphic surfaces of alluvial origin in the Monument have been assigned ages ranging from most recent (Holocene) to an estimated two million years old (late Pliocene or latest Tertiary) (Demsey 1989; Pendall 1994). Others who have worked in this area have noted difficulties in correlating discontinuous surfaces across space, either within or between ranges, owing to differences in aspect, topographic position, and lithology between deposits, and to slow rates of pedogenesis regionally (Huckleberry 1997).

In the northern Maricopa Mountains, the majority of the piedmont area is occupied by surfaces of middle- to late-Pleistocene age (10 ka-250 ka). Remnants of older (early- to middle-Pleistocene age, 250 ka-790 ka) surfaces are present within the range, particularly immediately adjacent to and adjoining the mountain front. Isolated fan remnants of this age are also present on the west side of the northern Maricopa Mountains between the mountain front and the Gila River. The Rainbow Valley and the Gila Plain are occupied by Holocene-age deposits (see Demsey 1989). A similar pattern is apparent for the Table Top Mountains. In the northeastern area, a few large remnants of Pliocene-age (>1.8 Ma) surfaces are preserved, with thin upper soil, underlying thick petrocalcic horizon, and planar bedrock pediment beneath. Early Pleistocene surfaces occur both adjacent to bedrock and as isolated remnants (ballenas) on all sides of the range. Pleistocene-age surfaces form the majority of the piedmont area around the Table Top Mountains, extending nearly to the Vekol Wash where these then intergrade with deposits of Holocene age (see Pendall 1994).

There are no significant playa surfaces in the Monument area. Likewise, eolian sand is quite uncommon, although eolian silt may occur on some piedmont and/or bedrock surfaces (K. Mauz, personal observation).



Granite in the South Maricopa Mountains (RSF).

CONSERVATION

Biological issues to be considered

In considering protection of biological resources of an area such as Sonoran Desert National Monument, there are several valuable insights offered by the discipline of conservation biology.

Bigger is better

Within conservation biology, the focus on large reserves stems from evidence that existing protected areas are not big enough to maintain viable populations of some species (Newmark 1995, 1996). For mammal communities, at least, there appear to be strong correlations between reserve size and species diversity contained within reserves (Brown 1971; Dunstan & Fox 1996; Newmark 1996). While small reserves may suffice to protect individual species with small area requirements, bigger is better for most community protection needs. Large areas of intact, native vegetation provide migratory birds with food resources and nesting habitat where this availability may be diminished in human-dominated or disturbed settings, particularly where creatures are heavily reliant upon temporally restricted resources (see Birds, this volume; Martinez del Rio et al. 2001; Wolf & Martinez del Rio 2000). Large areas can also help buffer the effects of spatial variability in the availability of resources. In general, bigger reserves suffer less from “edge effects” such as invasive non-native species and the impacts of human activities (Bierregaard et al. 1992; Newmark 1995).

Wilderness protects wildlife

The ecological effects of roads are well studied, and found to damage the biotic integrity of landscapes in many parts of the world. Negative effects include mortality from collision with vehicles, modification of animal behavior, alteration of the physical environment, spread of exotic species, and increased use by humans (Trombulak & Frissell 2000). Wilderness reserves have particular value by restricting roads, which would otherwise serve to extend edge effects into the interior of a reserve. In addition, some rare species have little tolerance for human disturbance and thus are best protected by maximizing the area without easy human access. There are at least five species with current state or federal special status known to occur or expected to be found within the Monument (Table 1). The inclusion of already-designated or de facto wilderness land into a larger Monument increases the likelihood of maintaining healthy biotic communities and a full complement of native species.

Corridors enhance reserves

Wildlife corridors can serve to greatly expand the effective area of reserves by connecting two or more reserves into a network. Corridors across what might otherwise be physical barriers or lethal threats (e.g., freeways, canals, urban development, farm fields) can maintain important ecological processes such as seasonal migration, dispersal of reproductively-active individuals (thus maintaining genetic diversity), and recolonization of areas where local

populations have been lost (Noss 1987; Beier & Noss 1998). Examples of functional corridors include wash crossings beneath freeways for mountain lions (Beier 1995) and undeveloped valley bottom between mountain ranges for desert bighorn sheep (Bleich et al.1990).

Major threats to biological resources

There exists a wide variety of factors which may damage the health and integrity of natural communities and native species in the Sonoran Desert (Nabhan & Holdsworth 1998), but the following are several which should be considered in current and future the management planning for the Monument.

Grazing

Cattle grazing in arid regions can damage a wide array of biological resources (Fleischner 1994). These impacts may include disturbance of soil crusts and stone pavement which help to stabilize soil, as well as direct impacts to vegetation. Within the Sonoran Desert, grazing causes long-term population declines in the saguaro cactus (*Carnegiea gigantea*) by removing or damaging nurse plants and inhibiting or trampling small saguaros (Steenbergh & Lowe 1977; Abouhaidar 1992). Following the removal of cattle from Saguaro National Park, it took more than two decades for measurable recovery of saguaro recruitment to appear (Turner & Funicelli 2000).

Permitted cattle grazing has been excluded from the Sand Tank Mountains for more than 50 years, but continues to the present through the remainder of the Monument. In places, the landscape reflects these different uses. Portions of the Sand Tank Mountains have an abundance of annual and perennial grasses that is notable when compared with other Sonoran desertscrub areas in Arizona, and the saguaro stand there is remarkable for its density. In contrast, parts of the Vekol Valley have suffered severe erosion and loss of vegetation caused by obvious overgrazing (Figure 4).

Off-road vehicle use

The environmental impacts of off-highway vehicles (OHV) in arid landscapes have been well documented, showing severe consequences to plant, wildlife, and soil resources (Sheridan 1979; Webb & Wilshire 1983). While three large portions of the Monument have been designated as Wilderness Areas and the former military lands in Area A have had OHV restrictions, the lowlands remain largely unprotected.

Of particular concern in the Monument is the (now cancelled) BLM-permitted OHV race held annually between the Sand Tank Mountains and Interstate 8. The “Gila Monster” race involves hundreds of trucks, dune buggies, and motorcycles driving at high speeds along an approximately 50-mile route of desert washes and dirt roads. Impacts include loss of vegetation in major washes, habitat loss and direct mortality of wildlife, and air pollution from the large dust plume created by each vehicle passage. While the BLM has cancelled this race, there is considerable pressure for it to be reinstated. Studies in the Mojave Desert

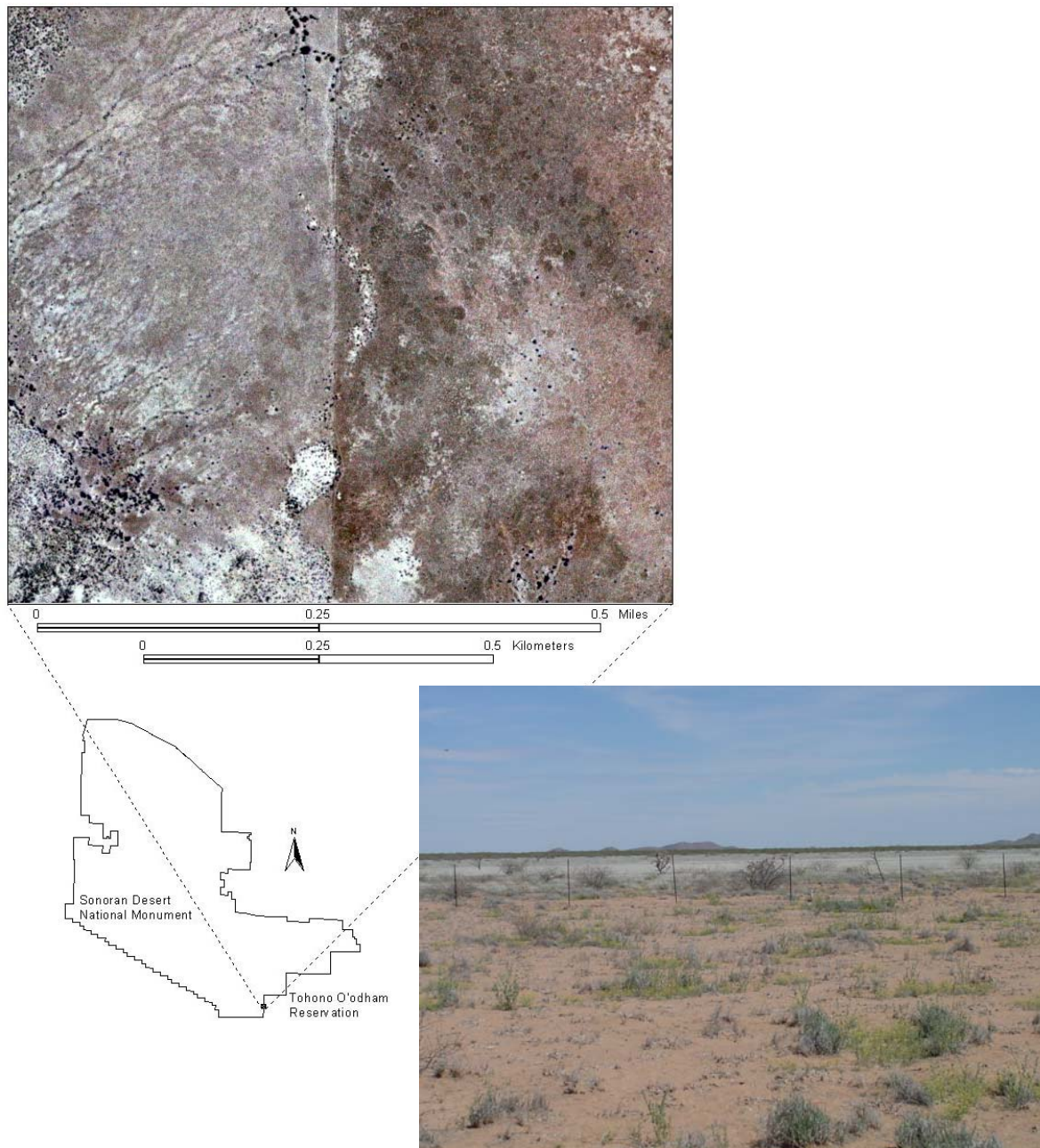


Figure 4. The area of the Vekol Valley tobosa (*Pleuraphis mutica*) grassland at the boundary of the Sonoran Desert National Monument (west half: T. 9 S, R. 1 E, E ½ of Sec.12) and the Tohono O’odham Reservation (east half: T. 9 S, R. 2 E, W ½ of Sec.7). The image above, left, is a color-infrared aerial photograph (DOQQ series June 1996, 1 m resolution) showing photosynthetic vegetation in reddish tones and bare soil in white; tree canopies show up as dark objects in this image. The general brightness (whiteness) of the west half is indicating generally less vegetative cover over the soil below, while the general redness of the east half indicates more vegetative cover (less soil showing through). This pattern may reflect long-term degradation of the grassland by livestock herbivory. The photograph shows a view of the same location from the ground. The Monument is in the foreground, the boundary fence crosses the center of the photo, and the grassland area on the Tohono O’odham reservation is in the background. (Imagery and map: K.Mauz; photo: R.Felger, 3-26-01.)

showed that large annual events cause significant long-term damage, and that their impacts tend to extend well beyond permitted boundaries (Wilshire 1983).

Other threats

Potential threats to any large natural area are, of course, numerous, such as too many visitors and uncontrolled access, ground water depletion from adjacent development, roads, and utility corridors. The highways traversing the Monument are major corridors for invasive species such as buffel grass. The giant saguaro forest along Interstate 8 shows severe rodent damage – the trunks are riddled with burrows and holes. It has been shown roads, especially paved roads, entice snakes and other important predators to their deaths (Rosen & Lowe 1994).

ANIMALS

Amphibians

Ten species of frogs and toads are known from the Monument (Table 2). These desert anurans all require water for breeding and development of the tadpoles. Many are active less than two months of the year – during the summer monsoon season (see Sullivan et al. 1996) – while some, living in permanent or longer-lasting waterholes, have longer periods of activity. Canyon bottom waterholes, or tinajas, such as in Bender Spring Canyon, and temporary ponds in Sonoran Desert valley bottoms provide the means for desert frogs and toads to thrive in the desert. The Vekol Valley is becoming famous for the frogs and toads that appear in amazing abundance during the brief summer thunderstorm season. On many a summer monsoon night the whole night seems to turn into screaming toads and frogs and, like the spring wildflowers during a favorable year, you cannot walk without stepping on one of these creatures.

The endemic Sonoran Desert green toad (*B. debilis*), rare in the U.S., is known in the Monument from Vekol Valley and lowland habitat about five miles west of Mobile. Such areas have been heavily altered by human activity, for better or worse, and any future management actions must take into account these issues.

Although the amphibian fauna of the Vekol Valley is not overly rich in terms of species diversity, it includes several anurans that are biogeographically quite remarkable. Southern Arizona is home to a number of species of amphibians and reptiles whose heartland lies in the Neotropics. While some of these species occur in the lowlands of tropical Mexico, at the latitude of Arizona they are largely restricted to high elevations where relictual populations persist in the Madrean Archipelago due to the presence of monsoonal moisture combined with moderate temperatures. Surprisingly, three species of Neotropical frogs that extend into southern Arizona meet the challenges of the arid Sonoran Desert lowlands head-on. These are the Lowland Burrowing Treefrog (*Pternohyla fodiens*), the Sinaloan Narrowmouth Toad (*Gastrophryne mazatlanensis*) and the Sonoran Green Toad (*Bufo retiformis*), all reaching

their northern limits in or very near the Vekol Valley. The Vekol thus represents the northern terminus in the American Southwest of the great lowland Neotropical anuran fauna.

The most interesting of these frogs is *Pternohyla fodiens*, which was discovered in the Vekol in August of 2000 (Enderson & Bezy 2000). This bizarre amphibian is one of several species of “casque-headed” frogs of the family Hylidae that are found in the American tropics. The casque head is a heavily boned skull that has protruding lip flanges and that is solidly connected (“co-ossified”) with the skin (Duellman & Trueb 1994). This feature facilitates burrowing in the mud of temporary ponds. Once buried in the mud at the end of the monsoon, the frog secretes a “cocoon” that retards dehydration (Ruibal & Hillman 1981). This frog is primarily a species of the tropical deciduous forest and thornscrub ranging from Colima, Mexico, to the Vekol Valley. Consistent with its occurrence in the Mexican thornscrub and tropical deciduous forest, within Arizona it is virtually restricted to dense mesquite bosques, which are spectacularly developed in the Vekol. Hearing the distinctive duck-like quack issuing from this broad-billed amphibian is truly one of the most thrilling experiences in the Sonoran Desert.

A second Neotropical frog that reaches its northern limit in the Vekol is *Gastrophryne mazatlanensis* (Jones et al. 1983). It represents an interesting example of an amphibian that combines two biogeographic patterns into one. As indicated by its name, it occurs in Thorn Scrub on the Pacific lowlands of Mexico. We use the name *G. mazatlanensis* for the narrow mouth toad in Vekol Valley, and in all likelihood it is not conspecific with the Great Plains narrowmouth frog *G. olivacea*. In Arizona, there are two population clusters. One is in the Madrean Woodland of the Pajarito and Patagonia Mountains, an example of a typical tropical deciduous forest-to-Madrean Archipelago pattern. The other northern population occurs in dense mesquite bosques from the Arizona-Sonora border, north through the Tohono O’odham lands to the Vekol (Jones et al. 1983; Sullivan et al. 1996). The population in the Vekol appears to be denser than any other we have observed in the Southwest. These frogs are primarily ant predators and give a high pitched buzzing advertisement call while immersed in water with only their tip of their pointed snout protruding from a tangle of mesquite branches and detritus.

The third jewel of the Vekol is *Bufo retiformis*. Its heartland lies in the Sonoran Desert of Sonora and northern Sinaloa, extending into Arizona primarily on Tohono O’odham lands north to near Mobile, Maricopa County (Sullivan et al. 1996). It is less restricted to mesquite bosques than the previous two species, occurring also on rocky bajadas. This shy toad often calls from beneath a small bush some distance from the edge of the water, and one or two non-calling (satellite) males may be present (Sullivan et al. 1996; personal observation). Although they breed in cattle tank impoundments, we have observed them calling also from newly formed shallow rain ponds in the Vekol. This spectacular amphibian is certainly the “the golden frog” of the Vekol.

The last anuran species we wish to comment on is *Bufo debilis*. In a short but important paper, Jones et al. (1983) reported both *Bufo retiformis* and *Bufo debilis* from the Vekol, associating the occurrence of the latter with the presence of relictual tobosa grasslands in the valley. This frog is otherwise known from the grasslands of southeastern Arizona ranging

east to approximately Benson, Cochise County. Sullivan et al. (1996) re-examined the one Vekol specimen and compared measurements to those presented by Ferguson and Lowe (1969). From the data they concluded that the specimen was indeed a *Bufo debilis*. We spent many hours during the monsoons of 2000 searching for additional specimens of the species in Vekol. We have observed, photographed, tape-recorded vocalizations, and obtained tissue samples of numerous *Bufo retiformis* but found no frogs in the area resembling *Bufo debilis* in color and color pattern or in vocalizations (see Sullivan et al. 2000). We are continuing our search in the 2001 monsoon season. We have also re-examined the one existing specimen of *Bufo debilis* from the Vekol, and our data support the conclusions of Sullivan et al. (1996) that it is clearly not a *Bufo retiformis*. If a relictual population of *Bufo debilis* proves to exist in the Vekol grasslands, it will be a most remarkable biogeographic occurrence and will greatly underscore the biological significance of the valley.

Finally, we wish to comment on the consequences of some human activity in the Vekol as it relates to anurans. This valley contains the most elaborate labyrinth of levees we have observed in the desert Southwest. We re-surveyed this series of levees in the height of the dry season in June 2001. Even though this was following an unusually wet winter, we were able to find standing water behind only one levee. We believe that these levees should be left in place, at least until a thorough ecological study of the area is completed. In June, 2000 we found recently metamorphosed individuals of several species around the pond behind one such levee. It is clear that while *Bufo cognatus* and *B. alvarius* are the main users of these man-made impoundments, *B. retiformis* and *Gastrophryne mazatlanensis* breed in (or are washed into) these impoundments. The flooding has created a spectacularly dense mesquite bosque, undoubtedly at the expense of the tobosa grassland (and perhaps also of *Bufo debilis* if it exists here), but this may have contributed to the equally spectacular abundance of at least *Gastrophryne*, which literally carpet the ground in some areas of the upper Vekol. At least some species of the anuran fauna appear to have survived and even flourished under the present conditions, and no action should be taken without a thorough study of the effect of these levees on the herpetofauna. The Vekol Valley presents an excellent opportunity to study differences in anuran breeding patterns and success in permanent versus temporary ponds in the same area.

Reptiles

Observations by a number of biologists and of museum specimens document the presence of 36 reptile species, including one turtle, 17 lizards, and 18 snake species within the boundaries of the Monument (Table 3). Some of the more notable species are discussed below.

Desert tortoise

A comparison of many desert tortoise (*Gopherus agassizii*) studies shows the Maricopa Mountains had, in 1987, the second-highest recorded population density estimated by herpetologists for any mountain range in Arizona. The estimated density of 146 tortoises/mi² was double the average (mean=73, SE=5.8, N=42) of all plots with density estimates and just below the maximum (150, from the Mazatzal Mountains) (Averill-Murray 2000). The Maricopa population crashed to approximately 20 tortoises/mi² in 1994.

Similar declines have been inferred in three other areas, including the Sand Tank Mountains. The reasons for these declines are unknown and of serious concern. Wirt & Holm (1997) showed a correlation between the Maricopa die-off and a period of hot summers and extended drought. They noted that there was no die-off in the population at Espanto Mountain, a small rockpile in the valley just east of the Maricopa Mountains and also within the Monument. They suggested that because the valley floor cools off much more at night than the rocky uplands, tortoises in that area were able to escape the combined effects of heat and drought which likely killed most of the mountain population. Thus the valley outliers of desert mountain ranges may provide vital refugia for long-term tortoise survival.

Increased protection for large blocks of land, including valley bottoms, may ward off a variety of long-term threats to tortoise survival in the Sonoran Desert. These include disease, habitat loss, habitat fragmentation, and direct loss of individuals caused by grazing, urban growth and recreational off-highway vehicle use. “Tortoises of both sexes have been observed to make relatively long-distance movements (up to three km over a several-week period) away from their normal observed activity centers. They crossed areas of atypical tortoise habitat, including an approximately 1-km wide alluvial fan and steep, boulder-free slopes occupied by few to no resident tortoises. ... The degree to which local populations depend on interchange with other populations for long-term persistence is unknown, as are the effects of dismissing intermountain valleys as ‘unsuitable’ habitat in Sonoran Desert tortoise conservation efforts” (Averill-Murray 2000).

One of the less-obvious threats to tortoise survival is the deliberate removal of habitat. There was an occasion of someone removing boulders from Espanto Mountain to sell to the landscaping trade. Besides removing resources from BLM land without a permit, the individual involved was taking the shelter sites beneath those boulders used by tortoises and other wildlife (Betsy Wirt, personal communication).

The Sand Tank Mountains population of desert tortoise was considered sufficiently isolated to serve as a “control” site in a study on the distribution of tortoise diseases and the potential for disease transmission by the release of captive tortoises (Dickinson et al. 1996).

Red-backed whiptail (a.k.a. Canyon spotted whiptail) lizard

This lizard species (*Cnemidophorus burtii xanthonotus*) is associated with thornscrub habitat more common in Mexico and exists in the U.S. as isolated populations in southwestern Arizona. The Sand Tank and Table Top populations are near the northern limit of the species’ range and therefore likely represent important components of the species’ overall genetic diversity.

Rosy boa

Because it is prized in the pet trade, the rosy boa (*Lichanura trivirgata*) has been subject to high levels of illegal collection in many desert mountain ranges. The Sand Tank and

Maricopa Mountains represent important refugia for this species, due to lack of access roads that would facilitate illegal collection.

Rattlesnakes

Six of Arizona's 11 rattlesnake species are found within the Monument. The Monument is unusual in that it contains both tiger and speckled rattlesnakes, an ecologically similar pair of species rarely found together; this area includes a western boundary of the tiger and an eastern boundary of the speckled. Rattlesnake diversity in the Monument is also due to the inclusion of several valleys, to which sidewinders are generally restricted.

Yellow mud turtle

The Arizona mud turtle (*Kinosternon flavescens arizonense*) is a narrowly-distributed subspecies which relies on valley floor pond habitat which has been heavily affected by human activity. Its habitat needs are much like the three rare toads described above. It has not been found in the Vekol Valley but is known from the next drainage south (Iverson 1984). It is considered likely to occur in Vekol Valley, but probably will only be found with targeted search efforts (Phil Rosen, personal communication).

Mammals

No comprehensive surveys of mammals have been conducted within the Monument, but incidental observations and targeted studies document the presence of 28 mammal species (Table 4).

Desert Bighorn Sheep

Desert bighorn sheep (*Ovis canadensis mexicana*) are known from all the mountain ranges in the Monument, with a particularly robust population in the Maricopa Mountains (BLM 1995). The Sand Tank and Table Top Mountains contain part of what was identified as one of the few viable herds remaining in Arizona (BLM 1988b).

Some bighorn populations elsewhere have declined due to human proximity and land management (Monson 1980), as they are largely intolerant of automobiles and livestock and are susceptible to livestock-transmitted diseases (Wilson 1969; Jones 1980), so the species can serve as a wilderness quality indicator. Their primary habitat consists of steep, rocky slopes in mountain ranges, but they also feed on the more-gentle bajadas adjacent to the mountains (Bleich et al. 1997). In desert settings, bighorn populations persist as metapopulations (sets of small, interacting subpopulations) which depend on movement of individuals between mountain ranges for long-term viability (Weaver 1975; Krausman and Leopold 1986; Bleich et al. 1990; Bleich et al. 1997). They tend to make linear movements between ranges (Simmons 1980), and may temporarily use small isolated areas of mountainous habitat as "stepping stones" within corridors (Bleich et al. 1990). Thus protection of movement corridors across a wide valley such as Little Rainbow Valley may require protecting broad swaths of valley floor, including isolated outcrops such as Espanto

Mountain. Protecting a functional corridor across this valley may be critical to maintaining a viable bighorn population in the Sierra Estrella, which is otherwise isolated by spreading urbanization from greater Phoenix.

Sonoran pronghorn

The endangered Sonoran pronghorn (*Antilocapra americana sonoriensis*) may use the Sentinel Plain area and historically used areas east of Highway 85, including the Vekol Valley (USFWS 1998). Sonoran pronghorn once roamed the desert valleys throughout much of western Arizona and in California near the Colorado River (Carr 1972). They use large home ranges and seasonally move long distances (AGFD 1986, USFWS 1994), and thus require large protected areas. Their decline in some areas has been blamed on over-hunting and overgrazing by domestic livestock (USFWS 1994), though the removal of these two factors in Cabeza Prieta National Wildlife Refuge has not brought substantial population increases there.

Bats

Seven bat species have been found within the Monument (Dalton et al. 1994). Lesser long-nosed bat (*Leptonycteris curasoae yerbabuena*), an endangered species, has been observed foraging in the Sand Tanks (Dalton et al. 1994). The dense saguaro forest there likely serves as an important food source for this species. California leaf-nosed bat (*Microtus californicus*) and cave myotis (*Myotis velifer*) are also found within the Monument (Dalton et al. 1994). Both are listed by the BLM as "sensitive species" requiring special management.

Birds

The primary purpose of this chapter is to bring together as much of the recent data on the birds of the Sonoran Desert National Monument and vicinity as possible. I also want to provide the reader with some insight as to what one could expect to find on the Monument in terms of the diversity of species, their breeding and migratory status, and seasonal and habitat relations. I present some recent sightings of species not previously recorded in the area and discuss in general special status species that are known or likely to occur in the Monument. The list of birds at the end of this chapter was created by consolidating the numerous sources of recent data cited below. These data have been collected by various researchers since 1994 and some records are as recent as 2000.

The documented avifauna of the Sonoran Desert National Monument includes at least 159 species in 13 orders and 36 families, with 51 known or probable nesting species and 87 neotropical migrant species (Table 5). The neotropical migrants are significant because they breed in the U.S. and Canada and spend the majority of their non-breeding season in Mexico, Central America, and South America. Habitat conditions have been changing dramatically, with increased urbanization and conversion to agriculture impacting these species during both breeding and non-breeding seasons. Many of the migrants that pass through the Monument do so in the spring during March through May and in the fall during September and October (Morrison et al. 1997; Bibles & Harris 1999). Washes lined with palo verde and

ironwood are important travel corridors for migrants because they provide cover from predators and food for replenishing the energy they need to complete their migration. Recent research in Area A that is now part of the Monument has demonstrated that desert populations of white-winged doves, for example, which winter in southern Mexico and breed in southern Arizona, depend closely on the nectar and fruit of the saguaro in the late spring and monsoon seasons while they are nesting and fledging their young (Wolf & Martinez del Rio 2000).

The varied terrain of the area provides a wide variety of microhabitats that support a diverse assemblage of birds. Steep-sided canyons, fertile bajadas, and deeply incised washes lined with leguminous trees all provide abundant resources for the many forms of wildlife that call the Monument home. Within the Monument, only the Sand Tank Mountains have had any recent comprehensive bird surveys (Bibles & Harris 1999). However, the Arizona Game and Fish Department (AGFD) has conducted extensive surveys of portions of each 7.5 minute quadrangle in the area for the Arizona Breeding Bird Atlas (AGFD, unpublished data, 1994-2001). Observations made by Hardy et al. (1997) and Bibles and Harris (1999) in the Saucedo Mountains will be cited in this text to provide a list of species likely to occur in the Monument, although not all of these species have been officially recorded as occurring there. Where records exist of credible observations of birds occurring in the area that now comprises the Monument, the species list has been annotated to reflect that status. Additional records include incidental sightings in the Sand Tank and Maricopa Mountains (Barry, 1999, 2000, 2001; Wirt, personal communication). Data on distribution, breeding, and migratory status of bird species in Sonoran Desert National Monument are presented in Tables 6 and 7.

New or uncommon observations

Varied buntings have been recorded nesting in the Bender Canyon area of the Sand Tanks and in Ryan's Canyon in the Saucedo mountains. Nesting rufous-winged sparrows have been recorded in the Vekol Valley, and purple martins commonly nest in small colonies in the Sand Tanks and Saucedos; none of these had been previously documented to nest in Maricopa County prior to 1994 (Paul Hardy, personal communication). On the Monument, purple martins can be seen regularly in the vicinity of Johnson Well and the White Tanks. They can also be seen in the vicinity of Tom's Thumb, outside of the Monument in the Saucedo Mountains.

An unexpected observation made by AGFD during breeding bird atlas surveys was a confirmed record of vermilion flycatcher nesting on the Black Gap quadrangle, south and west of the Monument. This species is usually associated with wet riparian areas and has only been previously recorded as a passage migrant through the area. Given the proximity of the Gila River near the north and western boundaries of the Monument, it is likely that other breeding vermilion flycatchers occur in the area.

Special status species

There exists one unconfirmed report of the endangered cactus ferruginous pygmy-owl in the South Maricopa Mountains (Gunn 2000) and two unconfirmed reports from the Sand Tanks

(Tibbitts, personal communication). Several targeted pygmy-owl surveys have been conducted within the Sand Tank Mountains, but those surveyors have not made any positive detections to date (Reichenbacher & Tiaz 1993; Hardy & Morrison 1996; Dames & Moore 1998, 1999; Barry 1999; Harris et al. 1999).

Seasonal and habitat relationships

During early February the chuparosa begin to bloom in the washes. Attracted to the abundant red flowers, Costa's hummingbirds stake out and defend their chuparosa patches from other males. Males performing courtship displays can usually be seen by first listening for the high pitched whine made by their wings as they display for potential mates. From late February through April, the migrant birds pass through the area on their way north. The most common raptors that migrate through the area are the Cooper's and sharp-shinned hawks, following the movements of songbirds. They are most frequently observed along washes but may soar overhead on a thermal with a Swainson's hawk. Once the palo verde trees begin blooming, migrant warblers are attracted to the abundant insects that forage on the nectar and pollen. The two most common warblers that migrate through the area are the Wilson's and MacGillivray's warblers. It's not uncommon to find several of these brightly colored birds foraging together in the same tree. It is also in the spring that large, tight flocks of 50 or more lark buntings pass through the area and stop to forage on the seeds of various grasses and forbs.

During the spring and early summer, the air is alive with the sounds of birds. Beginning just before dawn one might hear the great horned owl, elf owl and common poor-will. At first light, the haunting calls of white-winged and mourning doves join the chorus along with the calls of the ubiquitous Gila woodpecker and ash-throated flycatcher. At sunrise, from almost any point one can hear a half dozen cactus wrens and the clear melodic song of the Scott's oriole. The air above the washes is busy with the comings and goings of phainopeplas arguing over a ripe batch of mistletoe berries, and the varied songs of northern mockingbirds and curve-billed thrashers add variety to the morning symphony. From the dense brush along the washes the raspy, scolding call of the black-tailed gnatcatcher or clear, two or three-note song of the green-headed verdin can be heard. In the surrounding open areas you may hear the jumbled song of Brewer's sparrow or the bouncy song of the black-throated sparrow.

The Harris' hawk is one of the top avian predators in the Monument, though not as abundant as the red-tailed hawk. Their population appears to expand and contract, but it is not clear why. The dark chocolate plumage, chestnut shoulder patches and wide, white tail band give them away. Harris' hawks have been observed on a sporadic basis throughout the area south of I-8 and are known to breed regularly in the Sand Tanks, even into the hottest part of the summer. On 29 June 1994, I observed a pair with two 7-10 day old chicks in a nest on the west side of Javelina Mountain; the temperature that afternoon was around 114° F but the chicks appeared to be doing well. Regular observations of this species have been made near the following landmarks: Mesquite Well, Big Horn Game and Fish Catchment, Papago Indian Chief Mine, Johnson Well, Half-way Corral, and Paradise Well Road around the Goldwater Range entrance gate.

Hardy & Morrison (1996) found the Sand Tank population of elf owls to be healthy and stable, and noted that elf owls selected areas with the high densities of mature saguaros. Elf owls appear to be quite abundant around the Papago Indian Chief Mine and Johnson Well. As many as four males can be heard “singing” at the same time, within a couple hundred meters of each other during the peak of activity in mid April and/or during a waxing first quarter moon. Both elf owls and western screech owls appear to be more abundant in areas of relatively high mesquite cover (Hardy & Morrison 1996). Abundance of western screech owls declined during the three-year study period, while elf owl abundance did not change significantly. This difference was attributed to prey selection, with screech owls selecting small mammals and elf owls relying on invertebrates.

Birds occupy every habitat from icecap to icecap and have adapted superbly to extremes of climatic conditions. The Sonoran Desert is just one part of the physiological spectrum that birds contend with everyday. In addition to seeking shelter in wash banks, birds such as the Say's phoebe and rock wren have been recorded regularly roosting in mines on the Monument. Black-throated sparrows regularly seek shelter from the blazing sun in the relatively cool comfort of rodent burrows. Woodpeckers, kestrels, small owls and purple martins escape into their water-cooled cactus cavities. Small birds such as verdins and black-tailed gnatcatchers have even been found to use small depressions on the shady side of palo verde trees to keep them protected from heat stress.

It is during the hottest, driest part of the early summer that thermal cover (shade) becomes important to many species of wildlife, including birds. One of the common places that birds take refuge is in the myriad of nooks and pockets in the banks of deeply incised washes. I discovered this phenomenon quite by accident one hot June day before the monsoons arrived. I decided to drive the Sand Tank Wash up to the pass south of Javelina Mountain to meet some biologists for an evening of mist-netting bats. As I entered the steep-sided part of the wash, birds and other wildlife began pouring forth from the shelter of the wash banks. A pair of great horned owls, an American kestrel, gilded flickers, Gila woodpeckers, ash-throated flycatchers, cactus wrens, curve-billed thrashers, and dozens of mourning and white-winged doves and Gambel's quail all fled the vehicle. There were also a group of seven javelina, several black-tailed jackrabbits, desert cottontails and even a Mohave rattlesnake all taking advantage of the scarce shade during the hottest part of the day. It occurred to me that day that frequent disturbances of this nature could potentially lead to increased risk of mortality, as many of these species are balancing on the edge of existence while awaiting the monsoon rains.

PLANTS

Vegetation

The Sonoran Desert is the liveliest and most "tropical" of the North American deserts, because of its climate with mild winters of little or no frost, and summer monsoonal rainfall from tropical oceans, and because of its physical connections with more tropical communities to the south (Shreve 1964; Turner & Brown, 1982). It is most striking where its diverse vegetation is dominated by columnar cacti, like the saguaro, and legume trees like ironwood, mesquite, and palo verde.

The "tropicalness" of the Sonoran Desert lies in its evolutionary roots in the distant past. Many of the Sonoran Desert plants are closely related to species occurring farther south in Mexico, and apparently evolved in tropical deciduous forest and thornscrub isolated in northwestern Mexico by the uplift of the Sierra Madre Occidental more than 15 million years ago – long before the formation of the Sonoran Desert in the late Miocene (by eight million years ago). The Sonoran Desert has very old tropical affinities but has not been stable since the Miocene.

Ice Ages in the Desert

About two million years ago the Pleistocene ice age began, changing the climate and vegetation of the globe. Although the arid deserts of what are now the southwestern U.S. and northern Mexico were distant from the glaciated areas of North America, the ice age climates had profound effects on the biota. Radiocarbon dated plant remains preserved in ancient packrat (*Neotoma* spp.) middens in many areas in the North American deserts have permitted reconstructions of local vegetation and regional climates for the last 10,000 to 45,000 years (Van Devender et al. 1987; Betancourt et al. 1990). Packrats are medium-sized, herbivorous rodents that collect plants within their 30-meter diameter home range and carry them back to their houses or dens. Some of these remains become cemented into their 'middens', hard dark organic deposits that can be preserved for tens of thousands of years in dry caves or crevices.

Packrat midden fossils document the expansion of woodland trees and shrubs into desert elevations from 45,000 to 11,000 years ago in the last glacial period, and the development of the modern desertscrub communities in the Holocene, the present interglacial. In the present Arizona Upland subdivision of the Sonoran Desert in Arizona and California, woodlands with singleleaf pinyon (*Pinus monophylla*), junipers (*Juniperus* spp.), shrub live oak (*Quercus turbinella*), and Joshua tree (*Yucca brevifolia*) were widespread in areas that now support saguaros and palo verdes (Van Devender 1990). Ice age climates with greater winter rainfall from Pacific and reduced summer monsoonal rainfall from the tropical oceans likely favored woody, cool-season shrubs with northern affinities (Neilson 1986) rather than the summer-rainfall trees, shrubs, and cacti of tropical forests and subtropical deserts. Desertscrub communities dominated by creosotebush were restricted in the Sonoran Desert region to elevations below 300 m in the Lower Colorado River Valley subdivision of the Sonoran Desert (Van Devender 1990).

Saguaro and brittlebush (*Encelia farinosa*) returned to Arizona soon after the beginning of the present interglacial (the Holocene) about 11,000 years ago. Sonoran desertscrub, however, did not form until about 9,000 years ago when displaced woodland retreated upslope. Moreover, relatively modern community composition was not achieved until foothills palo verde, desert ironwood, and organpipe cactus arrived about 4500 years ago. Similar successional stages likely occurred during each of the 15-20 previous interglacials. Although the late Holocene desertscrub communities likely resembled the original late Miocene Sonoran Desert, relatively modern communities have only existed for about 5-10% of the 2.4 million years of the Pleistocene (Porter 1989; Winograd et al. 1997); in contrast, ice age woodlands have occupied desert lowlands for about 90% of this period.

Modern Plant Communities

The area of Sonoran Desert National Monument is especially interesting with its proximity to the northeastern limits of the Sonoran Desert. The lower elevations are dominated by the xeric desertscrub of the Lower Colorado River Valley subdivision of the Sonoran Desert in the valley bottoms (e.g., Brown 1982; Shreve 1951). The middle elevations are characterized by the Arizona Upland subdivision of the Sonoran Desert, where species of tropical, Mediterranean chaparral, grassland, and hyperarid desert communities are mixed. The mountaintops are inhabited by a unique mixture of Sonoran Desert and interior chaparral species, with populations of Arizona rosewood (*Vauquelinia californica*), Sonoran scrub oak (*Quercus turbinella*), Roseberry juniper (*Juniperus coahuilensis*), and many shrubs, cacti, and herbs. Many of these are relicts of widespread ice age woodland/chaparral communities that became isolated on upland islands during the Holocene (Brown 1978; Van Devender 1990).

Each of the mountain tops are natural laboratories, natural experiments where the genetics of small populations can be studied to understand genetic drift, natural selection of new species, and stabilizing selection. The Arizona Upland communities are mixtures of species that arrived at various times in the last 11,000 years. The creosotebush communities in the valley bottoms may have been more stable than upland communities, apparently less affected by ice age climate fluctuations. These areas are especially valuable because they are relatively intact with minimal human disturbance. Understanding past and modern community dynamics may help us understand how the Sonoran Desert may respond to future climatic changes.

Arizona Upland and Lower Colorado River Valley are examples of subdivisions of the Sonoran Desert phytogeographic region. These subdivisions can be further divided into plant communities, each of which gives a detailed picture of the vegetation. A hike beginning in the lower elevation of the Monument – say, in the Vekol Valley – and climbing by degrees out of the valley to one of the higher summits would take you through a dozen or so plant associations, depending on the route you took. The following entries describe a typical roll call of the associations you might see.

The **blue palo verde/mesquite/ironwood/canyon ragweed association** is typical of larger ephemeral washes or drainageways coursing through to broad bajadas and valley floors. These washes have flood-scoured sandy beds often 2 to 5 meters or more across. At their

margins there are often almost continuous galleries of tree and shrub cover along the banks, sheltering diverse assemblages of desert perennials like the lyre-pod mustard (*Lyrocarpa coulteri*) and climbing milkweed (*Sarcostemma cynanchoides*), as well as many annuals. These species-rich communities are vulnerable to human-induced degradation. Vegetation cover is often nearly 100%.

Often bordering the large washes at the valley bottoms is the **creosotebush/desert ephemeral (annuals) association**, usually very flat and the exclusive domain of creosotebush and an occasional barrel cactus (*Ferocactus wislizeni*). There may be other scattered perennials and, following seasonal rains, various desert annuals give their brief fling at life.

The **creosotebush/bursage association** is a bit further upslope, where the soils are coarser. The creosotebush is generally still dominant, but triangle-leaf bursage (*A. deltoidea*) makes a strong showing, along with white ratany (*Krameria grayi*) and others. On desert pavements of stones and dust there are often the skeletons of the rigid spiny herb (*Chorizanthe rigida*) left over from wetter times. Cacti become more common, especially the jumping cholla (*Cylindropuntia fulgida*) and desert Christmas cholla (*C. leptocaulis*) and a few saguaros. A straggle of mesquite trees traces the watercourses.

Higher still is the **creosote/bursage/foothill palo verde/ironwood association**, particularly at the foot of the great alluvial outwash plains called “bajadas.” Here, palo verde trees and/or ironwood appear, often along with large colonies of chain-fruit cholla and saguaros. It is the first place you’ll find good shade, offering the chance to notice some of the smaller perennials, including the desert trumpet (*Eriogonum inflatum*) with its weirdly inflated stems.

Approaching the mountains you enter the **foothill palo verde/ironwood/bursage association**, which differs from the preceding association in the density of palo verde and ironwood: here they provide a vegetative cover of at least 10 percent, and eclipse the creosotebush in importance. This is the classic expression of the Arizona Upland subdivision, characterized by palo verde and ironwood typically 4 to 6 meters tall, and saguaro reaching up to 10 meters in height.

The **mixed desertscrub**, such as the **cholla/brittle bush association** is characteristic of the pediment – where the rocky and well-drained soils of the mountain proper and lower slopes meet the bajada. Soil differences, slope and aspect, and a complexity of physical factors choreograph a multitude of shrubs, some small desert trees, and many cacti and perennials and annual plants. Here is where you might find saguaros, chollas (*Cylindropuntia* spp.), and various shrubs such as wolfberries (*Lycium* spp.), jojoba (*Simmondsia chinensis*), fairy duster (*Calliandra eriophylla*), and many others.

In this brief sampling we cannot do justice the myriad shifts in plant communities on different slopes depending upon rock substrate, sheltering, steepness, and slope exposure. On the hottest, driest, south-facing slopes you might find a sparse cover with extreme xerophytes such as teddybear cholla (*Cylindropuntia bigelovii*) and *Fagonia californica*.

Ascending any of the prominent mountains – usually a long day’s hike, you encounter increasing numbers of plants generally not seen at lower elevations, such as desert century-plant (*Agave deserti*), various desert ferns, wild onion (*Allium macropetalum*), desert straw (*Galium stellatum*), flat-top buckwheat (*Eriogonum fasciculatum*) and many more. The list of species is much too cumbersome to enumerate here, but in only a few hours’ climb you can expect to find more than 70 perennial species.

Relict chaparral, mixed with Sonoran Desert/Arizona Upland species. These are relict and outpost populations of intriguing distributions, mostly at mountaintops and sheltered montane passes above 2800 feet. Characteristic species include crucifixon thorn (*Canotia holocantha*), banana yucca (*Yucca baccata*), and desert olive (*Forestiera shrevei*). Notable are the “cliff-hangers,” often found on north-facing cliffs near or at mountain summits, made of up of small populations of plants the seem to be “barely hanging on” such as the Sonoran scrub-oak (*Quercus turbinella*) and roseberry juniper (*Juniperus coahuilensis*).

Sheltered canyons in the Monument are botanically exciting. As you climb over huge boulders of steep canyon watercourses, you encounter more plants at every turn. Some are of tropical affinity such as Sonoran croton (*Croton sonorae*) and *Bernardia incana*, Sonoran rosewood (*Vauquelinia californica* subsp. *sonorensis*), and Kofa Mountain barberry (*Berberis harrisoniana*).

Desert grasslands are found on volcanic terraces, with plenty of perennial grasses such as bush muhly (*Muhlenbergia porteri*), plains bristlegrass (*Setaria leucopila*), slim tridens (*Tridens muticus*), California cottontop (*Digitaria californica*) and numerous small shrubs and seasonal richness of wildflowers. Notable small areas of tobosa grass (*Pleuraphis mutica*) are occasionally found on the north-facing volcanic slopes, and a more extensive area of tobosa grass intermixed with a number of other grasses covers part of the summit-mesa of Table Top Mountain.

Tobosa grass swales occur in valley bottoms. These are interesting in that some of these communities appear to be relatively simple with only creosotebush, white ratany and tobosa grass (*Pleuraphis mutica*), and no bursages. A prime example is the Vekol Valley Grassland ACEC.

Non-native plants

Only 26 species of non-native plants, or 6.5 percent of the total flora, are known from the Monument (Table 8). We can expect at least several more, especially hot-weather annuals such as goathead (*Tribulus terrestris*) and a few annual grasses. Only a few of these non-natives are invasive species of concern. Red brome (*Bromus rubens*) might be a major threat since it could, following a favorable season, carry a fire and the native vegetation is not fire-resistant. A perennial grass, Lehmann's lovegrass (*Eragrostis lehmanniana*), is well established, especially at higher elevations, and seems to be actively spreading. Its apparent ingress seems to be along 4-wheel drive roads. It seems to be an invasive species that produce a negative impact. Buffel grass (*Pennisetum ciliare*) is abundant along the Interstate

highway, and has not made any significant inroad into natural areas in the Monument. It does, however, warrant careful monitoring lest it become truly invasive.

Two cool-season annuals, filaree (*Erodium cicutarium*) and Arabian grass (*Schismus arabicus*) are seasonally abundant and have probably expanded to the fullest extent. Bermuda grass (*Cynodon dactylon*) is well-established in the few, widely scattered canyon bottom and mountain waterholes; it is locally abundant in the Vekol Valley and it too has probably already expanded to its fullest extent.

Invasive shrub and tree species of the genus *Tamarix* have not yet been found on the Monument. The Vekol Valley bosque may be regionally unique not only for its incredible, nearly continuous gallery forest of native leguminous trees and desert willow, but also for the absence of tamarisk which afflicts nearly every major watercourse, dry or wet, in the greater Southwest. This and other major washes, particularly those with seeps or springs and those near disturbed and agricultural areas around the Monument's perimeter, should be vigilantly monitored to ensure that individuals and populations of tamarisk do not become established and spread into the Monument itself.

New and potentially serious invasive plants can be expected in the coming years. Backcountry roads and off-road traffic can provide likely paths of invasion. Weed seeds can also enter with hay for horses and with cattle feed, and even with dirt and equipment brought in for road maintenance. Disturbed habitats offer the easiest route for invasive plants to enter the Monument.

Flora of Sonoran Desert National Monument

The present listing includes 402 species in 260 genera and 71 families. We estimate that further botanical exploration may increase the total number of species by an additional ten to fifteen percent.

The plants in this listing are grouped as ferns and fern relatives (spore-bearing plants), gymnosperms (cone-bearing seed plants), and angiosperms (flowering plants). Within these categories the plants are listed alphabetically by family, genus, and species. The scientific names, including the variety (var.) or subspecies (subsp.), are in **bold**. The authors of scientific names are not in bold. Selected synonyms of scientific names are in *italics* within brackets [-]. Common names are in SMALL CAPITALS and follow the scientific names, and when known are given in English and Spanish. Non-native plants are indicated with an asterisk (*). Nomenclature follows Felger (1998, 2000) and Felger et al. (2001; in prep.).

Documentation is based on specimen vouchers and field observations by botanists. Specimen vouchers are primarily at the herbarium of the University of Arizona (ARIZ); some are at Arizona State University (ASU). Additional specimens are at the herbarium of Colorado State University, Fort Collins (CS), and a set of mounted "laminated (LA)" specimens are housed at Luke Air Force Base. Works covering the regional vegetation and flora include Benson and Darrow (1981), Bowers (1980), Felger (2000), Felger et al. (1997), Kearney and Peebles (1960), Robichaux (1999), Shreve (1951), Turner et al. (1995), and Wiggins (1964).

FERNS AND FERN RELATIVES

PTERIDACEAE - BRAKE FAMILY

Astrolepis cochisensis (Goodding) D.M. Benham & Windham subsp. **cochisensis**.

[*Notholaena cochisensis* Goodding]. SCALY STAR FERN

Small, sword-leaved ferns. Foothills to upper elevations, mostly in the shelter of rocks.

Javelina Mt, *Felger 00-69*.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Sand Tank Mts, *Felger 453*.

Table Top Mts, *Bolton 94-076*.

Astrolepis sinuata (Lagasca ex Swartz) D.M. Benham & Windham subsp. **sinuata**.

[*Notholaena sinuata* (Lagasca ex Swartz) Kaulfuss]. WAVY STAR FERN

Medium-sized sword-leaved ferns. Higher elevations, in shelter of rocks, especially on north-facing slopes. The plants are larger and more robust than *A. cochisensis*.

Javelina Mountain, *Felger 00-68*.

Sand Tank Mts, *Felger 95-339*.

Cheilanthes eatonii Baker. EATON'S LIP FERN

Small ferns with short rhizomes and elongated leaves. Higher elevations, in shelter of rocks, especially on north-facing slopes.

Sand Tank Mts, *Felger 95-462*.

Cheilanthes lindheimeri Hooker. FAIRY-SWORDS

Small, sword-leaved, rhizomatous ferns; leaves grayish, divided into many beadlike segments. Higher elevations, in shelter of rocks, especially on north-facing slopes.

Upper (adaxial) surfaces of leaf segments appear densely hairy (see *C. wootonii*)

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Sand Tank Mts, *Felger 95-340*.

Table Top Mts, *Felger 01-276*.

Cheilanthes parryi (D.C. Eaton) Domin. [*Notholaena parryi* D.C. Eaton]. PARRY'S LIP FERN

Small desert ferns with short rhizomes and small, gray-hairy leaves. Granitic mountains and hills, among rocks in shaded habitats.

North Maricopa Mts, *Felger 01-176*.

South Maricopa Mts, 24 Mar 2001, *Felger*, observation.

Cheilanthes wootonii Maxon. BEADED LIP FERN

Small, sword-leaved, rhizomatous ferns; leaves grayish, divided into many beadlike segments. Higher elevations, in shelter of rocks, especially on north-facing slopes.

Similar in appearance to *C. lindheimeri*, differing in having upper (adaxial) leaf segment surfaces glabrous or sparsely hairy, smaller ultimate leaf segments, and other technical differences.

Javelina Mt, top of Maricopa Peak, *Walter & Arnett LA 1394* (CS).

Sand Tank Mts, *Felger 01-388*.

Cheilanthes wrightii Hooker. WRIGHT'S LIP FERN

Small ferns with long rhizomes.

Sand Tank Mts, *Felger 95-380*.

Notholaena californica D.C. Eaton subsp. **californica**. [*Cheilanthes deserti* Mickel].

INDIAN FERN, CALIFORNIA CLOAK-FERN

Small tufted desert ferns. Leaf blade about as wide as long, on a stalk (petiole) usually longer than the blade; leaf blade divided into beadlike segments. Granitic hills and lower mountain slopes, in shelter of rocks. Probably not common in the Monument.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

Notholaena standleyi Maxon. [*Cheilanthes standleyi* (Maxon) Mickel]. STAR CLOAK-FERN

Small tufted desert ferns with 5-sided leaves, the leaves dark green above (adaxial surface) and with a golden-colored farina below. Rocky slopes in shelter of rocks, from lower slopes to mountain tops; probably the most widespread fern in the Monument.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Sand Tank Mts, *Felger 95-338*.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Mauz*, photo.

Pellaea truncata Goodding. CLIFF-BRAKE

Tufted rock ferns with short rhizomes; leaves divided into many and firm, bluish-green leaflets. Rocky slopes in shelter of rocks, mostly at higher elevations and on north-facing slopes.

Sand Tank Mts, *Felger 95-381*.

Table Top Mts, *Felger 01-275*.

SELAGINELLACEAE - SPIKE-MOSS FAMILY

Selaginella arizonica Maxon. ARIZONA SPIKE-MOSS; FLOR DE PIEDRA

Plants forming dense mats close to the ground, the stems creeping, with scalelike leaves. Mountains, mostly on north-facing slopes and locally abundant, especially at higher elevations where it may also occur on other slope exposures. Characteristically growing over bedrock with very thin soil; rhyolitic and granitic rock and on Pinal Schist in the Table Top Mts.

The plants are firm and wiry when dry, softer when wet, and visibly green only during brief wet periods.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

Sand Tank Mts, *Felger 95-342*.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Mauz 99-014*.

GYMNOSPERMS - CONE-BEARING PLANTS

CUPRESSACEAE - CYPRESS FAMILY

Juniperus coahuilensis (Martínez) Gaussen ex R. P. Adams. [*J. erythrocarpa* Cory var. *coahuilensis* Martínez. *J. monosperma* (Engelmann) Sargent, of authors]. ROSEBERRY JUNIPER; HUATA, TÁSCATE

Shrubs or small trees with scale leaves. This small, relictual population occurs near the southern margin of the Monument (Malusa 1995).

Sand Tank Mts, 1 mi SW of Squaw Tit Peak, 1050 m, 2 Jan 1995, *Malusa*, observation.

EPHEDRACEAE - EPHEDRA FAMILY

Ephedra aspera Englemann ex S. Watson. [*E. nevadensis* S. Watson var. *aspera* (Engelmann ex S. Watson) L. D. Benson]. BOUNDARY EPHEDRA, MORMON TEA; TEPOPOTE

Woody shrubs, often appearing leafless, with scale leaves in 2's. Pollen (male) and seed (female) cones borne on separate plants. Bajadas and mountains slopes to their summits.

The seed cones bear a single seed; the fresh, developing seed cone produces a glob of sweet-tasting nectar that covers the tip or apex; large, orange-winged spider wasps (*Pepsis* or *Hemipepsis*) greedily feed on the nectar globs, as does a kind of sawfly (wasp).

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

Sand Tank Mts, 11 Oct 1995, *Felger*, observation.

South Maricopa Mts, *Felger 01-160*.

Table Top Mts, *Bolton 94-051*.

ANGIOSPERMS - FLOWERING PLANTS

ACANTHACEAE - ACANTHUS FAMILY

Anisacanthus thurberi (Torrey) A. Gray. DESERT HONEYSUCKLE.

Shrubs; stems slender, with thin, pale brown shredding bark. Flowers pale orange. Washes and canyon bottoms, at least in the Sand Tank Mountains. Winter-dormant, flowering with warm weather and sufficient soil moisture.

Sand Tank Mts, *Felger 95-394*; Bender Springs canyon and road, 17 Apr 2001, *Felger*, observation.

Carlowrightia arizonica A. Gray. LEMILLA

Herbaceous perennials with slender stems; flowers white and yellow, the corollas snapping open soon after dawn and falling with daytime heat. Seldom very common but widespread; along arroyos, and slopes at various elevations to mountain tops.

Sand Tank Mts, *Felger 95-385*.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, 17 May 1999, *Mauz*, observation.

Justicia californica (Benth) D. Gibson. [*Beloperone californica* Benth]. DESERT HUMMINGBIRD-BUSH; CHUPAROSA

Shrubs; leaves quickly drought-deciduous. Flowers red-orange and tubular; various spring and with summer rains. Mostly along arroyos and canyons.

Table Top Mts, *Bolton 94-080*.

Justicia longii Hillsenbeck. [*Siphonoglossa longiflora* (Torrey) A. Gray].

Small herbaceous perennials; flowers long-tubular, pure white, opening at night.

Sand Tank Mts, *Felger 95-363*.

Ruellia nudiflora (Engelmann & A. Gray) Urban

Herbaceous perennials from underground rootstocks, dying back in winter and during extended drought. Flowers lavender and relatively showy, flowering with hot-season rains when the Vekol Valley frogs and toads are active. Low-lying, poorly draining soils of Vekol Valley in dense mesquite thickets, and expect elsewhere in similar habitats.

Vekol Valley, *Mauz 20-014*.

AGAVACEAE - CENTURY PLANT FAMILY

Agave deserti Engelmann subsp. **simplex** Gentry. DESERT AGAVE; MEZCAL

Perennial rosette succulents – small century plants. Leaves thick, succulent, and grayish, with sharp marginal spines. Flower stalks tall and slender, branched near top; flowers bright yellow in late spring. Middle to upper mountain slopes and summits.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Sand Tank Mts, Bender Saddle, 10 Oct 1995, *Felger*, observation.

Table Top Mts, *Mauz*, photo.

Yucca baccata Torrey. BANANA YUCCA

Shrub-sized, multiple trunk yucca; leaves firm, thick and succulent. Flower stalks about as tall to twice as tall as the surrounding leaves; flowers large and white, in spring. Fruit a fleshy berry falling from the stalk.

Abundant on mountain tops. These plants have narrow leaves, and appear intermediate with *Y. arizonica* McKelvey.

Javelina Mt, 1 Dec 2000, *Felger*, observation.

Sand Tank Mts, *Felger 95-352*.

Table Top Mts, *Mauz*, photo.

Yucca elata Engelmann. SOAP TREE YUCCA

Erect stems, often unbranched or with one or two branches. Leaves slender and flexible. Flower stalks tall, far over-reaching the leaves. Flowers white, in late spring or early summer. Fruit a dry capsule persisting on the stalk.

Widely scattered and not common in the Monument; on the lowest, inactive bajada surfaces amid creosotebush flat vegetation.

Water catchment north of Antelope Peak, 3 Apr 2001, *Felger*, observation.

Sand Tank Mts, road to Johnson Well, *Felger 95-333*.

Vekol Valley, 13 May 2001, *Mauz*, photo.

AIZOACEAE - AIZOON FAMILY

Trianthema portulacastrum Linnaeus. HORSE PURSLANE; VERDOLAGA DE COCHI

Summer annuals; flowers pink-lavender and rather inconspicuous. Probably widespread across the lowlands.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

AMARANTHACEAE - AMARANTH FAMILY

****Amaranthus albus*** Linnaeus. TUMBLEWEED PIGWEED

Hot weather annuals; flowers inconspicuous. Occurring in widely scattered pockets, disturbed lowland habitats and also infrequently elsewhere in natural habitats including mountain slopes.

Javelina Mt, 1 Dec 2000, *Felger*, observation.

Water catchment north of Antelope Peak, *Mauz 21-024*.

Amaranthus fimbriatus (Torrey) Bentham. FRINGED PIGWEED; BLEDO, QUELITILLO

Hot weather annuals; flowers inconspicuous. Low elevations and perhaps extending to higher elevation; often common along washes.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Sand Tank Mts, *Felger 95-353*.

Vekol Valley, *Mauz 99-075*.

Amaranthus palmeri S. Watson. CARELESS WEED, PIGWEED; BLEDO, QUELITE DE LAS AGUAS

Hot weather annuals; flowers inconspicuous. Seasonally abundant, especially in low-lying natural and disturbed habitats (wash and road margins), and canyon bottoms.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Sand Tank Mts, Bender Spring, *Felger 95-425*.

Vekol Valley, *Mauz 99-082*.

Tidestromia lanuginosa (Nuttall) Standley. HONEYSWEET; HIERBA CENIZA, HIERBA LANUDA

Hot weather annuals; flowers minute, yellow. Widespread across the Monument, especially at lower elevations, and also disturbed habitats. The plants are often whitish, due to a dense cover of branched hairs, but in moist and especially shaded places the herbage may be nearly green.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Sand Tank Mts, Johnson Well, *Funicelli & Anning 31*.

Table Top Mts, 17 Mar 1999, *Mauz*, observation.

APIACEAE (UMBELLIFERAE) - CARROT FAMILY

Bowlesia incana Ruiz & Pavón. HAIRY BOWLESIA

Cool season annuals; flowers minute and green. Widespread during years of favorable rains, often in shaded places and beneath shrubs or mesquite trees; at all elevations.

Flats east of North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

Junction of I-8 and Pinal-Maricopa county line, 3 Apr 2001, *Felger*, observation.
North Maricopa Mts, *Felger 01-174*.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, *Bolton 94-072*.
Vekol Valley, 26 Mar 2001, *Felger*, observation.

***Daucus pusillus* Michaux.** WILD CARROT; ZANAHORIA SILVESTRE

Cool season annuals; flowers white, minute. Widespread and at all elevations, but seldom abundant; among rocks and wash margins.

Flats between North and South Maricopa Mts, *Felger 01-168*.
Sand Tank Mts, *Felger 01-370*.
South Maricopa Mts, *Chamberland 1861*.
Table Top Mts, *Bolton 94-058*.
Vekol Valley, *Felger 01-234*.

***Spermolepis echinata* (Nuttall) A. Heller.** SCALE SEED

Cool season annuals; flowers white, minute. Generally in small, localized populations; widespread including mountain tops.

Sand Tank Mts, *Felger 01-362*.

***Yabea microcarpa* (Hooker & Arnott) Koso-Polj**

Cool season annuals; flowers white, minute. Generally localized, especially at higher elevations.

Sand Tank Mts, *Felger 01-363*.

APOCYNACEAE - DOGBANE FAMILY

***Haplophyton crooksii* Linnaeus.** [*H. cimicidum* A. de Candolle var. *crooksii* (Linnaeus) L. D. Benson]. COCKROACH PLANT; HIERBA DE LA CUCARACHA

Subshrubs with slender stems; flowers bright yellow. Fruits long and very slender. Mountains and hills, among rocks, often in brushy washes and canyons, lower-elevation foothills to upper slopes. The plant has been used an insecticide, hence its common name.

Javelina Mt, northern slope, *Arnett & Walter LA 1261* (CS).
Sand Tank Mts, Bender Spring Road, *Felger 95-434*.
Table Top Mts, *Mauz 99-108*.

ARISTOLOCHIACEAE - BIRTHWORT FAMILY

***Aristolochia watsonii* Wooton & Standley.** INDIAN-ROOT; HIERBA DEL INDIO

Small herbaceous vines often spreading across the ground, from a thickened, perennial root. Leaves arrow-shaped. Flowers tooth-shaped, maroon and yellow. Widespread but localized and seldom common, along washes and canyons.

A member of the large pipe-vine genus, the stems of this species are short and slender, and sometimes become modestly vining. The plants are often ravished by the red-orange caterpillars of the pipevine swallowtail butterfly. The caterpillars accumulate aristolochic acid, which makes them unpalatable to birds.

Antelope Peak, 20 Mar 1994, *Bolton*, observation.
Sand Tank Mts, 24 Nov 1995, *Rutman*, observation.
Vekol Valley, *Mauz 99-074*.

ASCLEPIADACEAE - MILKWEED FAMILY

Asclepias nyctaginifolia A. Gray. HIERBA LECHOSA

Herbaceous perennials from thickened, deep-seated roots. Leaves rather large compared to the usual microphyllous vegetation. Flowers yellow-white. Widely scattered, often in sandy soil along small washes or arroyos; not common.

Sand Tank Mts, 29 April 2001, *Felger*, observation.

South Maricopa Mts, *Felger 01-210*.

Vekol Valley, *Mauz 99-134*.

Matelea cordifolia Woodson. TALAYOTE

Perennial vines; flowers cream yellow. Known from the United States only in the Ajo Mountains and possibly in the Sand Tank Mts.

Road over pass E of Squaw Tit Mt, 24 Nov 1995, *Rutman*, observation (requires verification).

Matelea parvifolia (Torrey) Woodson

Small perennial vines climbing on small shrubs. Leaves triangular to 2 cm long. Flowers small, brown-purple to olive-brown. Fruits elongated, smooth with a few warts. Mountain slopes, mostly north-facing, lower or middle to higher elevations; not common.

Table Top Mts, *Bolton 94-092*.

Metastelma arizonicum A. Gray. [*Cynanchum arizonicum* (A. Gray) Shinnery]

Small perennial vines. Leaves oblong, often slender with inrolled margins. Flowers white, minute. Fruits elongated and smooth.

Javelina Mt, northern slope, *Arnett & Walter LA 1260* (CS).

Sand Tank Mts, *Felger 95-349*.

Sarcostemma cynanchoides Decaisne subsp. **hartwegii** (Vail) R. W. Holm. CLIMBING MILKWEED; GÜIROTE

Perennial vines, sprawling across the desert or climbing up trees and saguaros. Flowers maroon and white. This is one of the few common vines in the region; washes and arroyos, and canyons.

Sand Tank Mts, Johnson Well, *Funicelli & Anning 39*.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Vekol Valley, 15 Aug 1999, *Mauz*, observation.

ASTERACEAE - DAISY OR COMPOSITE FAMILY

Acourtia nana (A. Gray) Reveal & R. M. King. [*Perezia nana* A. Gray]. DESERT-HOLLY

Small herbaceous perennials with hollylike leaves; flower heads small and purplish. Mostly localized beneath mesquite shrubs in bottomland.

Sand Tank Mts, near Johnson Well, *Felger 95-336*.

Table Top Mts, summit of Table Top, *Mauz*, observation.

Vekol Valley, *Mauz 99-133*.

Acourtia thurberi (A. Gray) Reveal & R. M. King. [*Perezia wrightii* A. Gray].

BROWNFOOT

Tall, herbaceous perennials; flowers lavender. Mountain slopes and canyons, or arroyo margins in valleys near mountains. Seldom common.

Flats east of North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

Sand Tank Mts, eastern area, *Arnott & Walter LA 1254* (CS).

Table Top Mts, *Mauz 21-073*.

Adenophyllum porophylloides (A. Gray) Strother. [*Dyssodia porophylloides* A. Gray].

DOGWEED

Herbaceous perennials; disk flowers yellow, the rays small and orange-yellow. Herbage pungently aromatic. Mountains and canyons.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

Sand Tank Mts, 9 Oct 1995, *Felger* observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, 17 May 1999, *Mauz*, observation.

Ambrosia ambrosioides (Cavanilles) W. W. Payne. [*Franseria ambrosioides* Cavanilles].

CANYON RAGWEED; CHICURA

Scarcely woody, slender-stem shrubs. Herbage glandular-sticky. Leave triangular, mostly more than 10 cm long, often beset with small insect galls. Flowers inconspicuous, green or yellow. Fruit a bur with hooked spines, resembling a cocklebur. Common along larger washes, often beneath desert trees; valley bottoms, bajadas, and canyons.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Bolton 94-067*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Ambrosia confertiflora de Candolle. SLIM-LEAF RAGWEED; ESTAFIATE

Weedy perennial herbs from deeply seated rootstocks. Leaves 2 or 3 times pinnately divided. Flowers inconspicuous, green or yellow. Disturbed habitats, especially in overgrazed, bottomland habitats including Vekol Valley, Water catchments, dirt cattle tanks, and arroyos or washes. Also highway roadsides and ditches, as well sometimes in natural habitats. Probably a natural component of the vegetation of the Vekol Valley floodplain.

Junction of I-8 and Pinal-Maricopa county line; 3 Apr 2001, *Felger*, observation.

Sand Tank Mts, *Felger 95-422*.

Table Top Mts, *Mauz 99-121*.

Ambrosia deltoidea (Torrey) W.W. Payne. [*Franseria deltoidea* Torrey]. TRIANGLE-LEAF BURSAGE; CHAMIZO FORRAJERO

Small shrubs; flowers inconspicuous, green or yellow. Leave triangular and grayish. Summer dormant, although occasionally producing leaves following rainy, cloudy weather. Throughout the Monument, at almost all elevations. Along with creosotebush, this is the most widespread and common perennial plant in the region.

Junction of I-8 and Pinal-Maricopa county line; 3 Apr 2001, *Felger*, observation.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Bolton 94-035*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Ambrosia dumosa (A. Gray) W. W. Payne. [*Franseria dumosa* A. Gray]. WHITE BURSAGE; CHAMIZO

Small shrubs. Leaves grayish, 1- to 3-times pinnately dissected into small "rounded" segments; flowers minute, green or yellow. Arid habitats including south- and west-facing slopes and desert valleys. Along with *A. deltoidea*, this is one the most common and

widespread Sonoran Desert perennials, but in the Monument *A. dumosa* is much less common than *A. deltoidea*.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Bolton 94-037*.

Artemesia ludoviciana Nuttall subsp. ***albula*** (Wooton) D. D. Keck. WESTERN MUGWEED, WHITE SAGE; CHAMIZO CENIZO

Herbaceous perennials; stems dying back during drought or severe freezing. Stems and leaves white woolly; leaves with coarse teeth. Flower heads small and inconspicuous. Most common towards higher elevations, among rocks, especially on north-facing slopes.

Javelina Mt, *Arnott & Walter 1262* (CS).

North Maricopa Mts, *Wirt*, observation.

Sand Tank Mts, 11 Oct 1995, *Felger*, observation.

Table Top Mts, *Felger 01-278*.

Baccharis brachyphylla A. Gray

Low, spreading shrubs reaching 1-1.5 m tall. Flowers inconspicuous, dull white.

Infrequent along large sandy washes and canyon bottoms.

Bighorn Road, north of Javelina Mt, *Felger 95-327*.

Sand Tank Mts, Bender Spring Canyon, 17 Apr 2001, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, trail near the base, 4 Apr 2001, *Felger*, observation.

Baccharis salicifolia (Ruiz & Pavón) Persoon. [*B. glutinosa* Persoon]. SEEP WILLOW; BATAMOTE

Leafy, willowlike shrubs; flowers white. Localized at waterholes and wetland habitats.

Sand Tank Mts, Bender Spring Canyon, 17 Apr 2001, *Felger*, observation.

Water catchment north of Antelope Peak, 3 Apr 2001, *Felger*, observation.

Baccharis sarothroides A. Gray. DESERT BROOM; ESCOBA AMARGA, ROMERILLO

Broomlike shrubs to 2 meters; herbage glutinous-sticky and aromatic. Flowers white. Common in the Vekol Valley but apparently scarce elsewhere on the Monument; washes and canyon bottoms. Elsewhere in southern Arizona this shrub is common in disturbed habitats.

North Maricopa Mts, north of Butterfield pass, 1993, *Wirt*, observation.

Vekol Valley, *Mauz*, observation.

Baileya multiradiata Harvey & A. Gray. MANY-FLOWERED DESERT-MARIGOLD; HIERBA AMARILLA

Spring or sometimes non-seasonal annuals or short-lived perennials. Herbage white woolly. Flowers bright yellow, the flower heads large and showy. Highway roadsides, valley floors, washes, and scattered on bajadas, and may be locally abundant in low elevation ruderal settings.

Bighorn Road north of Javelina Mt, 9 Oct 1995, *Felger* observation.

Junction of I-8 and Pinal-Maricopa county line, 3 Apr 2001, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Bolton 94-064*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Bebbia juncea (Bentham) Greene var. ***aspera*** Greene. SWEET-BUSH, CHUCKWALLA DELIGHT

Small shrubs. Leave small, rough to the touch, and quickly falling in drought. Flowers yellow and aromatic. Widespread, often on arid slopes, and sometimes along washes.

Bighorn Road north of Javelina Mt, 9 Oct 1995, *Felger* observation.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

Table Top Mts, 17 Mar 1999, *Mauz*, observation.

Brickellia coulteri A. Gray var. **coulteri**. BRICKLELL-BUSH

Small shrubs; leave often arrow-shaped. Flowers small, yellow and purple. Washes, arroyos, canyons and mostly north-facing slopes. Often growing beneath ironwood, mesquite, or palo verde trees. Widespread at all elevations.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

Sand Tank Mts, Bender Spring Road, *Felger 95-441*.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Bolton 94-045*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Calycoseris wrightii A. Gray. WHITE TACKSTEM

Cool weather annuals; flowers white. Widespread but seldom very common; washes and roadsides, arroyos, canyons, and rocky slopes. Tack-shaped, stalked glands on the stems readily distinguish it from *Rafinesquea neomexicana*.

Junction of I-8 and Pinal-Maricopa county line, 3 Apr 2001, *Felger*, observation.

South Maricopa Mts, *Felger 01-211*.

Table Top Mts, *Bolton 94-010*.

Vekol Valley, *Felger 01-232*.

Chaenactis. The two Sonoran Desert species may be distinguished as follows:

- 1 Plants with short white hairs (not cobwebby); phyllaries with an elongated, slender (terete) tip; flower heads with stout receptacular bristles among the florets; pappus scales 1.1 – 3 mm. *C. carphoclinia*
- 1' Plants with cobwebby woolly hairs; phyllaries blunt, the tips not elongated; flower heads without receptacular bristles; pappus scales 3.5 – 6.5 mm. *C. stevioides*

Chaenactis carphoclinia A. Gray var. **carphoclinia**. PEBBLY PINCUSHION

Cool season annuals; flowers white. Widespread. Often growing intermixed with *C. stevioides*; *C. carphoclinia* tends to be more common in drier, more xeric habitats than those occupied by *C. stevioides*.

North Maricopa Mts, *Felger 01-173*.

Table Top Mts, *Bolton 94-004*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Chaenactis stevioides Hooker & Arnott. DESERT PINCUSHION

Cool season annuals; flowers white, sometimes suffused with pink. Widespread.

North Maricopa Mts, north of Butterfield pass, 1993, *Wirt*, observation.

South Maricopa Mts, *Chamberland 24 Mar 2001*.

Table Top Mts, *Felger 01-328*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Cirsium neomexicanum A Gray. DESERT THISTLE; CARDO

Annual herbs (elsewhere known as biennial herbs); spiny thistles reaching 1.7 m tall. Thistle-like flower heads, the flowers pale lavender. North-facing grassy slopes at higher

elevations in the Sand Tank Mountains and expected elsewhere in the Monument in similar habitats. This is the only thistle known from the Monument.

Sand Tank Mts, *Felger 95-356*.

****Conyza canadensis*** (Linnaeus) Cronquist var. ***glabrata*** (A. Gray) Cronquist. HORSEWEED, COLA DE CABALLO

Summer-fall annuals; tall and slender, not glandular. Leaves narrow, entire or with a few shallow teeth. Flowers white and inconspicuous. Not common; probably restricted to water catchments and other waterholes with cattle grazing.

Table Top foothills, 3 Apr 2001, *Felger*, observation.

Water catchment north of Antelope Peak, 3 Apr 2001, *Felger*, observation.

****Conyza coulteri*** A. Gray. [*Laennecia coulteri* (A. Gray) G. L. Nesom]

Summer-fall annuals, the herbage and flower heads sticky due to glandular exudate. Lower broad and lobed to coarsely toothed, the base usually clasping the stem. Flower heads small and inconspicuous. Vekol Valley bottom, silty clay in mesquite bosque.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Encelia farinosa A. Gray var. ***farinosa*** (Blake) I. M. Johnston. BRITTLEBUSH; INCIENSO, HIERBA DEL VASO

Small shrubs; flowers showy, the rays yellow, the disk yellow (forma *farinosa*) or purple-brown (forma *phenicodonta*); mostly spring, and also with summer-fall rains. Desert hills, mountains, and bajadas. One of the most abundant and conspicuous perennials in the region; producing massive displays of showy yellow, daisy-like flowers during favorable seasons.

The plants are frost sensitive and are sometimes severely nipped by freezing weather; it is fast-growing and can recover quickly from drought or moderate freeze damage. At maturity the heads turn downward, dumping out the thin, flat achenes (seeds).

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Bolton 94-048*.

Ericameria laricifolia (A. Gray) Shinnery. [*Haplopappus laricifolius* A. Gray]. TURPENTINE BUSH

Small shrubs; resinous, dense foliage of small, dark green linear leaves; flowers bright yellow. Higher elevations in the Sand Tank Mountains, mostly on north-facing slopes, and expected on other mountain tops.

Sand Tank Mts, *Felger 95-372*.

Erigeron divergens Torrey & A. Gray var. ***divergens***. [*E. lobatus* A. Nelson]. DESERT FLEABANE

Cool season annuals; taproot well developed on larger plants. Leaves soft and pale green; lower leaves lobed. Rays pale violet, the disk flowers yellow. Localized, best developed on wet soils at waterholes or temporarily waterlogged habitats; sometimes common on hard-packed clay soils and also sandy washes and arroyos.

Junction of I-8 and Pinal-Maricopa county line; 3 Apr 2001, *Felger*, observation.

Sand Tank Mts, Bender Spring, *Felger 95-442A*.

Vekol Valley, *Felger 01-237*.

Eriophyllum lanosum (A. Gray) A. Gray. [*Burrielia lanosum* A. Gray]. WOOLLY DAISY

Small, cool season annuals, conspicuously white woolly. Flower heads showy, the rays white with red candy-stripe lines below, the disk flowers yellow. Sandy and gravelly soils of floodplains, valley plains, and bajadas and sometimes on rocky slopes.

Junction of I-8 and Pinal-Maricopa county line; 3 Apr 2001, *Felger*, observation.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Bolton 94-001*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Evax multicaulis de Candolle var. **multicaulis**

Diminutive cool season annuals; plants white woolly and often many-stemmed. Flowers minute, inconspicuous. Achenes without a pappus (a reliable key character). Clay and other fine-textured soils; depressions and other places where water temporarily accumulates. (see *Filago*)

Vekol Valley, *Felger 01-236*.

Eupatorium solidaginifolium A. Gray. GOLDENROD THOROUGHWORT

Bushy perennials with slender stems and thin, ovate leaves. Flowers inconspicuous, white. Expected among rock at higher elevations, especially on north-facing slopes. Known from the Monument by a single report.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Filago

Five species of “fuzzy little composites” have been found in Monument. They are generally considered very difficult to identify because the keys rely on very tiny and technically difficult features. Yet with a little practice you can readily distinguish the species by their general appearance, and verify the identity with a few relatively easy to find features. Here are some hints at identification:

Evax multicaulis. Low-lying habitats, usually localized; plants short and very woolly; achenes all without a pappus.

Filago arizonica. Low-lying habitats, widespread and common; stems straight and forked, several or more from base.

Filago californica. Widespread, many habitats; plants usually upright, often with a single main axis.

Filago depressa. Lowland habitats; plants low and much-branched, can be confused with *Evax* but achenes bear a pappus; pappus bristles of the central achenes fall away singly or in 2's.

Stylocline micropoides. Widespread in many habitats. Stems leafy, often rather loose or lax, the flower heads rounded and relatively large; outer florets enclosed in a papery, heart-shaped bract, the mature head breaking apart into tiny fuzzy white balls.

Filago arizonica A. Gray. ARIZONA FLUFFWEED

Small, cool season annuals; flowers minute and inconspicuous. The stems tend to be several from the base, ascending to spreading, dark, slender, straight, leafless between the clusters of flower head, branching in a forked pattern (pseudo-dichotomous), and woolly at first, the hairs falling away with age. Pappus bristles on the tiny disk achenes fall away in complete or partial rings. Often on fine-textured soils or in low places where water temporarily accumulates and other depressions. Lowlands and also at summit of Table Top Mountains.

Flats east of North Maricopa Mts, *Felger 01-204*.

Junction of I-8 and Pinal-Maricopa county line; 3 Apr 2001, *Felger*, observation.

North Maricopa Mts, *Felger 01-182*.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation

Table Top Mts, *Felger 01-311*.

Vekol Valley, *Felger 01-245*.

Filago californica Nuttall. CALIFORNIA FLUFFWEED

Cool season annuals; flowers minute, inconspicuous. Widespread and common at all elevations, especially along washes and arroyos, and also on rocky slopes.

North Maricopa Mts, *Felger 01-183*.

Sand Tank Mts, *Felger 95-448.s*

South Maricopa Mts, *Chamberland 1854*.

Table Top Mts, *Felger 01-319*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Filago depressa A. Gray

Cool season annuals; flowers minute, inconspicuous. Mostly at lower elevations, especially on sandy or gravelly soils along drainageways; sometimes locally abundant.

North Maricopa Mts, *Felger 01-184*.

South Maricopa Mts, *Felger 01-212*.

Table Top Mts, 4 Apr 2001, *Felger*, observation.

Gaillardia arizonica A. Gray. [*G. arizonica* var. *pringlei* (Rydberg) S. F. Blake]. ARIZONA BLANKET-FLOWER

Cool season annuals; flowers heads showy, bright yellow, the rays conspicuously parted into three large lobes. Not common; widely scattered small, localize populations, especially in gravelly soils on bajadas.

Sand Tank Mts, *Morrison LA 1076 (CS)*.

Vekol Valley, east side near road to Table Top campground, lower bajada, 26 Mar 2001, *Felger*, observation.

Geraea canescens Torrey & A. Gray. DESERT SUNFLOWER, DESERT GOLD

Coarse spring annuals; flower heads sunflower-like, showy, and yellow.

Table Top Mts, *Bolton 94-085*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Gutierrezia arizonica (A. Gray) M. A. Lane. [*Greenella arizonica* A. Gray, *Xanthocephalum arizonicum* (A. Gray) Shinnors]

Delicate cool season annuals; disk flowers yellow, the rays white. A rather rare plant, locally beneath creosotebushes in the lower Vekol Valley.

Vekol Valley, *Felger 01-233*.

Gutierrezia sarothrae (Pursh) Britton & Rusby. BROOM SNAKEWEED; HIERBA DE LA VÍBORA

Perennial subshrubs; herbage glandular-punctate and resinous. Leaves very slender. Flowers yellow in small heads. Mostly in rocky habitats at higher elevations.

Sand Tank Mts, near Johnson Well, *Felger 95-335*.

Table Top Mts, *Felger 01-301*.

Gymnosperma glutinosum (Sprengel) Lessing. GUMHEAD

Small shrubs or subshrubby perennials, glistening with viscid, glandular exudate in dry seasons. Leaves dark green and narrow. Flower head small, bright yellow. Widely scattered but their numbers few; in heavily grazed areas such as Vekol Valley and also in canyon and to the summit on Table Top.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Sand Tank Mts, Johnson Well, 10 Oct 1996, *Felger*, observation.

Table Top Mts, 4 Apr 2001, *Felger*, observation.

Vekol Valley, 19 Mar 1999, *Mauz*, observation.

Hymenoclea salsola Torrey & A. Gray var. **pentalepis** (Rydberg) L. D. Benson. WHITE BURRO-BUSH

Globose shrubs, pungently aromatic and resinous. Foliage sparse, the leaves slender, the larger ones with threadlike segments. Flowers inconspicuous, the female flowers in small, papery burs. Mostly on open, valley floors and bajadas.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

Roadside, Hwy 238, 20 Mar 2001, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Vekol Valley, *Bolton 94-020*.

Isocoma acradenia (Greene) Greene var. **eremophila** (Greene) G. L. Nesom. [*I. eremophila* Greene, *I. acradenia* subsp. *eremophila* (Greene) Beauchamp, *Haplopappus acradenius* subsp. *eremophilus* (Greene) H. M. Hall]. GOLDENBUSH

Small, densely branched shrubs, copiously resinous-glutinous from the glands. Larger leaves with coarsely toothed margins. Flowers bright yellow; spring and late summer or fall. Silty clay soils of Vekol Valley and occasional elsewhere, especially in areas of cattle grazing.

Vekol Valley, *Felger 01-223*.

***Lactuca seriola** Linnaeus. PRICKLY LETTUCE, COMPASS PLANT

Warm weather annuals, growing with spring rains and often persisting into summer. Stems erect, the leaves upright in a north-south plane, hence the common name. Flowers pale yellow. Disturbed habitats but seldom common. Native to Europe, now a widespread weed.

Junction of I-8 and Pinal-Maricopa county line; 3 Apr 2001, *Felger*, observation.

Water catchment north of Antelope Peak, *Mauz 21-026*.

Machaeranthera pinnatifida (Hooker) Shinnery var. **gooddingii** (A. Nelson) B. L. Turner & D. B. Horne. [*Haplopappus spinulosus* (Pursh) de Candolle subsp. *gooddingii* (A. Nelson) H. M. Hall]. SPINY GOLDENWEED

Herbaceous perennials, also flowering in the first season; flowers yellow. Hills and rocky slopes to peak elevations and upper bajadas.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Sand Tank Mts, Bighorn Road, 9 Oct 1995, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, 17 May 1999, *Mauz*, observation.

Malacothrix coulteri A. Gray. SNAKE'S HEAD

Cool season annuals; semisucculent blue-green leaves and stems. Flower heads globose, the bracts (phyllaries) silvery with purplish midstripes; flowers pale yellow with pink bases. Clay and silty soils of Vekol Valley, often beneath mesquite shrubs and creosotebushes.

Vekol Valley, *Felger 01-229*.

Malacothrix fendleri A. Gray

Cool season annuals; flowers yellow. Widely scattered across the Monument but generally localized and uncommon.

Sand Tank Mts, *Shreve 10157*.

Table Top Mts, summit, *Felger 01-289*.

Water catchment north of Antelope Peak, 3 Apr 2001, *Felger*, observation.

Vekol Valley, *Felger 01-243*.

Malacothrix glabrata (D.C. Eaton) A. Gray. [*M. californica* de Candolle var. *glabrata* Eaton]. SMOOTH DESERT DANDELION

Cool season annuals. Leave with threadlike segments, generally withering as the flowers develop. Flowers yellow, in showy heads on long stalks. Mostly along sandy washes in the valleys.

South Maricopa Mts, *Felger 01-151*.

Malacothrix sonora W. S. Davis & P. H. Raven

Cool season annuals. Leave rather delicate and thin, with coarse teeth. Flowers white, the heads small. Widely scattered across the Monument, often along washes, and extending to the summit of Table Top.

Sand Tank Mts, *Felger 01-336*.

South Maricopa Mts, *Chamberland 1853*.

Table Top Mts, *Felger 01-313*.

Water catchment north of Antelope Peak, 3 Apr 2001, *Felger*, observation.

***Matricaria matricarioides** (Lessing) Porter. PINEAPPLE WEED, FALSE CHAMOMILE;
MANZANILLA

Cool season annuals.; flowers yellow. Rare in the Monument, seen only near a dirt cattle tank in silty-clay soil.

Flats east of North Maricopa Mts, *Felger 01-202*.

Monoptilon bellioides (A. Gray) H. M. Hall. MOJAVE DESERT-STAR

Small, low-growing cool season annuals; rays white to lavender, the disk yellow.

North Maricopa Mts, south end, 20 Mar 2001, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Bolton 94-036*.

Water catchment north of Antelope Peak, 3 Apr 2001, *Felger*, observation.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Pectis linifolia Linnaeus

Hot weather annuals; flowers yellow tinged with purple.

Sand Tank Mts, Johnson Well, *Funicelli & Anning 15*.

Pectis papposa Harvey & A. Gray var. **papposa**. DESERT CHINCHWEED; MANZANILLA DEL
COYOTE

Hot weather annuals; flowers yellow.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Sand Tank Mts, Johnson Well, *Funicelli & Anning 29*.

Vekol Valley, *Mauz*, observation.

Perityle emoryi Torrey. DESERT ROCK DAISY

Cool season annuals; flower heads of white rays and yellow centers.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Water catchment north of Antelope Peak, *Mauz 21-030*.

Porophyllum gracile Bentham. ODORA, HIERBA DEL VENADO

Herbaceous perennials; flowers purplish or whitish.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Table Top Mts, *Bolton 94-041*.

Psilostrophe cooperi (A. Gray) Greene. PAPER DAISY, PAPER FLOWER

Herbaceous perennials; flowers yellow.

Sand Tank Mts, Johnson Well, 10 Oct 1996, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Bolton 94-087*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Rafinesquia californica Nuttall. CALIFORNIA CHICORY

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

Sand Tank Mts, *Felger 01-337*.

South Maricopa Mts, *Felger 01-162*.

Rafinesquia neomexicana A. Gray. DESERT CHICORY, DESERT DANDELION

Sand Tank Mts, *Felger 01-331*.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Water catchment north of Antelope Peak, 3 Apr 2001, *Felger*, observation.

Senecio lemmonii A. Gray. LEMMON GROUNDSEL

Annuals, mostly in spring, to weakly perennial; flowers yellow.

Sand Tank Mts, Sand Tank Wash, 9 Oct 1995, *Felger*, observation.

***Sonchus asper** (Linnaeus) Hill subsp. **asper**. SPINY SOW-THISTLE; CHINITA

Cool season annuals; flowers pale yellow.

Junction of I-8 and Pinal-Maricopa county line; 3 Apr 2001, *Felger*, observation.

Roadside, Hwy 238, 20 Mar 2001, *Felger*, observation.

***Sonchus oleraceus** Linnaeus. COMMON SOW-THISTLE; CHINITA

Winter-spring annuals; flowers pale yellow.

North Maricopa Mts, 20 Mar 2001, *Felger 01-171*.

Sand Tank Mts, *Bertelson, Wirt, and Holm*, observation.

South Maricopa Mts, *Chamberland 1863*.

Stephanomeria pauciflora (Torrey) A. Nelson var. **pauciflora**. DESERT STRAW

Bushy perennials; flowers pale pink.

Javelina Mt, northern slope, *Arnett & Walter LA 1258 (CS)*.

Junction of I-8 and Pinal-Maricopa county line; 3 Apr 2001, *Felger*, observation.
North Maricopa Mts, 20 Mar 2001, *Felger*, observation.
Sand Tank Mts, 10 Oct 1995, *Felger*, observation.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts., 17 May 1999, *Mauz*, observation.

Stylocline micropoides A. Gray

Diminutive cool season annuals. Herbage, and especially the flower heads white woolly. Flowers minute, inconspicuous. Widespread, valley plains, washes, and mountains.

North Maricopa Mts, *Felger 01-195*.
Rock quarry north of Antelope Peak, 3 Apr 2001, *Felger*, observation.
Sand Tank Mts, *Felger 01-335*.
South Maricopa Mts, *Chamberland 1850*.
Table Top Mts, *Felger 01-320*.
Vekol Valley, *Felger 01-245*.

Thymophylla concinna (A. Gray) Strother. [*Dyssodia concinna* (A. Gray) B. L. Robinson].
DOGWEED; MANZANILLA DEL COYOTE

Small, cool season annuals; plants strongly scented with conspicuous oil glands. Leaves pinnate with slender segments. Rays white, the disk flowers yellow.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Thymophylla pentachaeta (de Candolle) Small. [*Dyssodia pentachaeta* (de Candolle) B.L. Robinson].

Small, short-lived herbaceous perennials; flowers bright yellow. Seen only at the summit of Table Top Mt, but probably more widespread.

Table Top Mts, *Felger 01-290*.

Trixis californica Kellogg var. **californica**

Small shrubs or subshrubs; flowers yellow.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.
Sand Tank Mts, Johnson Well, *Funicelli & Anning 26*.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, *Bolton 94-074*.
Vekol Valley, 26 Mar 2001, *Felger*, observation.

Uropappus lindleyi (de Candolle) Nuttall. [*Microseris linearifolia* (de Candolle) Schultz Bipontinus]. SILVER PUFFS

Spring annuals with milky sap.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, 04 Apr 2001, *Felger*, observation.
Vekol Valley, *Felger 01-228*.
Water catchment north of Antelope Peak, 3 Apr 2001, *Felger*, observation.

Viguiera parishii Greene. [*V. deltoidea* A. Gray var. *parishii* (Greene) Vasey & Rose].
PARISH GOLDENEYE

Small shrubs; flowers yellow.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.
Sand Tank Mts, 11 Oct 1995, *Felger*, observation.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, 9 Apr 1994, *Bolton*, observation.

Zinnia acerosa (de Candolle) A. Gray. DESERT ZINNIA

Dwarf, shrublike perennials; flowers white.

Sand Tank Mts, 10 Oct 1995, *Felger*, observation.

Table Top Mts, *Bolton 94-13*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

BERBERIDACEAE - BARBERRY FAMILY

Berberis harrisoniana Kearney & Peebles. KOFA MOUNTAIN BARBERRY

Shrubs; flowers yellow. Known only from southwestern Arizona in the Ajo, Sand Tank, and Kofa Mountains. In the Sand Tanks, about two dozen plants grow in a shady north facing alcove in Tertiary-age volcanic rocks, along a rocky drainage with *Vauquelinia californica* and *Juniperus coahuilensis*. *B. harrisoniana* is considered for federal listing, but deemed not threatened (Category 3C) since it is protected by absence of roads, people, and livestock (Malusa 1995). The locality is near the southern boundary of the Monument, and it should be sought within the Monument on the higher peaks.

Sand Tank Mts, one mile southwest of Squaw Tit Peak, 2 Jan 1995, *Malusa*, observation.

BIGNONIACEAE - BIGNONIA FAMILY

Chilopsis linearis (Cavanilles) Sweet subsp. **arcuata** (Fosberg) Henrickson. DESERT WILLOW; MIMBRE

Large shrubs or trees; flowers pink to purple and white, incredibly fragrant when blooming. Seeds flat, with dissected, papery wing at each end. Along the lower Vekol Wash.

Vekol Valley, *Mauz 21-021*.

BORAGINACEAE - BORAGE FAMILY

Amsinckia intermedia Fischer & C. A. Meyer var. **echinata** (A. Gray) Wiggins. DEVIL'S LETTUCE, FIDDLENECK

Cool season annuals; flowers yellow-orange.

Flats between North and South Maricopa Mts, *Felger*, observation.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Felger 01-323*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Amsinckia tessellata A. Gray

CHECKER FIDDLENECK

Cool season annuals; flowers yellow-orange.

Flats between North and South Maricopa Mts, *Felger 01-163*.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

Sand Tank Mts, *Felger*, observation.

Table Top Mts, *Bolton 94-012*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Cryptantha angustifolia (Torrey) Greene. NARROW-LEAF CRYPTANTHA, DESERT CRYPTANTHA

Cool season annuals; flowers white.

South Maricopa Mts, *Felger 01-144*.
Table Top Mts, *Bolton 94-005*.
Vekol Valley, 26 Mar 2001, *Felger*, observation.

Cryptantha barbiger (A. Gray) Greene. BEARDED CRYPTANTHA

Cool season annuals; flowers white.
Flats between North and South Maricopa Mts, *Felger 01-167*.
South Maricopa Mts, *Felger 01-143*.
Table Top Mts, *Bolton 94-027*.
Vekol Valley, 26 Mar 2001, *Felger 01-248*.

Cryptantha maritima Greene [includes var. **maritima** and var. **pilosa** I. M. Johnston].

WHITE-HAIRED CRYPTANTHA

Cool season annuals; flowers white.
North Maricopa Mts, *Felger 01-170*.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, 20 Mar 1999, *Mauz*, observation.

Cryptantha micrantha (Torrey) I. M. Johnston subsp. **micrantha**. DWARF CRYPTANTHA

Cool season annuals; flowers white.
South Maricopa Mts, *Chamberland 24 Mar 2001*.

Cryptantha pterocarya (Torrey) Greene var. **cycloptera** (Greene) Macbride. WING-NUT CRYPTANTHA

Cool season annuals; flowers white.
Flats east of North Maricopa Mts, 20 Mar 2001, *Felger*, observation.
North Maricopa Mts, 20 Mar 2001, *Felger*, observation.
Sand Tank Mts, *Felger 01-356*.
South Maricopa Mts, *Felger 01-145*.
Table Top Mts, *Bolton 94-011*.
Vekol Valley, 26 Mar 2001, *Felger*, observation.

Lappula occidentalis (S. Watson) Greene. [*Echinosperrum redowskii* (Hornemann) Greene var. *occidentale* S. Watson]. STICKSEED

Winter-spring annuals.
Junction of I-8 and Pinal-Maricopa county line; 3 Apr 2001, *Felger*, observation.
Sand Tank Mts, *Morrison & Walter LA 1078 (CS)*.
South Maricopa Mts, *Felger 01-140*.
Table Top Mts, 4 Apr 2001, *Felger*, observation.
Vekol Valley, 26 Mar 2001, *Felger*, observation.

Pectocarya heterocarpa (I. M. Johnston) I. M. Johnston. MIXED-NUT COMB-BUR

Flats between North and South Maricopa Mts, *Felger 01-164*.
South Maricopa Mts, *Felger 01-149*.

Pectocarya platycarpa (Munz & I. M. Johnston) Munz & I. M. Johnston. BROAD-WING COMB-BUR

Cool season annuals; flowers white.
Flats between North and South Maricopa Mts, *Felger 01-165*.
Table Top Mts, *Bolton 94-002*.
Vekol Valley, 26 Mar 2001, *Felger*, observation.

Pectocarya recurvata I. M. Johnston. ARCHED COMB-BUR

Cool season annuals; flowers white.
Flats between North and South Maricopa Mts, *Felger 01-166*.
Table Top Mts, *Bolton 94-061*.

Plagiobothrys arizonicus (A. Gray) A. Gray. ARIZONA POPCORN-FLOWER

Cool season annuals; flowers white.
Flats east of North Maricopa Mts, *Felger 01-199*.
North Maricopa Mts, 20 Mar 2001, *Felger*, observation.
South Maricopa Mts, *Felger 01-146*.

Plagiobothrys jonesii A. Gray

Cool season annuals; flowers white.
South Maricopa Mts, *Felger 01-142*.

Tiquilia canescens (de Candolle) A. T. Richardson. [*Coldenia canescens* de Candolle]

Dwarf, subshrubby perennials; flowers lavender. Rocky slopes to peak elevations.
Sand Tank Mts, *Felger 95-449*.
Table Top Mts, 9 Apr 1999, *Bolton*, observation.

BRASSICACEAE (CRUCIFERAE) - MUSTARD FAMILY

Arabis perennans S. Watson. ROCK CRESS

Perennial herbs; flowers pink-purple. Higher elevations, rocky slopes and canyons, generally above desert.
Sand Tank Mts, Bender Saddle, *Felger 95-391*.

***Brassica tournefortii** Gouan. SAHARA MUSTARD, WILD TURNIP

Cool season annuals; flowers pale yellow.
Junction of I-8 and Pinal-Maricopa county line; 3 Apr 2001, *Felger*, observation.
Roadside, Hwy 238, 20 Mar 2001, *Felger*, observation.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Caulanthus lasiophyllus (Hooker & Arnott) Payson var. **lasiophyllus**. [*Thelypodium lasiophyllus* (Hooker & Arnott) Greene].

Cool season annuals; flowers minute, white.
North Maricopa Mts, *Felger 01-175*.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, *Bolton 94-016*.
Vekol Valley, 26 Mar 2001, *Felger*, observation.

***Chorispora tenella** (Pallus) de Candolle

Winter-spring annuals; small pink flowers. Cattle tanks and Water catchments.
Water catchment north of Antelope Peak, *Felger 01-255*.

Descurainia pinnata (Walter) Britton. TANSY MUSTARD

Cool season annuals; flowers minute, pale yellow. Widespread.
Flats east of North Maricopa Mts, 20 Mar 2001, *Felger*, observation.
North Maricopa Mts, 20 Mar 2001, *Felger*, observation.
Sand Tank Mts, 17 Apr 2001, *Felger*, observation.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, *Felger 01-284*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Draba cuneifolia Torrey & A. Gray [*D. cuneifolia* var. *integrifolia* S. Watson]. WEDGE-LEAF DRABA

Cool season annuals; flowers minute, white. Widespread, mostly in shaded niches.

Javelina Mt, *Walter & Arnett LA 1398* (CS).

Maricopa Mts, *Wirt*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Felger 01-280*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Lepidium lasiocarpum Nuttall. SAND PEPPERGRASS

Cool season annuals; flowers minute, white. Common and widespread.

Flats east of North Maricopa Mts, *Felger 01-203*.

Javelina Mt, northern slope, *Walter & Morrison LA 244* (CS).

Junction of I-8 and Pinal-Maricopa county line; 3 Apr 2001, *Felger*, observation.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

South Maricopa Mts, *Felger 01-155*.

Table Top Mts, *Bolton 94-013*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Lesquerella gordonii (A. Gray) S. Watson var. **gordonii**. BLADDERPOD

Cool season annuals; flowers bright yellow.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Table Top Mts, *Felger 01-309*.

Vekol Valley, *Felger 01-235*.

Lesquerella purpurea (A. Gray) A. Nelson. WHITE BLADDERPOD

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

South Maricopa Mts, *Felger 01-154*.

Lesquerella tenella A. Nelson. DELICATE BLADDERPOD

Cool season annuals; flowers yellow.

Flats east of North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

North Maricopa Mts, *Felger 01-187*.

South Maricopa Mts, *Felger 01-150*.

Table Top Mts, *Felger 01-329B*.

Lyrocarpa coulteri Harvey var. **coulteri**. LYRE-POD

Perennial herbs; flowers yellow-green to yellow-brown. Mostly arroyo margins and canyon slopes; common. This is the only perennial mustard occurring in the Sonoran Desert.

Flats east of North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

Maricopa Mts, *Wirt*, observation.

South Maricopa Mts, 24 Mar 2001, *Felger*, observation.

Table Top Mts, *Bolton 94-078*.

***Sisymbrium irio** Linnaeus. LONDON ROCKET; PAMITA

Cool season annuals; flowers yellow. Well established and naturalized.

Flats east of North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

Table Top Mts, *Bolton 94-065*.

Vekol Valley, *Felger 01-224*.

Water catchment north of Antelope Peak, 3 Apr 2001, *Felger*, observation.

Streptanthus carinatus A. Gray. [*S. arizonicus* S. Watson var. *luteus* Kearney and Peebles, *S. carinatus* A. Gray subsp. *arizonicus* (S. Watson) Kruckeberg et al.]. TWIST FLOWER

Cool season annuals; flowers yellow. On Table Top, abundant above 3500', replacing *Lesquerella gordonii* as the yellow-flowered plant on the landscape.

Javelina Mt, *Walter & Arnett LA 1393* (CS).

Sand Tank Mts, *Felger 01-345*.

Table Top Mts, *Felger 01-295*.

Thysanocarpus curvipes Hooker. LACEPOD

Cool season annuals; flowers minute, white. Margins of the round, flat fruit winged and perforated.

Javelina Mt, northern slope, *Walter LA 240* (CS).

Sand Tank Mts, 17 April 2001, *Felger*, observation.

South Maricopa Mts, *Felger 01-161*.

Table Top Mts, *Mauz 21-007*.

BURSERACEAE - FRANKINCENSE FAMILY

Bursera microphylla A. Gray. ELEPHANT TREE; TOROTE

Treelike shrubs with thick, semisucculent limbs; flowers minute, white. From base to near peak elevations but localized on slopes and habitats affording protection from freezing weather.

Javelina Mt, 1 Dec 2000, *Felger & Bowden*, observation.

CACTACEAE - CACTUS FAMILY

Carnegiea gigantea (Engelmann) Britton & Rose. SAGUARO; SAHUARO

Giant columnar cactus; flowers white. Widespread throughout the Monument, on all mountains, hills, and surrounding piedmonts and bajadas. Amazingly dense stands of saguaro cactus in many parts of the Monument may be explained in part by favorable environmental conditions and general lack of livestock grazing in recent history. A forest of these giant cacti near Javelina Mountain is so dense in places that it is difficult to walk among them with your arms spread wide.

Cylindropuntia acanthocarpa (Engelmann & J. L. Bigelow) Knuth. [*Opuntia acanthocarpa* Engelmann & J. L. Bigelow]. BUCKHORN CHOLLA

Shrub-sized cholla; flower color variable but constant for an individual plants, the "petals" yellow, golden orange, orange, magenta red, or purplish, and the filaments red; flowering in spring. Fruits maturing the same season and dry. Common and widespread, at all elevations.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

Sand Tank Mts, 11 Oct 1995, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Mauz*, photo.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Cylindropuntia arbuscula (Engelmann) Knuth. [*Opuntia arbuscula* Engelmann]. PENCIL CHOLLA; SIVIRI

Shrub-sized or rare tree-sized chollas with a well-developed main stem or trunk. Stems green; flowers yellow-green; fruits fleshy and persistent. Occurring as occasional small populations in scattered, lowland habitats; sandy to gravelly soils near shallow washes.

Several treelike plants occur near the Bighorn Reservoir and between the Reservoir and the I-8 highway; the larger ones are 3-3.5 m tall and have well-developed trunks.

South Maricopa Mts, near Bighorn Reservoir, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Mauz*, observation.

Cylindropuntia bigelovii (Engelmann) Kunth var. **bigelovii**. [*Opuntia bigelovii* Engelmann var. *bigelovii*]. TEDDYBEAR CHOLLA; CHOLLA GÜERA

Shrub-sized cholla; flowers pale yellow-green. Plants seem to be especially successful on certain weathered (grus-strewn) exposures of the Oracle Granite in the Table Top foothills.

Javelina Mt, south side near base, 14 May 2000, *Malusa*, observation.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

Table Top Mts, *Mauz*, photo.

Cylindropuntia fulgida (Engelmann) Knuth var. **fulgida**. [*Opuntia fulgida* Engelmann var. *fulgida*]. JUMPING CHOLLA; CHAIN-FRUIT CHOLLA

Shrub- to small tree-sized cholla; flowers pink.

Maricopa Mts, *Baker*, observation.

Sand Tank Mts, east of Johnson Well, 10 Oct 1995, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Mauz*, photo.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Cylindropuntia leptocaulis (de Candolle) Knuth [*Opuntia leptocaulis* de Candolle].

DESERT CHRISTMAS-CHOLLA; TASAJILLO

Small shrub-sized cholla; flowers cream-white.

Sand Tank Mts, Bighorn Road, 9 Oct 1995, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Cylindropuntia spinosior (Engelmann) Knuth. [*Opuntia spinosior* (Engelmann) Toumey].

CANE CHOLLA

Shrub-sized cholla; flowers purple. Distinguished in part by the knobby, yellow and fleshy fruits. Not common in the Monument.

Vekol Valley grassland, 26 Mar 2001, *Felger*, observation.

Echinocereus engelmannii (Engelmann) Lemaire var. **acicularis** L. D. Benson.

STRAWBERRY HEDGEHOG CACTUS

Multiple-stem cactus; flowers deep magenta, large and showy, in spring. Abundant across most of the Monument.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

Sand Tank Mts, Bighorn Road, 9 Oct 1995, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Echinocereus sp.

Multiple-stem cactus. An unidentified hedgehog cactus, perhaps a variety of *E. engelmannii*, occurs at higher elevations at least on Table Top.

Echinomastus erectocentrus (J. M. Coulter) Britton & Rose var. **acunensis** (W. T. Marshall) Bravo [*Neolloydia erectocentra* var. *acunensis* (W. T. Marshall) L. D. Benson].

ACUÑA CACTUS

Dwarf barrel cactus; flowers rose-pink. Rare; a federally listed Category 1 plant. The record from south of Javelina Mountain represents a high elevation record – about 1600 feet higher than the previous records. A report of this cactus from the Sand Tank Mountains by Benson (1982) could be the same locality.

Sand Tank Mts, SE of Gila Bend, *J. P. Heser* (U.S., specimen received June, 1950; specimen not seen by us, reported by Benson [1982]).

Large butte south of Javelina Mt, 3610 ft, east aspect *Holm & Wirt 14 Sep 2000*.

Ferocactus cylindraceus (Engelmann) Orcutt. [*F. acanthodes* (Lemaire) Britton & Rose].

MOUNTAIN BARREL CACTUS; BIZNAGA

Unbranched, large barrel cactus; spine clusters with both stout and bristly spines. Flowers yellow to red, flowering in spring and probably again in late summer-early fall. Plants growing up straight (not leaning as in *F. wislizeni*), among rocks and from rock crevices on mountain slopes and hills.

Antelope Peak, 3 Apr 2001, *Felger*, photo.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

Sand Tank Mts, 10 Oct 1995, *Felger*, observation.

Table Top Mts, 19 Mar 1994, *Bolton*, observation.

Ferocactus emoryi (Engelmann) Orcutt. [*F. covillei* Britton & Rose]. BARREL CACTUS;

BIZNAGA

Unbranched, large barrel cactus; spine clusters with stout spines only, those of young plants noticeably larger, stouter, and more strongly hooked. Flowers red to red-orange, flowering with summer rains.

Sand Tank Mts, 10 Oct 1995, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, elevated (older) piedmont surfaces and in the foothills of Table Top, *Mauz*, photo.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Ferocactus wislizeni (Engelmann) Britton & Rose. BARREL CACTUS; BIZNAGA

Unbranched, large barrel cactus; stems stout, usually “leaning” or growing to the south. Flowers red to red-orange, late summer. Lowland habitats, desert flats.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

Sand Tank Mts, Bighorn Road, 9 Oct 1995, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, 19 Mar 1994, *Bolton*, observation.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Grusonia parishii (Orcutt) Pinkava. [*Opuntia parishii* Orcutt]. PARISH'S CLUB CHOLLA

Low-growing club chollas; flowers yellow, summer. Locally common on the lower bajada surfaces on both sides of the Vekol Valley.

Sand Tank Mts, east of Johnson Well, 10 Oct 1995, *Felger*, observation.

Vekol Valley, 26 Mar 2001, *Felger*, photo.

Mammillaria grahamii Engelmann. [*M. microcarpa* "Engelmann" of various authors].

FISHHOOK CACTUS; CABEZA DE VIEJO

Small globose to cylindrical cactus; flowers pink, appearing in flushes during summer, each about five days soaking rains. Widespread and common, bajadas, hills, and mountains.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

Sand Tank Mts, 11 Oct 1995, *Felger*, observation.

South Maricopa Mts, 24 Mar 2001, *Felger*, observation.

Table Top Mts, 4 Apr 2001, *Felger*, observation.
Vekol Valley, 26 Mar 2001, *Felger*, photo.

Mammillaria thornberi Orcutt. THORNER FISHHOOK CACTUS; CABEZA DE VIEJO

Small globose to cylindrical cactus, usually branching from the base and along the stem to form small, several- to many-stemmed colonies. Each areole bears a single, hooked central spine and slender, spreading radial spines. Flowers white and pink, with a bright magenta stigma; flowering with August rains.

This cactus occurs in a narrow zone on the lower bajada on the east side of Vekol Valley. The plants almost invariably grow beneath triangle bursage (*Ambrosia deltoidea*) and these often on the east side of foothills palo verde (*Parkinsonia microphylla*) casting light afternoon shade. They are locally common, although far outnumbered by *M. grahamii*.

Vekol Valley, *Felger 01-252*.

Mammillaria viridiflora (Britton & Rose) Bödecker

Small depressed-globose cacti, mostly solitary or with a few branches. Spines relatively long and slender as compared to *M. grahamii*. Flowers unknown for this population, probably larger than those of *M. grahamii*, and greenish, yellowish, or pink with lighter-colored margins.

A rare cactus, found on partially barren rock headlands at elevation above 730 meters in the Sand Tank Mountains. Here it grows intermixed with the more common *M. grahamii*. *M. viridiflora* is mostly a mountain species, occurring in western New Mexico and southeastern Arizona in oak woodland.

Sand Tank Mts, *Felger 01-372*.

Opuntia chlorotica Engelmann & J. L. Bigelow. PANCAKE PRICKLY-PEAR; NOPAL RASTRERA

Shrub-sized prickly-pear; flowers yellow.

Maricopa Mts, *Baker*, observation.

Sand Tank Mts, Sand Tank Wash, 9 Oct 1995, *Felger*, observation.

Table Top Mts, *Mauz*, photo.

Opuntia engelmannii Engelmann var. **engelmannii**. DESERT PRICKLY-PEAR; NOPAL

Shrub-sized prickly-pear; flowers yellow.

Sand Tank Mts, *Felger 01-381*.

Table Top Mts, upper elevations of Table Top, *Mauz*, photo.

Opuntia phaeacantha Engelmann. DESERT PRICKLY-PEAR; NOPAL

Subshrub-sized prickly-pear; flowers yellow with a reddish center.

Sand Tank Mts, *Felger 01-380*.

Peniocereus greggii (Engelmann) Britton & Rose var. **transmontanus** (Engelmann)

Backeberg. DESERT NIGHT-BLOOMING CEREUS; REINA DE LA NOCHE

Plants with slender stems about 1 m or more in height, mostly few-branched, and with a large tuberous root. Flowers nocturnal, white, large and showy; June or July. Widely scattered across the Monument; population density is low but the plants are probably not rare. It is a difficult plant to see since the stems resemble dead sticks, and the plants often grow in the shelter of shrubs. The scattered plants bloom simultaneously on the same night, producing a strong fragrance attracting hawk moths.

Vekol Valley Road, about 12 miles south of I-8, 3 Apr 2001, *Felger*, observation.

Stenocereus thurberi (Engelmann) Buxbaum. [*Lemaireocereus thurberi* (Engelmann) Britton & Rose]. ORGAN PIPE

Multiple-stemmed columnar cactus; flowers white to pink. Rare on the south-facing slope of Javelina Mountain.

Javelina Mt, *Rutman*, photos.

CAMPANULACEAE - BELLFLOWER FAMILY

Nemacladus glanduliferus Jepson var. **orientalis** McVaugh. THREADSTEM

Cool season annuals; flowers white with red-tipped petals. Widespread, mostly on gravelly bajadas and valley floors, and also on rocky slopes.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Bolton 94-083*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

CARYOPHYLLACEAE - PINK FAMILY

***Herniaria cinerea** de Candolle. BURST-WORT

Cool season annuals; small, prostrate plants with small, crowded leaves and minute, inconspicuous flowers. Disturbed bottomlands, often in clayish soils.

Flats east of North Maricopa Mts, *Felger 01-201*.

Junction of I-8 and Pinal-Maricopa county line, 3 Apr 2001, *Felger*, observation.

Loeflingia squarrosa Nuttall subsp. **cactorum** Barneby & Twisselmann.

Cool season annuals; flowers inconspicuous. Open, gravelly bajadas and lower hillslopes. These tiny plants thrive in places generally devoid of other vegetation.

South Maricopa Mts, 24 Mar 2001, *Felger*, photo.

Silene antirrhina Linnaeus. SLEEPY CATCHFLY

Cool season annuals; flowers dark red-purple. Widespread, washes and canyons, upper bajadas and rocky slopes.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

Sand Tank Mts, *Walter & Morrison LA 1067* (CS).

South Maricopa Mts, *Felger 01-206*.

Table Top Mts, 19 Mar 1999, *Mauz*, observation.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Water catchment north of Antelope Peak, 3 Apr 2001, *Felger*, observation.

CELASTRACEAE - STAFF-TREE FAMILY

Canotia holacantha Torrey. CANOTIA CRUCIFIXION THORN

Small trees with irregular, hardwood stems. Flowers white, the woody capsules are persistent. Locally common on mountain tops, especially on north-facing slopes, where it forms stange, elfin forests.

Javelina Mt, Maricopa Peak, *Walter & Arnett LA 1399* (CS).

Sand Tank Mts, *Felger 95-388*.

Table Top Mts, summit, *Bolton 94-107*.

CHENOPODIACEAE - GOOSEFOOT FAMILY

Atriplex canescens (Pursh) Nuttall. FOUR-WING SALTBUUSH; CHAMIZO CENIZO

Shrubs; flowers inconspicuous, the fruits 4-winged. Locally in small, widely scattered populations, often along drainageways but also on bajadas and occasionally on rocky slopes and mountain tops such near the summit of Table Top Mountains.

Junction of I-8 and Pinal-Maricopa county line, 3 Apr 2001, *Felger*, observation.

Sand Tank Mts, *Felger 95-355*.

Table Top Mts, *Felger 01-306*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Atriplex elegans (Moquin) D. Dietrich subsp. **elegans**. WHEELSCALE ORACH

Annuals, often growing during spring and one of the few annuals surviving into the summer. Disturbed habitats, often with clayish soils or nearly barren places, and fairly common on Table Top near the summit.

Sand Tank Mts, artificial waterhole ("guzzler" for wildlife), *Felger 95-347*.

Table Top Mts, *Felger 01-310*.

Atriplex linearis S. Watson. [*A. canescens* (Pursh) Nuttall subsp. *linearis* (S. Watson) H. M. Hall & Clements]. NARROW-LEAF SALTBUUSH

Small shrubs; flowers inconspicuous.

Table Top Mts, 17 May 1999, *Mauz*, observation.

***Chenopodium murale** Linnaeus. NET-LEAF GOOSEFOOT

Cool season annuals, sometimes surviving the summer; flowers inconspicuous. Often at disturbed habitats including places that have been vacant for many years.

Sand Tank Mts, Johnson Well, 10 Oct 1995, *Felger*, observation.

Chenopodium pratericola Rydberg

Cool season annuals; herbage grayish, the leaves slender and much longer than wide. Flowers minute and inconspicuous.

Water catchment north of Antelope Peak, *Felger 01-258A*.

Chenopodium watsoni A. Nelson

Non-seasonal or spring annuals; flowers inconspicuous. The plants stink like dead fish. Common and widespread, low elevations and also at higher elevations; often in large washes in the upper bajadas, especially under the canopies of palo verde trees.

Water catchment north of Antelope Peak, 03 Apr 2001, *Felger*, observation.

Table Top Mts, 18 Mar 1999, *Mauz*, observation.

Monolepis nuttalliana (Schultes) Greene. [*Blitum nuttallianum* Schultes]. POVERTY WEED

Cool season annuals; herbage smooth and sometimes semisucculent. Flowers minute and inconspicuous. Valley bottoms and bajadas.

Flats east of North Maricopa Mts, *Felger 01-200*.

Vekol Valley, *Felger 01-222*.

***Salsola tragus** Linnaeus. [*S. australis* R. Brown, *S. iberica* Sennen & Pau, *S. kali* of authors, not *S. kali* Linnaeus, *S. kali* var. *tenuifolia* Tausch, *S. pestifer* A. Nelson]. RUSSIAN THISTLE, TUMBLEWEED; CHAMIZO VOLADOR

Warm season annuals; flowers inconspicuous. Disturbed areas along roadsides.

Expected along roadsides and disturbed habitats. Not yet found in the Monument.

CONVOLVULACEAE - MORNING GLORY FAMILY

Cuscuta umbellata Kunth. [*C. desmouliniana* Yuncker; *C. umbellata* var. *reflexa* Yuncker]

DESERT DODDER

Warm season annual parasitic vines; flowers white. Common during summer rains, on various annuals.

Vekol Valley, on *Kallstroemia californica*, *Mauz 99-081*.

Evolvulus alsinoides Linnaeus var. **angustifolia** Torrey. [*E. alsinoides* var. *acapulcensis* (Willdenow) van Oostroom]. OREJA DE RATÓN

Small, perennials herbs; flowers blue. Upper bajadas and rocky slopes among rocks.

Javelina Mt, *Arnett & Walter LA 1263* (CS). Northern slope.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Sand Tank Mts, *Felger 95-374*.

Table Top Mts, mid-elevation among basalt boulders, *Mauz 99-106*.

Ipomoea hederacea Jacquin. MORNING GLORY; TROMPILLO MORADO

Herbaceous vines; flowers blue.

Table Top Mts, larger washes in the piedmont, 18 Mar 1999, *Mauz*, observation.

Vekol Valley, *Felger 01-246*.

CRASSULACEAE - STONECROP FAMILY

Crassula connata (Ruiz & Pavón) Berger. [*Tillaea erecta* Hooker & Arnott]

Diminutive, cool season annuals with succulent stems and leaves; flowers white, minute. Plants often reddish but also commonly green. Valley plains, bajadas and sometimes on rocky slopes. Even though the plants are tiny, they are often so abundant that they are conspicuous due to their bright red color.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

North Maricopa Mts, Butterfield Trail, 20 Mar 2001, *Felger*, observation.

Table Top Mts, *Felger 01-321*.

CROSSOSOMATACEAE - CROSSOSOMA FAMILY

Crossosoma bigelovii S. Watson. RAGGED ROCK-FLOWER

Shrubs; flowers white. Rocky slopes, mostly at higher elevations.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

South Maricopa Mts, 24 Mar 2001, *Felger*, observation.

CUCURBITACEAE - GOURD FAMILY

Brandegea bigelovii (S. Watson) Cogniaux. DESERT STAR-VINE

Cool season annual vines; flowers white, small and star-like. Apparently not common, one population found along a densely vegetated bajada wash with decomposed granite soil.

North Maricopa Mts, *Felger 01-171*.

Tumamoca macdougalii Rose. TUMAMOC GLOBE-BERRY

Delicate hot-season vines from a tuberous root; flowers yellow. Widely scattered, probably not common.

Vekol Valley, *Rutman*, observation.

CYPERACEAE - SEDGE FAMILY

Cyperus sp.

Probably an annual.

Vekol Valley, Vekol Wash, 14 July 2000, *Mauz*, observation.

EUPHORBIACEAE - SPURGE FAMILY

Bernardia incana Morton

Shrubs; flowers inconspicuous.

Sand Tank Mts, Apr 1995, *Linwood Smith*, observation.

South Maricopa Mts, *Felger 01-217*.

Table Top Mts, *Felger 01-277*.

Croton sonorae Torrey. SONORA CROTON; RAMA BLANCA

Small shrubs; flowers green or white.

Javelina Mt, 1 Dec 2000, *Felger*, observation.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Table Top Mts, *Harrison, Kearney & Fulton 7298; Mauz 20-021*.

Ditaxis lanceolata (Benth) Pax & K. Hoffmann. [*Argythamnia lanceolata* (Benth) Müller Argoviensis]. NARROWLEAF SILVERBUSH

Perennial herbs to subshrubs; flowers greenish.

Javelina Mt, 1 Dec 2000, *Felger*, observation.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Bolton 94-046*.

Ditaxis neomexicana (Müller Argoviensis) A. Heller. [*Argythamnia neomexicana* Müller Argoviensis]. NEW MEXICAN SILVERBUSH

Non-seasonal annuals; flowers green and white, inconspicuous.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, 17 Mar 1999, *Mauz*, observation.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Euphorbia albomarginata Torrey & A. Gray. [*Chamaesyce albomarginata* (Torrey & A. Gray) Small]. RATTLESNAKE WEED

Perennial herbs; "flowers" white.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Euphorbia arizonica Engelm. [*Chamaesyce arizonica* (Engelmann) Arthur].

GOLONDRINA

Perennial herbs; "flowers" pink; glandular-hairy.

Sand Tank Mts, *Felger 95-351*.

Table Top Mts, upper elevations of Table Top, *Mauz 99-110*.

Euphorbia eriantha Benth. BEETLE SPURGE

Non-seasonal annuals; flowers inconspicuous.

Javelina Mt, 1 Dec 2000, *Felger*, observation.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, low to mid-elevation foothills of Table Top, 9 Apr 1994, *Mauz*, observation.

Euphorbia florida Engelmann. [*Chamaesyce florida* (Engelmann) Millspaugh]

Summer annuals; "flowers" white.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Sand Tank Mts, *Felger* 95-362.

Table Top Mts, *Mauz* 99-098.

Euphorbia hyssopifolia Linnaeus. [*Chamaesyce hyssopifolia* (Linnaeus) Small]. HYSSOP SPURGE

Robust warm season annuals; "flowers inconspicuous."

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Sand Tank Mts, Bender Spring, *Felger* 95-438.

Vekol Valley, *Mauz* 99-078.

Euphorbia melanadenia Torrey. [*Chamaesyce melanadenia* (Torrey) Millspaugh].

GOLONDRINA

Herbaceous perennials; "flowers" pink.

Javelina Mt, Maricopa Peak, *Walter & Arnett LA 1397* (CS).

Sand Tank Mts, *Felger* 95-348.

Euphorbia pediculifera Engelmann var. **pediculifera**. [*Chamaesyce pediculifera* (Engelmann) Rose & Standley]. LOUSE SPURGE; GOLONDRINA

Non-seasonal annuals to herbaceous perennials; "flowers" white and maroon.

Javelina Mt, northern slope, *Morrison & Walter LA 255* (CS).

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

Sand Tank Mts, *Felger* 95-345.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Mauz* 99-105.

Euphorbia polycarpa Benth. [*Chamaesyce polycarpa* (Benth) Parish; *E. polycarpa* var. *hirtella* (Boissier) Parish]. DESERT SPURGE; GOLONDRINA

Non-seasonal annuals to herbaceous perennials; "flowers" white and maroon.

Sand Tank Mts, Johnson Well, *Funicelli & Anning 36*.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Bolton 94-060*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

***Euphorbia prostrata** Aiton. [*Chamaesyce prostrata* (Aiton) Small]

Warm weather annuals; flowers inconspicuous.

Table Top Mts, *Mauz* 99-130.

Euphorbia setiloba Torrey. [*Chamaesyce setiloba* (Torrey) Parish]. FRINGED SPURGE; GOLONDRINA

Non-seasonal annuals; "flowers" white or pink.

Sand Tank Mts, *Felger* 95-365.

Table Top Mts, 27 Jul 2000, *Mauz*, observation.

Jatropha cardiophylla (Torrey) Müller Argoviensis. LIMBERBUSH; SANGRENGADO

Small shrubs; flowers white.

Sand Tank Mts, east of Johnson Well, 10 Oct 1995, *Felger*, observation.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, *Mauz 99-086*.

Sebastiania bilocularis S. Watson. [*Sapium biloculare* (S. Watson) Pax]. HIERBA DE LA FLECHA

Shrubs; flowers green or yellow.
North Maricopa Mts, 20 Mar 2001, *Felger*, observation.
Sand Tank Mts, Bighorn Road and Rawly Wash, 10 Oct 1995, *Felger*, observation.

Tragia nepetifolia Cavanilles var. **dissecta** Müller Argoviensis. NOSEBURN; ORTIGA

Perennial vines; flowers inconspicuous.
North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.
Sand Tank Mts, south of Johnson Well, *Funicelli & Anning 41*.
Table Top Mts, *Mauz 99-101*.

FABACEAE (LEGUMINOSAE) - LEGUME FAMILY

Acacia constricta Bentham. WHITE-THORN

Shrubs; flowers bright yellow.
Javelina Mt, 1 Dec 2000, *Felger* observation.
North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, 19 Mar 1994, *Mauz*, observation.
Vekol Valley, 26 Mar 2001, *Felger*, observation.

Acacia greggii A. Gray. [*A. greggii* var. *arizonica* Isely]. CATCLAW; UÑA DE GATO

Shrubs; flowers pale yellow.
Flats east of North Maricopa Mts, 20 Mar 2001, *Felger*, observation.
Sand Tank Mts, 10 Oct 1995, *Felger*, observation.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, 10 Mar 1994, *Bolton*, observation.
Vekol Valley, 26 Mar 2001, *Felger*, observation.

Astragalus didymocarpus Hooker & Arnott var. **dispermus** (A. Gray) M. E. Jones

Flowers pale violet-pink.
Vekol Valley, *Felger 01-231*.

Astragalus nuttallianus de Candolle var. **imperfectus** (Rydberg) Barneby. SMALL-FLOWERED MILK-VETCH

Cool season annuals; flowers blue and white.
Flats east of North Maricopa Mts, 20 Mar 2001, *Felger*, observation.
North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, *Bolton 94-007*.
Vekol Valley, *Felger 01-230*.
Water catchment north of Antelope Peak, 3 Apr 2001, *Felger*, observation.

Calliandra eriophylla Bentham. FAIRY DUSTER; HUAJILLO

Small shrubs; flowers pink.
Javelina Mt, *Morrison & Walter LA 238* (CS). Northern slope.
South Maricopa Mts, 24 Mar 2001, *Felger*, observation.

Table Top Mts, *Bolton 94-043*.

Coursetia glandulosa A. Gray. [*C. microphylla* A. Gray]. SÁMOTA
Shrubs; flowers yellow and pink.
North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.
Sand Tank Mts, 10 Oct 1995, *Felger*, photo.

Dalea mollis Bentham. SILKY DALEA
Non-seasonal annuals; flowers violet. Herbage densely glandular.
Table Top Mts, *Bolton 94-059*.

Dalea pringlei A. Gray var. **pringlei**
Perennial herbs; flowers purple.
North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Desmodium procumbens (Miller) A.S. Hitchcock. TICK CLOVER
Hot season annuals; flowers yellow to green.
Sand Tank Mts, *Felger 95-376*.

Galactia wrightii A. Gray
Perennial vines; flowers pale purple with yellow-green.
Sand Tank Mts, *Felger 95-345*.

Lotus humistratus Greene. [*Hosackia brachycarpa* Bentham]. HILL LOCUST
Cool season annuals; flowers yellow.
North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.
Sand Tank Mts, *Felger 01-376*.

Lotus rigidus (Bentham) Greene. DESERT ROCK-PEA
Perennial subshrubs; flowers yellow.
North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.
Sand Tank Mts, *Felger 01-367*.

Lotus salsuginosus Greene var. **brevivexillus** Ottley
Cool season annuals; flowers yellow.
North Maricopa Mts, 20 Mar 2001, *Felger*, observation.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Lotus strigosus (Nuttall) Greene var. **tomentellus** (Greene) Isely. HAIRY LOTUS
Cool season annuals; flowers yellow.
Flats east of North Maricopa Mts, 20 Mar 2001, *Felger*, observation.
North Maricopa Mts, 20 Mar 2001, *Felger*, observation.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, *Bolton 94-006*.

Lupinus arizonicus S. Watson. [*L. arizonicus* subsp. *sonorensis* Christian & Dunn].
ARIZONA LUPINE; LUPINO
Cool season annuals; flowers lavender-pink, rarely white.
North Maricopa Mts, *Felger 01-190, 01-191*.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Lupinus concinnus J. Agardh. ELEGANT LUPINE

Cool season annuals; flowers blue.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Lupinus sparsiflorus Bentham. MOHAVE LUPINE

Cool season annuals; flowers blue.

Flats east of North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

North Maricopa Mts, *Felger 01-192*.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Bolton 94-026*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Marina parryi (A. Gray) Barneby. [*Dalea parryi* A. Gray]

Non-seasonal annuals or short-lived herbaceous perennials; flowers dark blue and white.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Bolton 94-082*.

***Melilotus indica** Allioni. YELLOW SWEET CLOVER, ALFALFILLA.

Cool season annuals. Flowers yellow. Water seeps and canyon bottoms; not common in the Monument.

Sand Tank Mts, *Felger 01-347*.

Nissolia schottii (Torrey) A. Gray

Perennial vines; flowers yellow. Mountain slopes and canyons; probably widespread but in the Monument documented only from Bender Spring Canyon.

Sand Tank Mts, *Felger 95-343*.

Olneya tesota A. Gray. IRONWOOD; PALO FIERRO

Trees; flowers pink-lavender. Flowering in late spring, the pods ripening in early summer. One of the most common and widespread desert trees in the region; characteristically along washes where it often grows with mesquite and palo verde trees.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

Sand Tank Mts, 11 Oct 1995, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Mauz*, photo.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Parkinsonia florida (A. Gray) S. Watson. [*Cercidium floridum* A. Gray subsp. *floridum*].

BLUE PALO VERDE; PALO VERDE

Trees or large shrubs; flowers bright yellow, mass flowering in April. Generally along larger washes.

Rock quarry north of Antelope Peak, 3 Apr 2001, *Felger*, observation.

Sand Tank Mts, Bighorn Road, 9 Oct 1995, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Mauz*, observation.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Parkinsonia microphylla Torrey. [*Cercidium microphyllum* (Torrey) Rose & Johnston].

FOOTHILL PALO VERDE; PALO VERDE

Small trees; flowers pale yellow and white. Widespread and abundant through the Monument, especially at lower elevations. Washes, bajadas, and rocky slopes.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Mauz*, observation.

Phaseolus filiformis Bentham. [*P. wrightii* A. Gray]. DESERT BEAN

Non-seasonal annual vines; flowers pink.

Sand Tank Mts, Bender Spring Road, *Felger 95-440*.

Table Top Mts, upper elevations of Table Top, *Mauz 99-109*.

Prosopis velutina Wooton. [*P. juliflora* var. *velutina* (Wooton) Sargent]. VELVET MESQUITE; MEZQUITE

Large shrubs or trees; flowers yellow. Peak flowering in early summer, the pods ripening about the time of the summer rains. Widespread and common, especially along washes and arroyos, and sparingly on rocky slopes and occasionally on mountain tops including Table Top.

Flats east of North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Mauz*, observation.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Rhynchosia texana Torrey & A. Gray. ROSARY BEAN

Perennial herbaceous vines; flowers yellow. Known in the Monument only from Bender Spring Canyon.

Sand Tank Mts, *Felger 95-345*.

Trifolium willdenovii Sprengel [*T. lacerum* Greene]. COW CLOVER.

Cool season annuals. Flowers small and lavender. In the Monument known only from higher elevations in the Sand Tank Mountains where it grows on north-facing slopes among rocks.

Sand Tank Mts, *Felger 01-391*.

Senna covesii (A. Gray) Irwin & Barneby. [*Cassia covesii* A. Gray]. DESERT SENNA; DAISILLO

Herbaceous perennials; flowers yellow. Widespread mostly at low elevations but seldom common.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

Sand Tank Mts, 10 Oct 1995, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Mauz 99-097*.

FAGACEAE - BEECH FAMILY

Quercus turbinella Greene. SONORAN SCRUB OAK

Sprawling shrubs with nearly evergreen, gray-green foliage; flowers inconspicuous. Bill Broyles located a small population near the top of Javelina Mountain; Brown (1978) reported it from the Sand Tank and Table Top Mountains but we have not seen specimens from these locations.

Javelina Mt, north-facing slope near summit, ca. 4000 ft, *Felger & Broyles 00-70*.

Sand Tank Mts, north slope of Squaw Tit Peak, *Malusa s. n.*

FOUQUIERIACEAE - OCOTILLO FAMILY

Fouquieria splendens Engelm subsp. **splendens**. OCOTILLO

Shrubs; flowers red-orange in spring. Widespread throughout the Monument.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

Sand Tank Mts, 11 Oct 1995, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, 19 Mar 1994, *Bolton*, observation.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

GERANIACEAE - GERANIUM FAMILY

***Erodium cicutarium** (Linnaeus) Aiton. FILAREE, STORKSBILL, HERONSBILL; ALFILERILLO

Cool season annuals; flowers pink-lavender. Widespread and common throughout the Monument.

Junction of I-8 and Pinal-Maricopa county line; 3 Apr 2001, *Felger*, observation.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Bolton 94-032*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Erodium texanum A. Gray. FALSE FILAREE, DESERT STORKSBILL

Cool season annuals; flowers pink-lavender.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Sand Tank Mts, *Morrison & Walter LA 1072* (CS).

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, 15 May 2000, *Mauz*, observation.

HYDROPHYLLACEAE - WATERLEAF FAMILY

Eucrypta chrysanthemifolia (Bentham) Greene var. **bipinnatifida** (Torrey) Constance

Cool season annuals; flowers pale lavender.

North Maricopa Mts, *Felger 01-180*.

Sand Tank Mts, *Felger 01-357*.

South Maricopa Mts, *Felger 01-158*.

Table Top Mts, *Mauz*, observation.

Eucrypta micrantha (Torrey) A. Heller. PELUDA

Cool season annuals; flowers white to pale violet or lavender.

North Maricopa Mts, *Felger 01-179*.

South Maricopa Mts, *Felger 01-159*.

Table Top Mts, *Bolton 94-073*.

Vekol Valley, *Felger 01-247*.

Nama demissum A. Gray. PURPLE MATSEED; MORADA

Cool season annuals; flowers bright lavender-pink.

South Maricopa Mts, *Chamberland 1852*.

Table Top Mts, 19 Mar 1994, *Bolton*, observation.

Nama hispidum A. Gray. BRISTLY NAMA; MORADA

Cool season annuals; flowers pale lavender.
North Maricopa Mts, 20 Mar 2001, *Felger*, observation.
North of Maricopa Rd, E of Gila Bend, near Bosque, 1998, *Chamberland*, photo.
South Maricopa Mts, *Chamberland 1851*.

Phacelia affinis A. Gray

Cool season annuals; flowers white.
South Maricopa Mts, *Felger 01-148*.

Phacelia ambigua M. E. Jones. [*P. crenulata* Torrey, *P. crenulata* var. *ambigua* (M. E. Jones) J. F. Macbride]. DESERT HELIOTROPE

Cool season annuals; flowers pale lavender.
North Maricopa Mts, *Felger 01-198*.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, *Bolton 94-056*.
Vekol Valley, 26 Mar 2001, *Felger*, observation.

Phacelia coerulea Greene

Cool season annuals; flowers lavender.
Table Top Mts, *Felger 01-267A*.

Phacelia distans Bentham. CATERPILLAR PHACELIA, FERN-LEAF PHACELIA

Cool season annuals; flowers pale violet to blue.
Flats east of North Maricopa Mts, 20 Mar 2001, *Felger*, observation.
North Maricopa Mts, 20 Mar 2001, *Felger*, observation.
Table Top Mts, *Bolton 94-022*.
Vekol Valley, 26 Mar 2001, *Felger*, observation.
Water catchment north of Antelope Peak, 3 Apr 2001, *Felger*, observation.

Pholistoma auritum (Lindley) Lilja var. **arizonicum** (M. E. Jones) Constance

Cool season annuals; flowers pale lavender.
North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.
South Maricopa Mts, *Felger 01-215*.

KOEBERLINIACEAE - KOEBERLINIA FAMILY

Koerberlinia spinosa Zuccarini. ALLTHORN

Large spinescent shrubs; flowers cream-yellow.
Sand Tank Mts, 23 Nov 1995, *Rutman*, observation.
Vekol Valley, *Mauz*, observation. Scattered on lowermost bajadas, along axis of valley, and in the grassland.

KRAMERIACEAE - RATANY FAMILY

Krameria erecta Schultes. [*K. parvifolia* Bentham]. RANGE RATANY

Dwarf shrubs; flowers pink-purple.
North Maricopa Mts, 20 Mar 2001, *Felger*, observation.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, *Bolton 94-063*.

Krameria grayi Rose & Painter. WHITE RATANY

Shrubs; flowers purple.
North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, *Bolton 94-038*.
Vekol Valley, 26 Mar 2001, *Felger*, observation.

LAMIACEAE (LABIATAE) - MINT FAMILY

Hedeoma nanum (Torrey) Briquet var. **macrocalyx** Stewart. FALSE PENNYROYAL
Perennial herbs; flowers lavender, herbage glandular and aromatic.
Javelina Mt, northern slope, *Morrison & Walter LA 243* (CS).
Sand Tank Mts, Bender Spring, *Felger 95-353*.
Table Top Mts, *Bolton 94-121*.

Hyptis emoryi Torrey. DESERT LAVENDER; SALVIA
Shrubs; flowers lavender, herbage densely white-pubescent.
North Maricopa Mts, 20 Mar 2001, *Felger*, observation.
Sand Tank Mts, Bender Saddle, *Felger 95-412*.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, *Bolton 94-075*.

Salvia columbariae Bentham. DESERT CHIA; CHÍA
Cool season annuals; flowers blue.
North Maricopa Mts, 20 Mar 2001, *Felger*, observation.
Sand Tank Mts, *Morrison & Walter LA 536* (CS).
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, *Bolton 94-024*.

Salvia mohavensis Greene. MOHAVE SAGE
Small shrubs; flowers pale to dark violet-blue.
South Maricopa Mts, *Felger 01-218*.

Salvia pinguifolia (Fernald) Wootton and Standley. ROCK SAGE
Shrubs; flowers lavender.
Sand Tank Mts, *Felger 455*.

Teucrium cubense Jacquin subsp. **depressum** (Small) McClintock & Epling
Vekol Valley, *Felger 01-225*.
Water catchment north of Antelope Peak, *Mauz 21-029*.

Teucrium glandulosum Kellogg
Perennial herbs; flowers white. A relatively rare plant known from few, widely disjunct populations (Felger 2000).
Javelina Mt, *Broyles s. n.* Above 3600 ft.

LILIACEAE - LILY FAMILY

Allium macropetalum Rydberg. ONION
Sand Tank Mts, *Felger 01-354*.
South Maricopa Mts, *Felger 01-214*.
Table Top Mts, *Felger 01-272*.

Calochortus kennedeyi Porter. DESERT MARIPOSA LILY
Perennials from a bulb; flowers orange-red.

Javelina Mt, *Walter & Morrison LA 258* (CS).
Sand Tank Mts, *Felger 444*.
Table Top Mts, *Felger 01-300*.

Dichelostemma capitatum (Bentham) Wood subsp. **pauciflorum** (Torrey) Keator. [*D. pulchellum* (Salisbury) A. Heller var. *pauciflorum* (Torrey) Hoover, *Brodiaea capitata* Bentham var. *pauciflora* Torrey]. BLUE DICKS; COVERIA

Perennials from a bulb; flowers violet-blue.
Sand Tank Mts, *Felger 463*.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, *Felger 01-299*.

Hesperocallis undulata A. Gray AJO LILY; AJO SILVESTRE
South Maricopas, 24 Mar 2001, *Felger*, photo.

LINACEAE - FLAX FAMILY

Linum lewisii Pursh

Cool season annuals (elsewhere often perennial); flowers blue.
Sand Tank Mts, 2.2 km northeast of Round Butte, *Morrison & Walter LA 1073* (CS).
South Maricopa Mts, *Chamberland 1864*.
Table Top Mts, *Felger 01-314*.
Vekol Valley, *Felger 01-236*.
Water catchment north of Antelope Peak, 3 Apr 2001, *Felger*, observation.

LOASACEAE - STICK-LEAF FAMILY

Mentzelia affinis Greene. TRIANGLE SEED BLAZING STAR

Cool season annuals; flowers yellow.
North Maricopa Mts, *Felger 01-194*.
South Maricopa Mts, *Felger 01-153*.
Table Top Mts, *Bolton 94-029*.
Vekol Valley, *Felger 01-258*.

Mentzelia albicaulis Hooker. SMALL-FLOWERED BLAZING STAR

Sand Tank Mts, *Felger 01-394*.
South Maricopa Mts, *Chamberland 1858*.

Mentzelia involucrata S. Watson var. **megacantha** I. M. Johnston. STICKLEAF, SILVER BLAZING-STAR

Cool season annuals; flowers silvery white.
North Maricopa Mts, 20 Mar 2001, *Felger*, observation.
South Maricopa Mts, 24 Mar 2001, *Felger*, observation.
Table Top Mts, *Bolton 94-109*.

Mentzelia jonesii (Urban & Gilg) Thompson & Roberts

Cool season annuals; flowers yellow.
Table Top Mts, *Bolton 94-097*.

Petalonyx thurberi A. Gray. SANDPAPER PLANT

Shrubs; flowers pale yellow, crab spiders of the same shade observed on some plants.
Plants of the warm season, flowering in late spring and summer.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.
Rock quarry north of Antelope Peak, *Mauz 21-020*.
Vekol Wash, *Mauz*, observation.

MALPIGHIACEAE - MALPIGHIA FAMILY

Janusia gracilis A. Gray. FERMINA

Perennial vines; flowers yellow.
Javelina Mt, northern slope, *Walter & Morrison LA 230* (CS).
North Maricopa Mts, 20 Mar 2001, *Felger*, observation.
Sand Tank Mts, 11 Oct 1995, *Felger*, observation.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, *Bolton 94-050*.

MALVACEAE - MALLOW FAMILY

Abutilon incanum (Link) Sweet. INDIAN MALLOW

Small shrubs; flowers pale orange with a maroon center.
Javelina Mt, northern slope, *Arnett & Walter LA 1257* (CS).
North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.
Sand Tank Mts, 10 Oct 1995, *Felger*, observation.
Table Top Mts, 4 Apr 2001, *Felger*, observation.

Abutilon malacum S. Watson

Perennial subshrubs; flowers pale yellow-orange.
Sand Tank Mts, *Felger 95-417*.
Vekol Valley, *Mauz*, photo.

Abutilon palmeri A. Gray

Sparingly branched shrubs or subshrubs with rather large, velvety leaves; flowers yellow-orange.
Sand Tank Mts, *Felger 95-341*.

Herissantia crispa (Linnaeus) Brizicky. BLADDER MALLOW

Perennial herbs; flowers pale yellow.
Sand Tank Mts, Bender Sp[ri]ng Road, 11 Oct 1995, *Felger*, observation.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, foothills to mid-elevations of Table Top, *Mauz*, photo.

Hibiscus coulteri Harvey. DESERT ROSE-MALLOW

Perennial herbs or subshrubs; flowers yellow.
North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.
Sand Tank Mts, *Felger 95-357*.
South Maricopa Mts, 24 Mar 2001, *Felger*, observation.
Table Top Mts, 27 Jul 2000, *Mauz*, observation.

Hibiscus denudatus Benth var. **denudatus**. ROCK HIBISCUS

Perennial subshrubs; flowers white to pinkish with maroon spots in the center.
North Maricopa Mts, 20 Mar 2001, *Felger*, observation.
Sand Tank Mts, *Felger 95-357*.

Malvastrum bicuspidatum (S. Watson) Rose subsp. **bicuspidatum**

Shrubs; flowers pale yellow-orange.
Sand Tank Mts, *Felger 95-350*.

Malvella sagittifolia (A. Gray) Fryxell. [*Sida lepidota* A. Gray var. *sagittifolia* A. Gray]
Delicate, creeping herbs. Typically occurring in wash margin habitat. Summer.
Vekol Valley, Vekol Valley bosque, *Mauz 20-004*.

Sida abutifolia Miller

Perennial herbs; flowers orange mostly with warmer weather.
Sand Tank Mts, *Felger 01-352*.
Table Top Mts, *Felger 01-302*.

Sphaeralcea ambigua A. Gray subsp. **ambigua**. DESERT GLOBE-MALLOW

Shrubby perennials; flowers orange.
North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.
Table Top Mts, *Bolton 94-069*.
Vekol Valley, 26 Mar 2001, *Felger*, photo.

Sphaeralcea coulteri (S. Watson) A. Gray var. **coulteri**. ANNUAL GLOBE-MALLOW; MAL DE OJO

Cool season annuals; flowers orange.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, *Bolton 94-008*.
Vekol Valley, 26 Mar 2001, *Felger*, observation.
Water catchment north of Antelope Peak, 3 Apr 2001, *Felger*, observation.

Sphaeralcea emoryi Torrey. MAL DE OJO

Annuals to short-lived perennial herbs or subshrubs; flowers orange to red-orange.
Vekol Valley, *Felger 01-228*.

MARTYNIACEAE - DEVIL'S CLAW FAMILY

Proboscidea altheaefolia (Bentham) Decaisne. DEVIL'S CLAW; GATO, UÑA DE GATO, TORITO

Perennial herbs from a tuberous root; flowers yellow.
Table Top Mts, lowermost bajadas, *Mauz 99-083*.
Vekol Valley, 8 Aug 1999, *Mauz*, photo.

Proboscidea parviflora (Wooton) Wooton & Standley subsp. **parviflora**. DEVIL'S CLAW; GATUÑA, TORITO, AGUARO, CUERNITO

Hot weather annuals; flowers lavender with purple, white, and yellow. Herbage glandular-pubescent with a slightly pungent odor.
Table Top Mts, *Mauz 99-085*.

MOLLUGINACEAE - CARPETWEED FAMILY

Mollugo cerviana (Linnaeus) Seringe. THREAD-STEM CARPETWEED, INDIAN CHICKWEED

Hot weather annuals; flowers white, minute.
Vekol Valley, *Mauz 99-076*.

NYCTAGINACEAE - FOUR-O'CLOCK FAMILY

Acleisanthes longiflora A. Gray. ANGEL'S TRUMPETS

Perennial herbs from thickened roots; flowers white.

Javelina Mt, *Arnett & Walter LA 1256* (CS). Northern slope.

Sand Tank Mts, *Felger 95-418*.

Table Top Mts, *Mauz 99-059* (cleistogamous specimen; 17 May 1999); *Mauz 99-107* (long-flowered specimen; 9 Aug 1999); *G. J. Harrison, T. H. Kearney, & H. J. Fulton 7299* (16 Aug 1930).

Allionia incarnata Linnaeus. TRAILING WINDMILLS, TRAILING FOUR O'CLOCK

Short-lived perennials or annuals; flowers bright pink-purple.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Sand Tank Mts, Bender Saddle, *Felger 95-405*.

South Maricopa Mts, 24 Mar 2001, *Felger*, observation.

Table Top Mts, *Mauz*, photo.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Boerhavia coccinea Miller. SCARLET SPIDERLING

Short-lived perennial herbs; flowers red-purple.

Sand Tank Mts, near Sand Tank Well, *Felger 95-329*.

Boerhavia erecta Linnaeus var. **erecta**. SPIDERLING

Hot weather annuals; flowers pink.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Table Top Mts, *Mauz 99-079*.

Boerhavia erecta var. **intermedia** (M. E. Jones) Kearney & Peebles. [*B. intermedia* M. E. Jones, *B. triquetra* S. Watson]. SPIDERLING

Hot weather annuals; flowers pink.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Boerhavia wrightii A. Gray. SPIDERLING

Hot weather annuals; flowers pink.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Sand Tank Mts, near Sand Tank Well, *Felger 95-330*.

Table Top Mts, *Mauz 99-116*.

Commicarpus scandens (Linnaeus) Standley. BUSH SPIDERLING

Bushy perennials. Flowers pale yellow-green.

Sand Tank Mts, near Sand Tank Well, 9 Oct 1995, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, half way up south slope of Table Top, 24 May 1999, *Mauz*, observation.

Vekol Valley, *Mauz 99-077*.

Mirabilis bigelovii A. Gray var. **bigelovii**. DESERT FOUR O'CLOCK

Perennial herbs; flowers white.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

Sand Tank Mts, Bighorn Road, *Funicelli & Anning 59*.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Bolton 94-047*.

OLEACEAE - OLIVE FAMILY

Forestiera shrevei Standley. DESERT OLIVE

Shrubs; flowers inconspicuous.
Sand Tank Mts, Bender Saddle, *Felger 95-392*.

Menodora scabra A. Gray. TWINBERRY

Small shrubs or subshrubs; flowers yellow.
Javelina Mt, northern slope, *Arnett & Walter LA 1259* (CS).
North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.
Sand Tank Mts, 10 Oct 1995, *Felger*, observation.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, *Bolton 94-102*.

ONAGRACEAE - EVENING PRIMROSE FAMILY

Camissonia boothii (Douglas) P. H. Raven subsp. **condensata** (Munz) P. H. Raven. WOODY BOTTLE-WASHER

Cool season annuals; flowers white.
Antelope Peak area, 20 Mar 1999, *Mauz*, observation.
Vekol Valley, *Felger 01-253*.

Camissonia californica (Torrey & A. Gray) P. H. Raven

Cool season annuals; flowers yellow.
North Maricopa Mts, 20 Mar 2001, *Felger*, observation.
Sand Tank Mts, 17 April 2001, *Felger*, observation.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, *Mauz 21-011*.
Vekol Valley, 26 Mar 2001, *Felger*, observation.

Camissonia chamaenerioides (A. Gray) P. H. Raven. WILLOW-HERB PRIMROSE

Cool season annuals; flowers pink.
Flats east of North Maricopa Mts, 20 Mar 2001, *Felger*, observation.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, *Felger 01-315*.

Camissonia claviformis (Torrey & Frémont) P. H. Raven subsp. **peeblesii** (P. H. Raven) P. H. Raven

Cool season annuals; flowers white, some with pink tinges, the throat red-brown.
Flats between North and South Maricopa Mts, *Felger 01-169*.
North Maricopa Mts, 20 Mar 2001, *Felger*, observation.
South Maricopa Mts, *Felger 01-141*.

Oenothera primiveris A. Gray subsp. **primiveris**

Cool season annuals; flowers yellow.
Flats east of North Maricopa Mts, 20 Mar 2001, *Felger*, observation.
Javelina Mt, 1 Dec 2000, *Felger*, observation.
North Maricopa Mts, 20 Mar 2001, *Felger*, observation.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, *Mauz*, photo.
Vekol Valley, 26 Mar 2001, *Felger*, observation.
Water catchment north of Antelope Peak, 3 Apr 2001, *Felger*, observation.

OROBANCHACEAE - BROOMRAPE FAMILY

Orobanche cooperi (A. Gray) A. Heller. [*Orobanche ludoviciana* Nuttall var. *cooperi* (Gray) G. Beck]. DESERT BROOMRAPE; BURSAGE STRANGLER; FLOR DE TIERRA

Perennial herbs, parasitic on the roots of *Ambrosia* spp.; flowers purple and white.
Flats east of North Maricopa Mts, 20 Mar 2001, *Felger*, observation.
Sand Tank Mts, *Felger 95-421*.

PAPAVERACEAE - POPPY FAMILY

Argemone pleiakantha Greene. PRICKLY POPPY; CARDO

Large perennial herbs; flowers white and yellow.
Roadside, Hwy 8 east of Gila Bend, *Chamberland*, photo.

Eschscholzia californica Chamisso subsp. **mexicana** (Greene) C. Clark. MEXICAN GOLD-POPPY

Cool season annuals; flowers gold-yellow.
Flats east of North Maricopa Mts, 20 Mar 2001, *Felger*, observation.
Sand Tank Mts, *Felger 01-333*.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, *Bolton 94-033*.

PLANTAGINACEAE - PLANTAIN FAMILY

Plantago ovata Forsskal. [*P. insularis* Eastwood var. *fastigiata* (Morris) Jepson]. WOOLLY PLANTAIN, INDIAN WHEAT; PASTORA

Cool season annuals; flowers straw-color.
Junction of I-8 and Pinal-Maricopa county line; 3 Apr 2001, *Felger*, observation.
North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, *Bolton 94-003*.
Vekol Valley, 26 Mar 2001, *Felger*, observation.

Plantago patagonica Jacquin. [*P. purshii* Roemer & Schultes]. PASTORA

Cool season annuals; flowers straw-color.
Javelina Mt, *Walter & Arnett LA 1400* (CS).
Sand Tank Mts, Bender Spring, *Felger*, observation.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, *Felger 01-288*.
Vekol Valley, 26 Mar 2001, *Felger*, observation.

Plantago rhodosperma Decaisne

Flowers white with pale reddish ovary. Leaves broad, dentate.
Vekol Valley, *Felger 01-226*.

POACEAE (GRAMINEAE) - GRASS FAMILY

Aristida adscensionis Linnaeus. SIX-WEEKS THREE-AWN; ZACATE TRES BARBAS

Non-seasonal annuals.
Javelina Mt, *Felger*, observation.
Junction of I-8 and Pinal-Maricopa county line; 3 Apr 2001, *Felger*, observation.
North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, *Bolton 94-084*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Aristida purpurea Nuttall var. **nealleyi** (Vasey) Allred. [*A. glauca* (Nees) Walpers].

PURPLE THREE-AWN; TRES BARBAS

Tufted perennials. Awns 2-3 cm long.

North Maricopa Mts, north of Butterfied Pass, 1993, *Wirt*, observation.

South Maricopa Mts, 24 Mar 2001, *Felger*, observation.

Table Top Mts, *Mauz 99-120*.

Aristida purpurea Nuttall var. **parishii** (A. S. Hitchcock) Allred. [*A. parishii* A. S. Hitchcock]

Javelina Mt, northern slope, *Morrison & Walter LA 231* (CS).

Aristida purpurea Nuttall var. **purpurea**. PURPLE THREE-AWN; TRES BARBAS

Tufted perennials.

Javelina Mt, wash near base of mountain, 1 Dec 2000, *Felger*, observation.

Aristida ternipes Cavanilles var. **gentilis** (Henrard) Allred. [*A. hamulosa* Henrard].

POVERTY THREE-AWN; ZACATE ARAÑA DE TRES BARBAS

Tufted perennials.

Sand Tank Mts, *Felger 95-452*.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Aristida ternipes var. **ternipes**. SPIDERGRASS; ZACATE ARAÑA

Tufted perennials.

Javelina Mt, northern slope, *Morrison & Walter LA 234* (CS).

Sand Tank Mts, *Felger 95-369*.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, 17 Mar 1999, *Mauz*, observation.

***Avena fatua** Linnaeus. WILD OAT; AVENA LOCA

Cool season annuals, generally in ruderal and disturbed settings.

Hwy I-8, at Pinal-Maricopa county line, *Felger 01-254*.

Bothriochloa barbinodis (Lagasca) Herter. [*Andropogon barbinodis* Lagasca]. CANE

BLUESTEM; ZACATE POPOTILLO

Perennials with cottony inflorescences.

North Maricopa Mts, north of Butterfied Pass, 1993, *Wirt*, observation.

Sand Tank Mts, *Felger 95-387*.

Bouteloua aristidoides (Kunth) Grisebach. SIX-WEEKS NEEDLE GRAMA; ACEITILLA,

NAVAJITA

Summer annuals.

North Maricopa Mts, north of Butterfied Pass, 1993, *Wirt*, observation.

Sand Tank Mts, *Felger 95-422*.

Table Top Mts, *Mauz*, observation.

Bouteloua barbata Lagasca. SIX-WEEKS GRAMA; NAVAJITA, ZACATE LIEBRERO

Summer annuals.

North Maricopa Mts, north of Butterfied Pass, 1993, *Wirt*, observation.

Sand Tank Mts, Johnson Well, *Funicelli & Anning 32*.

Table Top Mts, *Mauz 99-129*.

Bouteloua curtipendula (Michaux) Torrey. SIDEOATS GRAMA; BANDERILLA

Tufted perennials, in mountains.

Sand Tank Mts, *Felger 95-384*.

Table Top Mts, 04 Apr 2001, *Felger*, observation.

Bouteloua repens (Kunth) Scribner & Merrill. SLENDER GRAMA; NAVAJITA DELGADA

Tufted perennials.

Sand Tank Mts, *Felger 95-366*.

Table Top Mts, *Mauz*, observation.

Bouteloua rothrockii Vasey. ROTHROCK GRAMA; ZACATE LIEBRERO

Tufted perennials.

Sand Tank Mts, *Felger 95-364*.

Table Top Mts, 17 Mar 1999, *Mauz*, observation.

Bouteloua trifida Thurber. RED GRAMA; NAVAJITA CHINA

Small tufted perennials.

Sand Tank Mts, Johnson Well, *Funicelli & Anning 9*.

Table Top Mts, Bolton *94-090*.

Brachiaria arizonica (Scribner & Merrill) S. T. Blake. [*Panicum arizonicum* Scribner & Merrill]. PIOJILLO DE ARIZONA

Hot weather annuals.

Sand Tank Mts, Johnson Well, *Funicelli & Anning 28*.

Bromus carinatus Hooker & Arnott. [*B. carinatus* var. *arizonicus* Shear, *B. arizonicus* (Shear) Stebbins]. CALIFORNIA BROME

Cool season annuals.

Sand Tank Mts, Bender Saddle, *Felger 95-390*.

Bromus catharticus Vahl var. ***catharticus***. [*B. unioloides* Kunth, *B. willdenowii* Kunth].

RESCUE GRASS

Sand Tank Mts, *Felger 01-361*.

Table Top Mts, *Felger 01-307*.

****Bromus rubens*** Linnaeus. [*B. madritensis* Linnaeus subsp. *rubens* (Linnaeus) Husnot].

FOXTAIL BROME, RED BROME; BROMO ROJO

Cool season annuals.

Antelope Peak area, *Bolton 94-039*.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Sand Tank Mts, 11 Oct 1995, *Felger*, observation.

****Cynodon dactylon*** (Linnaeus) Persoon var. ***dactylon***. BERMUDA GRASS; ZACATE

BERMUDA, ZACATE INGLÉS

Creeping perennials.

Junction of I-8 and Pinal-Maricopa county line; 3 Apr 2001, *Felger*, observation.

Sand Tank Mts, Johnson Well, *Funicelli & Anning 33*.

Vekol Valley, *Mauz 99-124*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Digitaria californica (Bentham) Henrard. [*Trichachne californica* (Bentham) Chase].

CALIFORNIA COTTONTOP; ZACATE PUNTA BLANCA

Tufted perennials.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Sand Tank Mts, *Felger 95-359*.

South Maricopa Mts, 24 Mar 2001, *Felger*, observation.

Table Top Mts, near summit of Table Top, *Mauz 99-113*.

Elymus elymoides (Rafinesque) Swezey. [*Sitanion hystrix* (Nuttall) J. G. Smith].

BOTTLEBRUSH SQUIRRELTAIL; ZACATE LADERA

Tufted perennials.

Sand Tank Mts, Bender Saddle, *Felger 95-388*.

Enneapogon desvauxii P. Beauvois. SPIKE PAPPUSGRASS; ZACATE LOBERO

Dwarf tufted perennials.

Sand Tank Mts, *Felger 95-358*.

***Eragrostis cilianensis** (Allioni) Janchen. STINKING LOVEGRASS; ZACATE APESTOSO

Hot weather annuals.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Sand Tank Mts, *Arnett & Walter LA 1253* (CS).

Vekol Valley, *Mauz 99-128*.

***Eragrostis lehmanniana** Nees. LEHMANN LOVEGRASS; ZACATE AFRICANO

Tufted and stoloniferous perennials.

Sand Tank Mts, Bender Saddle, *Felger 95-409*.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation. Roadside.

Eragrostis pectinacea (Michaux) Nees. [*E. diffusa* Buckley, *E. tephrosanthos* Schultes, *E. arida* Hitchcock, *E. pectinacea* var. *miserrima* (Fournier) J. Reeder]. CAROLINA LOVEGRASS

Hot weather annuals.

Sand Tank Mts, Johnson Well, *Funicelli & Anning 35*.

Erioneuron pulchellum (Kunth) Tateoka. [*Tridens pulchellus* (Kunth) Hitchcock]. FLUFF-

GRASS; ZACATE BORREGUERO

Dwarf tufted perennials.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

Sand Tank Mts, Johnson Well, *Funicelli & Anning 8*.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Bolton 94-062*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Festuca octoflora var. **hirtella** Piper. [*Festuca octoflora* Walter, *Vulpia octoflora* (Walter) Rydberg]. SIXWEEKS FESCUE, EIGHT-FLOWERED FESCUE; FESCUE

Cool season annuals.

Flats east of North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Bolton 94-040*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Water catchment north of Antelope Peak, 3 Apr 2001, *Felger*, observation.

Heteropogon contortus (Linnaeus) Roemer & Schultes. TANGLEHEAD; ZACATE COLORADO

Robust tufted perennials.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Sand Tank Mts, Bender Saddle, *Felger 95-402*.

South Maricopa Mts, 24 Mar 2001, *Felger*, observation.

Table Top Mts, 9 Apr 1994, *Bolton*, observation.

Hilaria belangeri (Steudel) Nash. CURLY MESQUITE; ZACATE CHINO

Stoloniferous perennials.

Sand Tank Mts, *Felger 451*.

***Hordeum murinum** Linnaeus subsp. **glaucum** (Steudel) Tzvelev. [*H. stebbinsii* Covas, *H. leporinum* Link subsp. *glaucum* (Steudel) Booth & Rich.]. WILD BARLEY; CEBADILLA

SILVESTRE

Cool season annuals.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Bolton 94-073*.

Vekol Valley, *Felger 01-242*.

Hordeum pusillum Nuttall. LITTLE BARLEY

Sand Tank Mts, *Felger 01-348*.

Table Top Mts, *Felger 01-308*.

Leptochloa dubia (Kunth) Nees. GREEN SPRANGLETOP; ZACATE GIGANTE

Tufted perennials.

Sand Tank Mts, *Felger 446*.

Leptochloa fusca (Linnaeus) Kunth subsp. **uninervia** (J. Presl) N. Snow. [*Leptochloa uninervia* (J. Presl) Hitchcock & Chase]. MEXICAN SPRANGLETOP; ZACATE SALADO

MEXICANO

Robust, warm weather annuals.

Sand Tank Mts, Bender Spring, *Felger 95-426*.

Leptochloa panicea (Retzius) Ohwi subsp. **brachiata** (Steudel) N. Snow. [*L. brachiata* Steudel, *L. mucronata* (Michaux) Kunth, *L. filiformis* (Lamarck) P. Beauvois]. RED

SPRANGLETOP; ZACATE SALADO, DESPARRAMO ROJO

Hot weather annuals.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Sand Tank Mts, Bighorn Road, *Felger 95-328*.

Table Top Mts, 17 Mar 1999, *Mauz*, observation.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Leptochloa viscida (Scribner) Beal. STICKY SPRANGLETOP; ZACATE SALADO PAGAJOSO

Hot weather annuals.

Vekol Valley, *Mauz 99-125*.

Muhlenbergia microsperma (de Candolle) Trinius. LITTLESEED MUHLY; LIENDRILLA CHICA

Non-seasonal annuals.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Sand Tank Mts, *Felger 01-368*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Muhlenbergia porteri Beal. BUSH MUHLY; ZACATE APAREJO

Bushy perennials.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

Sand Tank Mts, 10 Oct 1995, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, 9 Apr 1999, *Mauz*, observation. Often abundant under palo verde canopies; these observed ravaged by cows with concomitant damage to the tree.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Panicum hirticaule J. Presl var. **hirticaule**. [*P. capillare* Linnaeus var. *hirticaule* (J. Presl) Gould, *P. sonorum* Beal]. MEXICAN PANICGRASS

Hot weather annuals.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Sand Tank Mts, *Felger 95-360*.

Table Top Mts, *Mauz 99-123*.

Panicum obtusum Kunth. VINE MESQUITE; ZACATE GUÍA

Stoloniferous perennials.

Vekol Valley, Vekol Wash bosque, *Mauz*, photo.

***Pennisetum ciliare** (Linnaeus) Link. [*Cenchrus ciliaris* Linnaeus]. BUFFELGRASS; ZACATE BUFFEL

Tufted perennials. Mostly along roadsides, especially I-8 where it is abundant. As of 2001 this invasive grass had not spread into the wilderness areas of the Monument.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

***Phalaris minor** Retzius. LITTLE-SEED CANARY GRASS; ALPISTILLO, ALPISTE SILVESTRE

Cool season annuals.

Table Top Mts, summit, *Felger 01-294*.

Water catchment north of Antelope Peak, 3 Apr 2001, *Felger*, observation.

Pleuraphis mutica Buckley. [*Hilaria muticus* (Buckley) Benth]. TOBOSA GRASS

Coarse perennials generally forming large colonies and populations. The tobosa grassland in the Vekol Valley grassland ACEC seems to be the most extensive stand of this species protected by a National Monument. The majority of bottomland tobosa grassland in southern Arizona has been lost to cultivation and overgrazing. Isolated populations occur on Table Top and in the Sand Tank Mountains.

Sand Tank Mts, *Felger 01-330*.

Table Top, summit, 4 Apr 2001, *Felger*, observation.

Vekol Valley, *Mauz 21-022*.

Pleuraphis rigida Thurber. [*Hilaria rigida* (Thurber) Scribner]. BIG GALLETA; GALLETA GRANDE, TOBOSO

Large, suffrutescent, tufted or bushy perennials.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

***Poa annua** Linnaeus. ANNUAL BLUEGRASS, WINTERGRASS; PASTITO DE INVIERNO

Cool season annuals.

Vekol Valley, *Felger 01-238*.

Poa bigelovii Vasey & Scribner. BIGELOW BLUEGRASS; ZACATE AZUL NATIVO

Cool season annuals.

Flats east of North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

North Maricopa Mts, *Felger 01-197*.

Sand Tank Mts, *Felger 01-355*.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Felger 01-283A*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Water catchment north of Antelope Peak, 3 Apr 2001, *Felger*, observation.

***Polypogon monspeliensis** (Linnaeus) Desfontaines. RABBITFOOT GRASS; COLA DE ZORRA

Cool season annuals.

Sand Tank Mts, Bender Spring, *Felger 95-422*.

***Schismus arabicus** Nees. ARABIAN GRASS

Cool season annuals.

North Maricopa Mts, *Felger 01-196*.

South Maricopa Mts, *Felger 01-147*.

Table Top Mts, *Felger 01-292*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Water catchment north of Antelope Peak, 3 Apr 2001, *Felger*, observation.

Setaria leucopila (Scribner & Merrill) K. Schumann. WHITE-HAIRED BRISTLEGRASS; ZACATE TEMPRANO

Tufted perennials.

Sand Tank Mts, *Felger 95-381*.

Table Top Mts, *Mauz 20-013*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Sporobolus cryptandrus (Torrey) A. Gray. SAND DROPSEED; ZACATE DE ARENA

Tufted perennials.

Table Top Mts, 4 Apr 2001, *Felger*, observation.

Tridens muticus (Torrey) Nash var. **muticus**. SLIM TRIDENS

Small tufted perennials.

Javelina Mt, eastern base, *Morrison, Walter, & Anderson LA 540 (CS)*.

Sand Tank Mts, *Felger 95-370*.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Mauz 99-091*.

POLEMONIACEAE - PHLOX FAMILY

Eriastrum diffusum (A. Gray) Mason

Cool season annuals; flowers blue.

North Maricopa Mts, *Felger 01-177*.

Table Top Mts, *Bolton 94-088*.

Gilia flavocincta A. Nelson

Annuals; flowers pink. Base of plant with cobwebby hairs.

North Maricopa Mts, *Felger 01-186*.

South Maricopa Mts, *Felger 01-156*.

Table Top Mts, summit, *Felger 01-305A*.

Gilia stellata A. Heller. STAR GILIA

Cool season annuals; flowers white tinged with violet. Base of plant with coarse, kinked hairs.

North Maricopa Mts, *Felger 01-185*.

South Maricopa Mts, *Felger 01-157*.

Table Top Mts, *Felger 01-305*.

Vekol Valley, *Felger 01-244*.

Linanthus bigelovii (A. Gray) Greene

Cool season annuals; flowers white. Fragrant at night when flowering.

Flats east of North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

North Maricopa Mts, *Felger 01-188*.

South Maricopa Mts, *Chamberland 24 Mar 2001*.

Table Top Mts, *Bolton 94-031*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Linanthus demissus (A. Gray) Greene

Cool season annuals; flowers white with red stripes at the throat.

Sand Tank Mts, northeast of Round Butte, *Morrison & Walter LA 1074* (CS).

South Maricopa Mts, *Felger 01-213*.

Vekol Valley, Vekol Wash, 1 Apr 1932, *Harrison & Kearney 8449*.

Linanthus dichotomus Bentham. [*Gilia dichotoma* Bentham]. EVENING SNOW

North Maricopa Mts, *Felger 01-189*.

South Maricopa Mts, *Chamberland 24 Mar 2001*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

POLYGALACEAE - MILKWORT FAMILY

Polygala macradenia A. Gray. MILKWORT

Small perennial herbs with woody bases; flowers purple.

Sand Tank Mts, *Felger 95-419*.

POLYGONACEAE - BUCKWHEAT FAMILY

Chorizanthe brevicornu Torrey subsp. **brevicornu**. BRITTLE SPINE FLOWER, SHORT-HORN SPINE-FLOWER

Cool season annuals; flowers white, minute.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Roadside, Hwy 238, 20 Mar 2001, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Bolton 94-023*.

Chorizanthe rigida (Torrey) Torrey & A. Gray. RIGID SPINE-FLOWER

Cool season annuals; flowers white, minute.

Javelina Mt, 1 Dec 2000, *Felger* observation.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

Table Top Mts, *Bolton 94-057*.

Eriogonum abertianum Torrey

Annuals or short-lived perennial herbs; flowers pink.
Sand Tank Mts, *Felger 95-386*.
Table Top Mts, *Felger 01-283*.

Eriogonum deflexum Torrey. SKELETON WEED

Annuals, cool season and often surviving the summer; flowers white to pink.
Junction of I-8 and Pinal-Maricopa county line; 3 Apr 2001, *Felger*, observation.
North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.
Table Top Mts, *Bolton 94-034*.

Eriogonum fasciculatum Bentham var. **polifolium** (Bentham) Torrey & A. Gray. FLAT-TOP
BUCKWHEAT

Small shrubs; flowers white to pink.
North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.
Sand Tank Mts, 11 Oct 1995, *Felger*, observation.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, *Bolton 94-052*.

Eriogonum inflatum Torrey & Frémont. DESERT TRUMPET, BLADDER STEM

Perennial herbs; flowers yellow.
Javelina Mt, *Felger*, observation.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, 19 Mar 1994, *Bolton*, observation.

Eriogonum maculatum A. Heller

Red-stemmed and red-leaved, cool season perennials; inflorescences woolly; growing at higher elevations among rocks.
Table Top Mts, *Felger 01-266A*.

Eriogonum thomasi Torrey

Cool season annuals; flowers yellow and pink.
North Maricopa Mts, *Felger 01-178*.

Eriogonum trichopes Torrey var. **trichopes**. LITTLE TRUMPET

Cool season annuals, occasionally surviving the summer; flowers yellow.
North Maricopa Mts, 20 Mar 2001, *Felger*, observation.
South Maricopa Mts, 24 Mar 2001, *Felger*, observation.
Table Top Mts, *Bolton 94-009*.

Eriogonum wrightii Bentham var. **pringlei** (J. M. Coulter & Fisher) Reveal

Small shrubs; flowers white to pink.
North Maricopa Mts, north of Butterfield Pass, 1993 *Wirt*, observation.
Sand Tank Mts, *Felger 95-371*.
South Maricopa Mts, *Felger 01-216*.

PORTULACACEAE - PORTULACA FAMILY

Calandrinia ciliata (Ruiz & Pavón) de Candolle. RED MAIDS

Cool-season, succulent annuals; flowers rose-red.
North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Cistanthe monandra (Nuttall) Hershkovitz. [*Calyptridium monandrum* Nuttall]

Cool season, succulent annuals; flowers minute, white and yellow.

Sand Tank Mts, *Morrison & Walter LA 1081* (CS).

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Portulaca suffrutescens Engelman

Hot season, succulent annuals; flowers orange.

Sand Tank Mts, *Felger 95-414*.

Talinum angustissimum (A. Gray) Wooton & Standley

Perennial herbs; flowers yellow. Uncommon.

Table Top Mts, *Mauz 99-099*.

PRIMULACEAE - PRIMROSE FAMILY

Androsace occidentalis Pursh. ROCK JASMINE

Diminutive spring annuals, flowers white.

Sand Tank Mts, *Felger 01-358*.

RANUNCULACEAE - RANUNCULUS FAMILY

Anemone tuberosa Rydberg. DESERT WINDFLOWER

Herbaceous root perennials growing during winter-spring; flowers pink.

Javelina Mt, 1 Dec 2000, *Felger*, observation.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

South Maricopa Mts, 24 Mar 2001, *Felger*, photo.

Clematis drummondii Torrey & A. Gray. TEXAS VIRGIN BOWER

Robust, perennial vines, often shrubby; flowers cream-white, the fruits in feathery clusters.

Sand Tank Mts, *Felger 95-378*.

Vekol Valley, *Felger 01-239*.

Vekol Valley, *Mauz 99-118* (male), *Mauz 99-122* (female).

Delphinium scaposum Greene. BARESTEM LARKSPUR

Herbaceous root perennials growing during winter-spring; flowers blue.

Javelina Mt, northern slope, *Morrison & Walter LA 229* (CS).

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Bolton 94-095*.

Myosurus cupulatus S. Watson. MOUSETAIL

Sand Tank Mts, *Felger 01-359*.

RESEDACEAE - MIGNONETTE FAMILY

Oligomeris linifolia (Hornemann) J. F. Macbride. DESERT CAMBESS

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

Table Top Mts, *Felger 01-325*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

RHAMNACEAE - BUCKTHORN FAMILY

Colubrina californica I. M. Johnston. CALIFORNIA SNAKE-BUSH

Woody shrubs; flowers small, yellow-green.

Sand Tank Mts, 1.2 km east of Round Butte, *Morrison & Walter LA 1084* (CS).

Condalia warnockii M. C. Johnston var. **kearneyana** M. C. Johnston

Large shrubs; flowers small, yellow-green.

Sand Tank Mts, *Felger 95-361*.

Table Top Mts, parasitized by *Phoradendron californicum*, 17 Feb 2001, *Mauz*, observation.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Ziziphus obtusifolia (Torrey & A. Gray) A. Gray var. **canescens** (A. Gray) M. C. Johnston.

GRAYTHORN; ABROJO

Spinescent shrubs; flowers small, yellow-green.

Flats east of North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

Sand Tank Mts, 11 Oct 1995, *Felger*, observation.

Vekol Valley, 19 Mar 1999, *Mauz*, observation.

ROSACEAE - ROSE FAMILY

Coleogyne ramosissima Torrey. BLACK BRUSH

Small shrubs; flowers yellow. A spectacularly disjunct population represents a southern outpost for this characteristically Mojavean sagebrush species.

Javelina Mt, 3 individuals (reported by Brown 1978).

Vauquelinia californica (Torrey) Sargent subsp. **sonorensis** Hess & Henrickson. SONORAN

ROSEWOOD

Large shrubs to small trees; flowers white. This subspecies an ecoregion endemic.

Sand Tank Mts, *Felger 95-337*.

RUBIACEAE - MADDER FAMILY

Galium aparine Linnaeus

Sand Tank Mts, *Felger 01-338*.

Galium stellatum Kellogg var. **eremicum** Hilend & J. T. Howell. STARRY BEDSTRAW

Subshrubby perennials; flowers minute, yellow green. Fruit densely bristly.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Sand Tank Mts, 10 Oct 1995, *Felger*, observation.

South Maricopa Mts, 24 Mar 2001, *Felger*, observation.

Table Top Mts, *Bolton 94-110*.

SCROPHULARIACEAE - SNAPDRAGON FAMILY

Castilleja exserta (A. Heller) Chuang & Heckard. [*Orthocarpus purpurascens* Bentham].

OWL'S CLOVER

Spring annuals; flowers and bracts pink-purple and yellow.

Flats east of North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

Junction of I-8 and Pinal-Maricopa county line; 3 Apr 2001, *Felger*, observation.

South Maricopa Mts, 24 Mar 2001, *Felger*, observation.

Table Top Mts, 19 Mar 1994, *Bolton*, observation.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Castilleja lanata A. Gray. INDIAN PAINTBRUSH

Herbaceous perennials; bracts red, the flowers yellow and red.

Sand Tank Mts, *Felger 95-373*.

Keckiella antirrhinoides (Bentham) Straw subsp. **microphylla** (A. Gray) Straw.

[*Penstemon antirrhinoides* Bentham subsp. *microphyllus* (A. Gray) Keck]. BUSH PENSTEMON

Shrubs; flowers yellow.

Table Top Mts, *Felger 01-279*.

Maurandya antirrhiniflora Humboldt & Bonpland. SNAPDRAGON VINE

Annual vines; flowers blue.

Sand Tank Mts, Bender Spring, *Felger 95-428*.

Mimulus guttatus de Candolle. MONKEY FLOWER

Spring annuals; flowers yellow.

Sand Tank Mts, Bender Spring, 11 Oct 1995, *Felger* observation.

Mimulus rubellus A. Gray

Cool season annuals; flowers yellow or pink.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Penstemon parryi A. Gray. DESERT PENSTEMON

Cool season annuals or short-lived perennial herbs; flowers rose-pink.

Table Top Mts, *Bolton 94-025*.

Sand Tank Mts, *Funicelli & Anning 40*.

Vekol Valley, *Felger 01-250*.

Penstemon subulatus M. E. Jones

Sand Tank Mts, *Felger 01-375*.

Veronica peregrina Linnaeus subsp. **xalapensis** (Kunth) Pennell. PURSLANE SPEEDWELL,
NECKLACE-WEED

Small cool season annuals; flowers white.

I-8 at Pinal-Maricopa county line, 03 Apr 2001, *Felger*, observation.

Vekol Valley, *Felger 01-240*.

SIMAROUBACEAE - QUASSIA FAMILY

Castela emoryi (A. Gray) Moran & Felger. [*Holacantha emoryi* A. Gray]. CRUCIFIXION
THORN; CORONA DE CRISTO

Dioecious, arborescent shrubs with an unkempt appearance. Growing in valley bottoms
and lower bajadas. Flowers pink.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

SIMMONDSIACEAE - JOJOBA FAMILY

Simmondsia chinensis (Link) Schneider. JOJOBA

Shrubs; flowers green or yellow.

1 km east of east end of Javelina Mt, 1 Dec 2000, *Felger*, observation.

SOLANACEAE - NIGHTSHADE FAMILY

Datura discolor Bernhardt. POISONOUS NIGHTSHADE, DESERT THORN-APPLE; TOLOACHE

Non-seasonal annuals; flowers white with purple-tinged throat.

Water catchment north of Antelope Peak, *Mauz 21-025*.

Table Top Mts., bajadas along washes, 27 July 2000, *Mauz*, observation.

Lycium andersonii A. Gray var. **andersonii**. DESERT WOLFBERRY; SALICIESO

Shrubs; flowers white and lavender.

Flats east of North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Vekol Valley, Vekol Wash bosque, *Mauz 20-005*.

Lycium berlandieri Dunal var. **longistylum** C. L. Hitchcock. BACHATA, SALICIESO

Shrubs; flowers cream-white.

Javelina Mt, 1 Dec 2001, *Felger*, observation.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Lycium exsertum A. Gray

Shrubs; flowers white.

North Maricopa Mts, *Felger 01-193*.

Lycium fremontii A. Gray var. **fremontii**. FRÉMONT WOLFBERRY; TOMATILLO

Shrubs; flowers lavender.

Javelina Mt, summit of Maricopa Peak, *Walter & Arnett LA 1396* (CS).

Lycium macrodon A. Gray var. **macrodon**

Shrubs; flowers white and green.

Flats east of North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Lycium parishii A. Gray var. **parishii**. PARISH WOLFBERRY; SALICIESO

Shrubs of wash-margin understory; flowers lavender. Herbage glandular-pubescent.

Javelina Mountain, eastern base of mountain, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Vekol Valley, *Bolton 94-053*.

Nicotiana obtusifolia M. Martens & Galeotti. [*N. trigonophylla* Dunal]. COYOTE TOBACCO, DESERT TOBACCO; TABAQUILLO DE COYOTE

Perennial herbs; flowers cream-white.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Roadside, Hwy 238, 20 Mar 2001, *Felger*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, *Mauz 99-117*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

Water catchment north of Antelope Peak, 3 Apr 2001, *Felger*, observation.

Physalis crassifolia Bentham. DESERT GROUND CHERRY; TOMATILLO DEL DESIERTO

Perennial herbs; flowers pale yellow.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.
Sand Tank Mts, Bender Saddle, *Felger 95-408*.

Physalis lobata Torrey. [*Quincula lobata* (Torrey) Rafinesque]

Perennial herbs; flowers lavender to deep blue-purple with a white center.

Vekol Valley, *Mauz 99-084*.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

***Solanum elaeagnifolium** Cavanilles

Perennial herbs; flowers lavender. Herbage and fruit bearing few to numerous small, yellowish spines.

Vekol Valley, 27 Jul 2000, *Mauz*, observation.

STERCULIACEAE - CACAO FAMILY

Ayenia filiformis S. Watson. [*A. pusilla* of authors, not Linnaeus]

Herbaceous perennials to slender subshrubs; flowers maroon, minute, and intricately complicated. Sheltered rocky slopes and along washes and arroyos.

Antelope Peak, 3 Apr 2001, *Felger*, observation.

Sand Tank Mts, *Felger 95-368*.

South Maricopa Mts, 24 Mar 2001, *Felger*, observation.

Table Top Mts, 8 Aug 1999, *Mauz*, observation.

Ayenia microphylla A. Gray

Small shrubs with slender, rigid stems; flowers maroon, minute. Arid, rocky slopes, especially at higher elevations; generally localized.

Antelope Peak, *Felger 01-257*.

Sand Tank Mts, *Felger 443*.

Table Top Mts, *Mauz 99-089*.

ULMACEAE - ELM FAMILY

Celtis pallida Torrey subsp. **pallida**. DESERT HACKBERRY; GARAMBULLO

Spinescent, briarlike shrubs. Leaves rough like sandpaper and drought-deciduous. ; flowers small, green, and inconspicuous. Fruits 8 mm, bright orange, the pericarp rather thin, fleshy, edible and moderately sweet and tart. The fruits are especially relished by birds. Drainageways and sometimes on rocky, especially north-facing, slopes and canyons.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Sand Tank Mts, Bender Saddle, *Felger 95-399*.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.

Table Top Mts, 20 Mar 1999, *Mauz*, observation.

Vekol Valley, 26 Mar 2001, *Felger*, observation.

URTICACEAE - NETTLE FAMILY

Parietaria floridana Nuttall. [*P. hespera* Hinton]. DESERT PELLITORY

Cool season annuals; flowers inconspicuous, green. Widespread at all elevations, generally not in the hotter, drier habitats; often at the base of the sides of rocks and in the shelter of trees and shrubs.

Flats east of North Maricopa Mts, 20 Mar 2001, *Felger*, observation.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, 4 Apr 2001, *Felger*, observation.
Javelina Mt, 1 Dec 2000, *Felger*, observation.

VERBENACEAE - VERBENA FAMILY

Aloysia wrightii (A. Gray) A. Heller. OREGANILLO

Shrubs; flowers minute, white.
North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.
Sand Tank Mts, 10 Oct 1995, *Felger*, observation.
Table Top Mts, *Bolton 94-116*.

Tetradlea coulteri A. Gray

Short-lived perennials or perhaps a hot weather annual; flowers white. Known in our region from few, widely scattered records.
Vekol Valley, *Mauz 99-132*.

Verbena bracteata Lagasca & Rodriguez

Cool season annuals; flowers pink.
Water catchment north of Antelope Peak, *Felger 01-259*.

Verbena gooddingii Briquet. [*Glandularia gooddingii* (Briquet) Solbrig]. DESERT VERBENA

Short-lived perennials herbs or non-seasonal annuals; flowers lavender-pink.
North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Verbena neomexicana (A. Gray) Small

Sand Tank Mts, *Felger 95-437, 01-371*.
Table Top Mts, *Felger 01-304*.

VISCACEAE - MISTLETOE FAMILY

Phoradendron californicum Nuttall. DESERT MISTLETOE

Epiphytic perennial parasites. Flowers minute, yellow-green. Common on *Olneya tesota*, *Prosopis velutina*, *Parkinsonia florida*, *P. microphylla*, and occasionally *Condalia warnockii*.
Javelina Mt., *Felger*, observation.
North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, 20 Mar 1994, *Bolton*, observation.
Vekol Valley, 26 Mar 2001, *Felger*, observation.

ZYGOPHYLLACEAE - CALTROP FAMILY

Fagonia californica Bentham subsp. **longipes** (Standley) Felger & Lowe. [*F. longipes* Standley]

Perennial herbs; flowers lavender. Dry, exposed slopes, mostly at low elevations.
North Maricopa Mts, *Felger 01-181*.
Sand Tank Mts, *Felger 95-326*.
South Maricopa Mts, 21 Feb 2001, *Felger*, observation.
Table Top Mts, *Bolton 94-096*.

Kallstroemia californica (S. Watson) Vail. CALIFORNIA CALTROP; MAL DE OJO

Hot weather annuals; flowers small and yellow. Probably widespread across the Monument at lower elevations.

Vekol Valley, 8 Aug 1999, *Mauz*, observation.

Kallstroemia grandiflora Torrey. ORANGE CALTROP; BAIBORÍN, MAL DE OJO

Hot weather annuals; flowers orange with a reddish center, rather large and showy. Seasonally common and widespread, sometimes coloring the landscape orange during favorable summers; roadsides, valley floors, bajadas, and sometimes on rocky slopes.

North Maricopa Mts, north of Butterfield Pass, 1993, *Wirt*, observation.

Table Top Mts, 8 Aug 1999, *Mauz*, observation.

Larrea divaricata Cavanilles subsp. **tridentata** (de Candolle) Felger & Lowe. [*L. tridentata* de Candolle]. CREOSOTEBUSH; HEDIONDILLA, GOBERNADORA

Shrubs with multiple, slender stems, and pungently aromatic foliage. Flowers bright yellow at various seasons, especially spring and summer following favorable rains. This is the single most common and abundant shrub across the Monument, extending in places to mountain tops. Creosotebush forms the dominant feature of the expansive valley plains, hills and lower slopes.

Totals:

Species: 402

Genera: 260

Families: 71

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Table 1. Special status species known or expected within Sonoran Desert National Monument.

Common name	Scientific name	Presence	Status ^a
Desert tortoise	<i>Gopherus agassizii</i>	known	SC
Cactus ferruginous pygmy-owl	<i>Glaucidium brasilianum cactorum</i>	expected	SC, E
Swainson's thrush	<i>Catharus ustulatus</i>	known	SC
Lesser long-nosed bat	<i>Leptonycteris curasoae yerbabuena</i>	known	E, SC
Sonoran pronghorn	<i>Antilocapra americana sonoriensis</i>	known	E, SC
Acuña cactus	<i>Echinomastus erectocentrus var. acunensis</i>	known	C

^a Status designations:

SC – Wildlife of Special Concern in Arizona (AGFD 1996)
 E – Federal Endangered
 C – Federal Candidate.

Table 2. Amphibians documented within Sonoran Desert National Monument.

Family	Scientific Name	Common Name	References ^a	Specimens ^b	Vekol Valley	Sand Tanks	Maricopa Mtns
Bufonidae	<i>Bufo alvarius</i>	Sonoran desert toad	2	X	X	X	
Bufonidae	<i>Bufo cognatus</i>	Great Plains toad	2	X	X		
Bufonidae	<i>Bufo debilis</i>	Green toad	2		?		
Bufonidae	<i>Bufo punctatus</i>	Red-spotted toad	1,6	X	P	X	X
Bufonidae	<i>Bufo retiformis</i>	Sonoran green toad	1,2,3	X	X	X	X
Bufonidae	<i>Bufo woodhousei</i>	Woodhouse's toad	6				X
Microhylidae	<i>Gastrophryne mazatlanensis</i>	Sinaloan narrowmouth toad	2	X	X		
Hylidae	<i>Pternohyla fodiens</i>	Lowland burrowing treefrog	4	X	X		
Pelobatidae	<i>Scaphiopus couchii</i>	Couch's spadefoot	2,5	X	X	X	
	<i>Spea multiplicatas</i>	New Mexico spadefoot			P		
Ranidae	<i>Rana berlandieri</i>	Rio Grande leopard frog	6				X

X present

P possible but not confirmed

^a Specimens held at University of Arizona and U.S. National Museum.

^b References:

1. Dames & Moore 1994
2. Jones et al. 1983
3. Sullivan et al. 1996
4. Enderson & Bezy 2000
5. Erik Enderson, unpublished data
6. Betsy Wirt, personal communication

Table 3. Reptiles documented within Sonoran Desert National Monument.

Family	Scientific Name	Common Name	References ^a	Specimens ^b	Table Top	Vekol Valley	Sand Tanks	Maricopa Mtns.
TURTLES								
Testudinidae	<i>Gopherus agassizii</i>	Desert tortoise	1,3,6		X		X	X
LIZARDS								
Crotaphytidae	<i>Crotaphytus nebrius</i>	Sonoran collared lizard	1,4,5	X			X	X
Crotaphytidae	<i>Gambelia wislizenii</i>	Long-nosed leopard lizard	1,2			X	X	
Eublepharidae	<i>Coleonyx variegatus</i>	Western banded gecko	2,5	X		X	X	X
Helodermatidae	<i>Heloderma suspectum</i>	Gila monster	5,7				X	X
Iguanidae	<i>Dipsosaurus dorsalis</i>	Desert iguana	1,2,5			X	X	X
Phrynosomatidae	<i>Callisaurus draconoides</i>	Zebra-tailed lizard	1,4	X	X	X	X	X
Phrynosomatidae	<i>Cophosaurus maculata</i>	Lesser earless lizard	4					X
Phrynosomatidae	<i>Phrynosoma platyrhinos</i>	Desert horned lizard	2	X		X		
Phrynosomatidae	<i>Phrynosoma solare</i>	Regal horned lizard	1	X		X	X	X
Phrynosomatidae	<i>Sauromalus obesus</i>	Common chuckwalla	1,4,6	X			X	X
Phrynosomatidae	<i>Sceloporus clarkii</i>	Clark's spiny lizard	5					X
Phrynosomatidae	<i>Sceloporus magister</i>	Desert spiny lizard	1,4,5	X		X	X	X
Phrynosomatidae	<i>Urosaurus graciosus</i>	Long-tailed brush lizard	1,5				X	X
Phrynosomatidae	<i>Urosaurus ornatus</i>	Tree lizard	1,2,4	X	X	X	X	X
Phrynosomatidae	<i>Uta stansburiana</i>	Side-blotched lizard	1,4	X		X	X	X
Teiidae	<i>Cnemidophorus tigris</i>	Western whiptail	1,4	X	X	X	X	X
Teiidae	<i>Cnemidophorus burti xanthanotus</i>	Red-backed whiptail	6,7	X	X		X	
SNAKES								
Boidae	<i>Lichanura trivirgata</i>	Desert rosy boa	1,5				X	X
Colubridae	<i>Arizona elegans</i>	Glossy snake	2,5			X		X
Colubridae	<i>Chilomeniscus cinctus</i>	Banded sand snake	5					X
Colubridae	<i>Lampropeltis getula</i>	Common kingsnake	5					X
Colubridae	<i>Hypsiglena torquata</i>	Night snake	2,5	X		X		X
Colubridae	<i>Masticophis flagellum</i>	Coachwhip	2,4,5	X	X	X		X
Colubridae	<i>Masticophis bilineatus</i>	Sonoran whipsnake	1,4,5	X			X	X
Colubridae	<i>Phyllorhynchus decurtatus</i>	Spotted leaf-nosed snake	2,5			X		X
Colubridae	<i>Pituophis catenifer</i>	Gopher snake	2,5			X		X

(Table 3 continued)

Family	Scientific Name	Common Name	References ^a	Specimens ^b	Table Top	Vekol Valley	Sand Tanks	Maricopa Mtns.
(SNAKES)								
Colubridae	<i>Rhinocheilus lecontei</i>	Long-nosed snake	2,5			X		X
Colubridae	<i>Salvadora hexalepis</i>	Western patch-nosed snake	1,2,5	X		X	X	X
Elapidae	<i>Micruroides euryxanthus</i>	Arizona coral snake	5					X
Viperidae	<i>Crotalus cerastes</i>	Sidewinder	2,4,5	X		X		X
Viperidae	<i>Crotalus mitchellii</i>	Speckled rattlesnake	1,4,5	X			X	X
Viperidae	<i>Crotalus atrox</i>	Western diamondback rattlesnake	1,2,5	X		X	X	X
Viperidae	<i>Crotalus molossus</i>	Black-tailed rattlesnake	1,4,5,8		X		X	X
Viperidae	<i>Crotalus scutulatus</i>	Mojave rattlesnake	1,5	X		X	X	X
Viperidae	<i>Crotalus tigris</i>	Tiger rattlesnake	1,4,5				X	X

^a Specimens held at University of Arizona.

^b References

1. Dames & Moore 1994
4. Paul Frank, personal communication
7. Dames & Moore 1996

2. Erik Enderson, personal communication
5. Betsy Wirt, personal communication
8. Richard Felger, photo, Table Top, 4 April 2001

3. Wirt and Holm 1997
6. BLM 1995

Table 4. Mammals documented within the Sonoran Desert National Monument.

Order	Family	Scientific name	Common name	References ^a	Table Top	Vekol Valley	Sand Tanks	Maricopa Mtns.	Sentinel Plain
Artiodactyla	Antilocapridae	<i>Antilocapra americana sonoriensis</i>	Sonoran pronghorn	7		X			X
Artiodactyla	Bovidae	<i>Ovis canadensis mexicana</i>	Desert bighorn sheep	1,5	X		X	X	
Artiodactyla	Cervidae	<i>Odocoileus hemionus</i>	Mule deer	1,6			X	X	
Artiodactyla	Cervidae	<i>Odocoileus virginianus</i>	White-tailed deer	1			X		
Artiodactyla	Dicotylidae	<i>Tayassu tajacu</i>	Collared peccary	1,4,6			X	X	
Carnivora	Canidae	<i>Canis latrans</i>	Coyote	1,3,4			X	X	
Carnivora	Canidae	<i>Urocyon cinereo-argenteus</i>	Gray fox	1,3			X	X	
Carnivora	Felidae	<i>Felis concolor</i>	Mountain lion	3,4,6			X	X	
Carnivora	Felidae	<i>Lynx rufus</i>	Bobcat	1,4			X		
Carnivora	Mustelidae	<i>Mephitis mephitis</i>	Striped skunk	3				X	
Chiroptera	Phyllostomidae	<i>Leptonycteris curasoae</i>	Lesser long-nosed bat	2			X		
Chiroptera	Phyllostomidae	<i>Macrotus californicus</i>	California leaf-nosed bat	2			X		
Chiroptera	Vespertilionidae	<i>Antrozous pallidus</i>	Pallid bat	2			X		
Chiroptera	Vespertilionidae	<i>Eptesicus fuscus</i>	Big brown bat	2			X		
Chiroptera	Vespertilionidae	<i>Myotis californicus</i>	California myotis	2,8			X		
Chiroptera	Vespertilionidae	<i>Myotis velifer</i>	Cave myotis	2,8			X		
Chiroptera	Vespertilionidae	<i>Pipistrellus hesperus</i>	Western pipistrelle	2			X		
Lagomorpha	Leporidae	<i>Lepus californicus</i>	Black-tailed jackrabbit	1,3			X	X	
Lagomorpha	Leporidae	<i>Sylvilagus audubonii</i>	Desert cottontail	1,3			X	X	
Rodentia	Heteromyidae	<i>Chaetodipus baileyi</i>	Bailey's pocket mouse	8			X		
Rodentia	Heteromyidae	<i>Chaetodipus penicillatus</i>	Desert pocket mouse	8			X		
Rodentia	Heteromyidae	<i>Dipodomys merriami</i>	Merriam's kangaroo rat	6,8			X	X	
Rodentia	Heteromyidae	<i>Perognathus amplus</i>	Yavapai Arizona pocket mouse	8			X		
Rodentia	Muridae	<i>Neotoma albigula</i>	Desert woodrat	1,3,8			X	X	
Rodentia	Muridae	<i>Peromyscus eremicus</i>	Cactus mouse	8			X		
Rodentia	Sciuridae	<i>Ammospermo-philus harrissii</i>	Harris' antelope squirrel	1,3			X	X	
Rodentia	Sciuridae	<i>Spermophilus tereticaudus</i>	Round-tailed ground squirrel	3				X	
Rodentia	Geomyidae	<i>Thomomys bottae</i>	Botta's pocket gopher	4					

^a References:

1. Dames & Moore 1994.
5. BLM 1995.

2. Dalton et al. 1994.
6. Betsy Wirt, personal communication.

3. Paul Frank, personal communication.
7. USFWS 1998.

4. David Griffin, personal communication.
8. Dames & Moore 1996.

Table 5. Bird species documented in the Sonoran Desert National Monument and vicinity, Arizona

Order	Family	Scientific Name	Common Name		
Anseriformes	Anatidae	<i>Aythya collaris</i>	Ring-necked Duck		
Ciconiiformes	Ardeidae	<i>Butorides virescens</i>	Green Heron		
		<i>Ardea herodias</i>	Great Blue Heron		
		<i>Aythya collaris</i>	Ring-necked Duck		
Falconiformes	Cathartidae	<i>Cathartes aura</i>	Turkey Vulture		
		<i>Coragyps atratus</i>	Black Vulture		
		Accipitridae	<i>Circus cyaneus</i>	Northern Harrier	
	<i>Aquila chrysaetos</i>		Golden Eagle		
	<i>Accipiter cooperii</i>		Cooper's Hawk		
	<i>Accipiter striatus</i>		Sharp-shinned Hawk		
	<i>Parabuteo unicinctus</i>		Harris's Hawk		
	<i>Buteo jamaicensis</i>		Red-tailed Hawk		
	<i>Buteo swainsoni</i>		Swainson's Hawk		
	<i>Buteo regalis</i>		Ferruginous Hawk		
	Falconidae	<i>Falco sparverius</i>	American Kestrel		
<i>Falco mexicanus</i>		Prairie Falcon			
Galliformes	Odontophoridae	<i>Callipepla gambelii</i>	Gambel's Quail		
Charadriiformes	Charadriidae	<i>Charadrius vociferus</i>	Killdeer		
	Recurvirostridae	<i>Himantopus mexicanus</i>	Black-necked Stilt		
	Scolopacidae	<i>Actitis macularia</i>	Spotted Sandpiper		
<i>Calidris minutilla</i>		Least Sandpiper			
Columbiformes	Columbidae	<i>Columbina fasciata</i>	Band-tailed Pigeon		
		<i>Columbina livia</i>	Rock Dove		
		<i>Zenaida asiatica</i>	White-winged Dove		
		<i>Zenaida macroura</i>	Mourning Dove		
		<i>Columbina inca</i>	Inca Dove		
		<i>Columbina passerina</i>	Common Ground-Dove		
Cuculiformes	Cuculidae	<i>Geococcyx californianus</i>	Greater Roadrunner		
Strigiformes	Strigidae	<i>Asio otus</i>	Long-eared Owl		
		<i>Bubo virginianus</i>	Great Horned Owl		
		<i>Otus kennicottii</i>	Western Screech-Owl		
		(potential)	<i>Glaucidium brasilianum cactorum</i>	Cactus Ferruginous Pygmy-Owl	
		<i>Micrathene whitneyi</i>	Elf Owl		
		<i>Otus flammeolus</i>	Flammulated Owl		
		<i>Athene cucularia</i>	Burrowing Owl		
		Tytonidae	<i>Tyto alba</i>	Common Barn Owl	
		Caprimulgiformes	Caprimulgidae	<i>Chordeiles acutipennis</i>	Lesser Nighthawk
				<i>Phalaenoptilus nuttallii</i>	Common Poorwill
	Apodiformes	Apodidae	<i>Aeronautes saxatalis</i>	White-throated Swift	
<i>Chaetura vauxi</i>			Vaux's Swift		
<i>Cypseloides niger</i>			Black Swift		
Trochilidae		<i>Archilochus alexandri</i>	Black-chinned Hummingbird		
		<i>Calypte anna</i>	Anna's Hummingbird		
		<i>Calypte costae</i>	Costa's Hummingbird		
		<i>Selasphorus platycircus</i>	Broad-tailed Hummingbird		
		<i>Selasphorus rufus</i>	Rufous Hummingbird		

(Table 5 continued)

Order	Family	Scientific Name	Common Name
Piciformes	Picidae	<i>Selasphorus sasin</i>	Allen's Hummingbird
		<i>Stellula calliope</i>	Calliope Hummingbird
		<i>Colaptes auratus</i>	Northern Flicker
		<i>Colaptes chrysoides</i>	Gilded Flicker
		<i>Melanerpes uropygialis</i>	Gila Woodpecker
		<i>Sphyrapicus nuchalis</i>	Red-naped Sapsucker
Passeriformes	Tyrannidae	<i>Picoides scalaris</i>	Ladder-backed Woodpecker
		<i>Contopus cooperi</i>	Olive-sided Flycatcher
		<i>Contopus sordidulus</i>	Western Wood-Pewee
		<i>Empidonax traillii</i>	Willow Flycatcher
		<i>Empidonax hammondi</i>	Hammond's Flycatcher
		<i>Empidonax oberholseri</i>	Dusky Flycatcher
		<i>Empidonax wrightii</i>	Gray Flycatcher
		<i>Empidonax difficilis</i>	Pacific-Slope Flycatcher
		<i>Empidonax occidentalis</i>	Cordilleran Flycatcher
		<i>Pyrocephalus rubinus</i>	Vermillion Flycatcher
		<i>Sayornis nigricans</i>	Black Phoebe
		<i>Sayornis saya</i>	Say's Phoebe
		<i>Myiarchus cinerascens</i>	Ash-throated Flycatcher
		<i>Myiarchus tyrannulus</i>	Brown-crested Flycatcher
	<i>Tyrannus verticalis</i>	Western Kingbird	
	<i>Tyrannus vociferans</i>	Cassin's Kingbird	
	Laniidae	<i>Lanius ludovicianus</i>	Loggerhead Shrike
	Vireonidae	<i>Vireo bellii</i>	Bell's Vireo
		<i>Vireo plumbeus (solitarius)</i>	Plumbeous (Solitary) Vireo
		<i>Vireo vicinior</i>	Gray Vireo
		<i>Vireo gilvus</i>	Warbling Vireo
	Corvidae	<i>Corvus corax</i>	Common Raven
	Hirundinidae	<i>Eremophila alpestris</i>	Horned Lark
		<i>Progne subis</i>	Purple Martin
		<i>Tachycineta bicolor</i>	Tree Swallow
		<i>Tachycineta thalassina</i>	Violet-green Swallow
		<i>Hirundo pyrrhonota</i>	Cliff Swallow
<i>Hirundo rustica</i>		Barn Swallow	
	<i>Stelgidopteryx serripennis</i>	Northern Rough-winged Swallow	
Paridae	<i>Poecile gambeli</i>	Mountain Chickadee	
Remizidae	<i>Auriparus flaviceps</i>	Verdin	
Troglodytidae	<i>Thryomanes bewickii</i>	Bewick's Wren	
	<i>Troglodytes aedon</i>	House Wren	
	<i>Troglodytes troglodytes</i>	Winter Wren	
	<i>Campylorhynchus brunneicapillus</i>	Cactus Wren	
	<i>Catherpes mexicanus</i>	Canyon Wren	
	<i>Salpinctes obsoletus</i>	Rock Wren	
	Regulidae	<i>Regulus calendula</i>	Ruby-crowned Kinglet
Sylviidae	<i>Poliophtila caerulea</i>	Blue-gray Gnatcatcher	
	<i>Poliophtila melanura</i>	Black-tailed Gnatcatcher	
Turdidae	<i>Myadestes townsendi</i>	Townsend's Solitaire	
	<i>Sialia currucoides</i>	Mountain Bluebird	

(Table 5 continued)

Order	Family	Scientific Name	Common Name
		<i>Sialia mexicana</i>	Western Bluebird
		<i>Catharus guttatus</i>	Hermit Thrush
		<i>Catharus ustalatus</i>	Swainson's Thrush
		<i>Turdus migratorius</i>	American Robin
	Mimidae	<i>Mimus polyglottos</i>	Northern Mockingbird
		<i>Oreoscoptes montanus</i>	Sage Thrasher
		<i>Toxostoma bendirei</i>	Bendire's Thrasher
		<i>Toxostoma crissale</i>	Crissal Thrasher
		<i>Toxostoma curvirostre</i>	Curve-billed Thrasher
		<i>Toxostoma lecontei</i>	Le Conte's Thrasher
	Sturnidae	<i>Sturnus vulgaris</i>	European Starling
	Ptilonotidae	<i>Phainopepla nitens</i>	Phainopepla
	Parulidae	<i>Vermivora celata</i>	Orange-crowned Warbler
		<i>Vermivora luciae</i>	Lucy's Warbler
		<i>Vermivora ruficapilla</i>	Nashville Warbler
		<i>Vermivora virginiae</i>	Virginia's Warbler
		<i>Dendroica coronata</i>	Yellow-rumped Warbler
		<i>Dendroica nigrescens</i>	Black-throated gray Warbler
		<i>Dendroica occidentalis</i>	Hermit Warbler
		<i>Dendroica townsendi</i>	Townsend's Warbler
		<i>Dendroica petechia</i>	Yellow Warbler
		<i>Oporornis tolmiei</i>	MacGillivray's Warbler
		<i>Wilsonia pusilla</i>	Wilson's Warbler
		<i>Geothlypis trichas</i>	Common Yellowthroat
		<i>Icteria virens</i>	Yellow-breasted Chat
	Thraupidae	<i>Piranga ludoviciana</i>	Western Tanager
	Emberizidae	<i>Pipilo aberti</i>	Abert's Towhee
		<i>Pipilo chlorurus</i>	Green-tailed Towhee
		<i>Pipilo fuscus</i>	Canyon Towhee
		<i>Pipilo maculatus</i>	Spotted Towhee
		<i>Aimophila cassinii</i>	Cassin's Sparrow
		<i>Aimophila carpalis</i>	Rufous-winged Sparrow
		<i>Aimophila ruficeps</i>	Rufous-crowned Sparrow
		<i>Spizella breweri</i>	Brewer's Sparrow
		<i>Spizella passerina</i>	Chipping Sparrow
		<i>Aimophila belli</i>	Sage Sparrow
		<i>Amphispiza bilineata</i>	Black-throated Sparrow
		<i>Chondestes grammacus</i>	Lark Sparrow
		<i>Spizella atrogularis</i>	Black-chinned Sparrow
		<i>Calamospiza melanocorys</i>	Lark Bunting
		<i>Passerculus sandwichensis</i>	Savannah Sparrow
		<i>Melospiza lincolni</i>	Lincoln's Sparrow
		<i>Melospiza melodia</i>	Song Sparrow
		<i>Pooecetes gramineus</i>	Vesper Sparrow
		<i>Zonotrichia leucophrys</i>	White-crowned Sparrow
		<i>Junco hyemalis</i>	Dark-eyed Junco
	Cardinalidae	<i>Pheucticus ludovicianus</i>	Rose-breasted Grosbeak
		<i>Pheucticus melanocephalus</i>	Black-headed Grosbeak

(Table 5 continued)

Order	Family	Scientific Name	Common Name
		<i>Cardinalis cardinalis</i>	Northern Cardinal
		<i>Cardinalis sinuatus</i>	Pyrrhuloxia
		<i>Guiraca caerulea</i>	Blue Grosbeak
		<i>Passerina amoena</i>	Lazuli Bunting
		<i>Passerina versicolor</i>	Varied Bunting
	Icteridae	<i>Sturnella neglecta</i>	Western Meadowlark
		<i>Agelaius phoeniceus</i>	Red-winged Blackbird
		<i>Xanthocephalus xanthocephalus</i>	Yellow-headed Blackbird
		<i>Quiscalus mexicanus</i>	Great-tailed Grackle
		<i>Euphagus cyanocephalus</i>	Brewer's Blackbird
		<i>Molothrus ater</i>	Brown-headed Cowbird
		<i>Icterus bullockii</i>	Bullock's Oriole
		<i>Icterus cucullatus</i>	Hooded Oriole
		<i>Icterus parisorum</i>	Scott's Oriole
	Fringillidae	<i>Carpodacus mexicanus</i>	House Finch
		<i>Carduelis psaltria</i>	Lesser Goldfinch
		<i>Carduelis tristis</i>	American Goldfinch
	Passeridae	<i>Passer domesticus</i>	House Sparrow

Table 6. Distribution indices, breeding status codes, and migratory status of bird species known or likely to occur in the Sonoran Desert National Monument, Arizona.

Common name	Distribution Index ¹	Breeding Code ²	Migratory Status ³	Passage ⁴
Red-tailed Hawk	100.0	CO	B	
Ash-throated Flycatcher	100.0	CO	B	
Verdin	100.0	CO	N	
Northern Mockingbird	100.0	CO	B	
Cactus Wren	96.7	CO	N	
House Finch	96.7	CO	N	
Gambel's Quail	93.3	CO	N	
Black-throated Sparrow	93.3	CO	B	
Mourning Dove	90.0	CO	B	
Black-tailed Gnatcatcher	90.0	CO	N	
Turkey Vulture	86.7	PR	B	
Gila Woodpecker	86.7	CO	N	
Loggerhead Shrike	86.7	PR	B	
Greater Roadrunner	83.3	CO	N	
Costa's Hummingbird	83.3	CO	A	
Brown-headed Cowbird	83.3	PR	B	
White-winged Dove	80.0	CO	A	
Ladder-backed Woodpecker	80.0	CO	N	
Phainopepla	80.0	CO	A	
Gilded Flicker	76.7	CO	N	
Curve-billed Thrasher	76.7	CO	N	
American Kestrel	73.3	CO	B	
Great Horned Owl	73.3	CO	N	
Brewer's Sparrow	70.0	OB	A	
Rock Wren	66.7	CO	B	
Western Screech-Owl	63.3	CO	N	
Common Poorwill	63.3	PR	B	
Say's Phoebe	63.3	CO	B	
Lucy's Warbler	63.3	CO	A	
Common Raven	60.0	CO	N	
Canyon Wren	60.0	CO	N	
Scott's Oriole	60.0	CO	A	
Western Kingbird	56.7	CO	A	
Ruby-crowned Kinglet	56.7	OB	B	
Elf Owl	50.0	CO	A	
Bendire's Thrasher	50.0	CO	B	
Canyon Towhee	50.0	CO	N	
Wilson's Warbler	46.7	OB	A	P
White-crowned Sparrow	46.7	OB	B	
Lesser Nighthawk	43.3	PR	A	
Brown-crested Flycatcher	43.3	CO	B	
Yellow-rumped Warbler	43.3	OB	B	
Horned Lark	40.0	PO	B	
Hooded Oriole	40.0	CO	A	
Orange-crowned Warbler	36.7	OB	A	P
Abert's Towhee	36.7	PO	N	

(Table 6 continued)

Common name	Distribution Index ¹	Breeding Code ²	Migratory Status ³	Passage ⁴
Bell's Vireo	33.3	CO	A	
European Starling	33.3	PO	N	
Lesser Goldfinch	33.3	OB	B	P
Prairie Falcon	30.0	CO	B	
Black-chinned Hummingbird	30.0	CO	A	P
Plumbeous (Solitary) Vireo	30.0	OB	A	P
Northern Rough-winged Swallow	30.0	OB	A	P
Pyrrhuloxia	30.0	CO	N	
House Sparrow	30.0	PO	N	
Cooper's Hawk	26.7	PO	B	P
Killdeer	26.7	PO	N	
Anna's Hummingbird	26.7	OB	B	P
Townsend's Warbler	26.7	OB	A	P
Sharp-shinned Hawk	23.3	OB	B	P
Rock Dove	23.3	OB	N	
Warbling Vireo	23.3	OB	A	P
House Wren	23.3	OB	A	P
MacGillivray's Warbler	23.3	OB	A	P
Rufous-crowned Sparrow	23.3	PO	N	
Black-headed Grosbeak	23.3	OB	A	P
Northern Cardinal	23.3	CO	N	
Bullock's Oriole	23.3	OB	A	P
Harris's Hawk	20.0	CO	N	
Inca Dove	20.0	OB	N	
White-throated Swift	20.0	PR	A	
Cordilleran Flycatcher	20.0	OB	A	P
Lark Sparrow	20.0	OB	A	P
Common Barn Owl	16.7	CO	N	
Hermit Thrush	16.7	OB	B	P
Le Conte's Thrasher	16.7	PR	N	
Black-throated gray Warbler	16.7	OB	A	P
Yellow Warbler	16.7	OB	A	P
Western Tanager	16.7	OB	A	P
Song Sparrow	16.7	OB	B	
Vesper Sparrow	16.7	OB	B	
Great-tailed Grackle	16.7	OB	N	
Northern Harrier	13.3	OB	B	
Western Wood-Pewee	13.3	OB	A	P
Blue-gray Gnatcatcher	13.3	OB	A	P
Sage Thrasher	13.3	OB	B	
Chipping Sparrow	13.3	OB	A	
Western Meadowlark	13.3	OB	B	
Red-winged Blackbird	13.3	OB	N	
Black Vulture	10.0	PO	A	
Common Ground-Dove	10.0	OB	N	
Rufous Hummingbird	10.0	OB	A	P
Gray Flycatcher	10.0	OB	A	P

(Table 6 continued)

Common name	Distribution Index ¹	Breeding Code ²	Migratory Status ³	Passage ⁴
Black Phoebe	10.0	OB	B	
Purple Martin	10.0	CO	A	
Tree Swallow	10.0	OB	B	P
Violet-green Swallow	10.0	OB	A	P
Cliff Swallow	10.0	PO	A	P
Barn Swallow	10.0	OB	A	P
Nashville Warbler	10.0	OB	A	P
Blue Grosbeak	10.0	OB	A	P
Yellow-headed Blackbird	10.0	OB	A	P
Green Heron	6.7	OB	N	
Golden Eagle	6.7	OB	B	
Swainson's Hawk	6.7	OB	A	
Burrowing Owl	6.7	PR	B	
Black Swift	6.7	OB	A	P
Broad-tailed Hummingbird	6.7	OB	A	
Northern Flicker	6.7	PO	N	
Willow Flycatcher	6.7	OB	A	P
Hammond's Flycatcher	6.7	OB	A	P
Dusky Flycatcher	6.7	OB	A	P
Bewick's Wren	6.7	OB	B	P
Townsend's Solitaire	6.7	OB	A	P
Western Bluebird	6.7	OB	A	
American Robin	6.7	OB	B	P
Hermit Warbler	6.7	OB	A	P
Common Yellowthroat	6.7	OB	A	P
Spotted Towhee	6.7	OB	B	P
Cassin's Sparrow	6.7	OB	B	
Rufous-winged Sparrow	6.7	PR	N	
Black-chinned Sparrow	6.7	OB	A	
Dark-eyed Junco	6.7	OB	B	P
Lazuli Bunting	6.7	OB	A	P
Great Blue Heron	3.3	OB	N	
Ring-necked Duck	3.3	OB	B	P
Ferruginous Hawk	3.3	OB	B	
Black-necked Stilt	3.3	CO	N	
Spotted Sandpiper	3.3	OB	B	
Least Sandpiper	3.3	OB	A	P
Band-tailed Pigeon	3.3	OB	A	P
Vaux's Swift	3.3	OB	A	
Allen's Hummingbird	3.3	OB	A	P
Calliope Hummingbird	3.3	OB	A	P
Red-naped Sapsucker	3.3	OB	B	
Olive-sided Flycatcher	3.3	OB	A	P
Cassin's Kingbird	3.3	OB	A	P
Gray Vireo	3.3	OB	A	P
Mountain Chickadee	3.3	OB	N	A
Winter Wren	3.3	OB	A	P

(Table 6 continued)

Common name	Distribution Index ¹	Breeding Code ²	Migratory Status ³	Passage ⁴
Virginia's Warbler	3.3	OB	A	P
Yellow-breasted Chat	3.3	OB	A	P
Sage Sparrow	3.3	OB	B	
Lark Bunting	3.3	OB	A	P
Savannah Sparrow	3.3	OB	B	
Lincoln's Sparrow	3.3	OB	A	P
Rose-breasted Grosbeak	3.3	OB	A	P
Varied Bunting	3.3	PR	A	
American Goldfinch	3.3	OB	B	P
Cactus Ferruginous Pygmy-Owl	0.0	PO	N	
Flammulated Owl	0.0	OB	A	P

¹ Percent of 30 quadrangle blocks in which species was observed

² CO = confirmed, PR = probable, PO = possible, OB = observed only, not breeding

³ A = species breeds in U.S. and winters outside U.S.; B = species breeds in U.S. and some part of population winters in U.S.; N = non-migratory

⁴ P = passage migrant moves through and does not breed in the area

Table 7. Documented location information for bird species in the Sonoran Desert National Monument.

Common name	N & S Maricopa Mountains												Sand Tank Mountains						Sauceda Mountains												
	Antelope Peak NE	Avondale SE	Avondale SW	Butterfield Pass	Conley Well	Enid	Estrella	Haley Hills	Laveen	Maricopa	Mobile	Mobile NE	Mobile NW	Montezuma Peak	Johnson Well	Bighorn	Blue Plateau	Lost Horse Peak	Kaka NW	S of Gila Bend	Platt Well	Hat Mtn	Hat Mtn SW	Tom Thumb	Midway NW	Midway SW	Smurr	Black Gap	Midway	Deadman Gap	
Green Heron											X		X																		
Great Blue Heron												X																			
Ring-necked Duck				X																											
Turkey Vulture	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Black Vulture	X	X							X																						
Northern Harrier			X																X						X						
Golden Eagle													X		X																
Cooper's Hawk			X		X										X		X						X			X					X
Sharp-shinned Hawk			X				X								X		X						X			X					X
Harris's Hawk															X	X	X						X								X
Red-tailed Hawk	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Swainson's Hawk																											X				
Ferruginous Hawk			X																												
American Kestrel	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X			X			X	X		X		X	X	X	
Prairie Falcon		X		X											X					X		X						X			X
Gambel's Quail		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Killdeer					X	X				X	X	X	X				X														X
Black-necked Stilt						X																									
Spotted Sandpiper													X																		
Least Sandpiper																															X
Band-tailed Pigeon																															X
Rock Dove	X		X			X		X	X	X					X																
White-winged Dove		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mourning Dove		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Inca Dove	X					X			X	X						X												X			
Common Ground-Dove	X																						X	X							
Greater Roadrunner	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X			X	X		X	X	X	X	X	X	X	X	X
Long-eared Owl													X	X															X		X
Great Horned Owl	X		X	X	X	X	X			X	X	X	X	X	X		X	X			X		X	X	X	X	X	X	X	X	X
Common Barn Owl															X	X							X								X
Western Screech-Owl		X	X	X	X		X	X			X	X	X	X	X	X	X		X		X		X	X	X						X
Cactus Ferruginous Pygmy-Owl																															
Elf Owl				X							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

(Table 7, continued)

Common name	N & S Maricopa Mountains												Sand Tank Mountains						Sauceda Mountains												
	Antelope Peak NE	Avondale SE	Avondale SW	Butterfield Pass	Conley Well	Enid	Estrella	Haley Hills	Laveen	Maricopa	Mobile	Mobile NE	Mobile NW	Montezuma Peak	Johnson Well	Bighorn	Blue Plateau	Lost Horse Peak	Kaka NW	S of Gila Bend	Platt Well	Hat Mtn	Hat Mtn SW	Tom Thumb	Midway NW	Midway SW	Smurr	Black Gap	Midway	Deadman Gap	
Flammulated Owl																															
Burrowing Owl	X									X																					
Lesser Nighthawk					X	X	X			X	X	X			X	X	X					X				X			X	X	
Common Poorwill		X		X		X	X				X	X	X	X	X	X	X				X				X				X	X	
White-throated Swift														X	X			X			X			X						X	
Vaux's Swift																														X	
Black Swift																											X			X	
Black-chinned Hummingbird	X	X				X			X	X			X		X								X							X	
Anna's Hummingbird	X					X				X	X	X	X							X								X			
Costa's Hummingbird	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	
Broad-tailed Hummingbird														X				X													
Rufous Hummingbird																X							X		X						
Allen's Hummingbird																							X								
Calliope Hummingbird																							X								
Northern Flicker		X	X																												
Gilded Flicker		X	X		X		X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Gila Woodpecker		X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Red-naped Sapsucker															X																
Ladder-backed Woodpecker		X	X	X	X		X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Olive-sided Flycatcher																														X	
Western Wood-Pewee				X					X						X															X	
Willow Flycatcher																							X							X	
Hammond's Flycatcher									X																					X	
Dusky Flycatcher				X										X																	
Gray Flycatcher				X														X													
Pacific-Slope Flycatcher																								X	X					X	
Cordilleran Flycatcher								X				X								X	X		X							X	
Vermillion Flycatcher															X						X							X			
Black Phoebe																X				X										X	
Say's Phoebe	X	X	X		X		X		X	X	X		X	X	X	X					X		X		X	X	X	X	X	X	
Swainson's Thrush																							X								
American Robin														X									X								
Northern Mockingbird	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Sage Thrasher			X											X													X				
Bendire's Thrasher	X		X	X		X	X		X	X	X	X	X	X			X			X					X		X				

(Table 7, continued)

Common name	N & S Maricopa Mountains												Sand Tank Mountains						Sauceda Mountains													
	Antelope Peak NE	Avondale SE	Avondale SW	Butterfield Pass	Conley Well	Enid	Estrella	Haley Hills	Laveen	Maricopa	Mobile	Mobile NE	Mobile NW	Montezuma Peak	Johnson Well	Bighorn	Blue Plateau	Lost Horse Peak	Kaka NW	S of Gila Bend	Platt Well	Hat Mtn	Hat Mtn SW	Tom Thumb	Midway NW	Midway SW	Smurr	Black Gap	Midway	Deadman Gap		
Crissal Thrasher				X	X	X	X				X	X	X	X	X							X		X			X			X		
Curve-billed Thrasher	X	X		X	X		X	X	X		X	X	X	X	X	X	X			X	X	X	X				X	X		X		
Le Conte's Thrasher		X			X																			X	X					X		
European Starling	X		X			X		X	X	X			X	X	X									X	X					X		
Phainopepla			X	X	X		X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X		X		X	X	X		
Orange-crowned Warbler				X									X	X				X	X	X			X	X	X					X		
Lucy's Warbler		X			X		X		X	X	X	X	X	X	X		X		X			X	X	X	X		X	X		X		
Nashville Warbler				X																				X		X						
Virginia's Warbler																															X	
Yellow-rumped Warbler			X	X			X	X					X	X		X	X			X			X			X	X				X	
Black-throated gray Warbler														X							X			X							X	
Hermit Warbler																							X								X	
Townsend's Warbler				X					X						X	X					X		X								X	
Yellow Warbler													X			X							X			X					X	
MacGillivray's Warbler				X											X	X							X			X	X				X	
Wilson's Warbler			X	X			X	X							X				X		X	X	X	X	X	X	X	X			X	
Common Yellowthroat	X																						X									
Yellow-breasted Chat													X																		X	
Western Tanager									X				X			X							X								X	
Abert's Towhee	X		X	X				X	X	X	X	X	X	X		X											X					
Green-tailed Towhee		X	X	X			X						X	X					X		X		X	X				X				
Canyon Towhee				X	X						X		X	X	X	X						X	X	X		X			X	X		
Spotted Towhee				X																									X			
Cassin's Sparrow															X	X																
Rufous-winged Sparrow														X																	X	
Rufous-crowned Sparrow													X			X							X							X	X	
Brewer's Sparrow			X	X			X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Chipping Sparrow							X																	X							X	
Ash-throated Flycatcher	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Brown-crested Flycatcher				X			X				X	X		X	X	X				X			X	X					X	X		
Western Kingbird	X	X	X		X	X	X	X	X	X	X	X		X	X									X	X			X	X	X	X	
Cassin's Kingbird																													X			
Loggerhead Shrike	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X				X	
Bell's Vireo				X				X					X	X	X		X						X	X			X				X	
Plumbeous (Solitary) Vireo			X	X			X						X	X					X	X	X		X									

(Table 7, continued)

Common name	N & S Maricopa Mountains												Sand Tank Mountains						Sauceda Mountains												
	Antelope Peak NE	Avondale SE	Avondale SW	Butterfield Pass	Conley Well	Enid	Estrella	Haley Hills	Laveen	Maricopa	Mobile	Mobile NE	Mobile NW	Montezuma Peak	Johnson Well	Bighorn	Blue Plateau	Lost Horse Peak	Kaka NW	S of Gila Bend	Platt Well	Hat Mtn	Hat Mtn SW	Tom Thumb	Midway NW	Midway SW	Smurr	Black Gap	Midway	Deadman Gap	
Orange-crowned Warbler				X								X	X					X	X	X		X	X		X	X				X	
Lucy's Warbler		X			X		X		X	X	X	X	X	X	X		X		X			X	X	X		X	X	X	X	X	
Nashville Warbler				X																				X		X					
Virginia's Warbler																														X	
Yellow-rumped Warbler			X	X			X	X					X	X		X	X			X						X	X			X	
Black-throated gray Warbler														X							X				X					X	
Hermit Warbler																						X								X	
Townsend's Warbler				X				X							X	X		X		X			X							X	
Yellow Warbler												X				X						X				X				X	
MacGillivray's Warbler				X											X	X							X			X	X			X	
Wilson's Warbler			X	X			X	X							X			X		X		X		X	X	X	X	X		X	
Common Yellowthroat	X																						X								
Yellow-breasted Chat													X																		
Western Tanager								X				X				X						X								X	
Abert's Towhee	X		X	X				X	X	X	X	X	X		X												X				
Green-tailed Towhee		X	X	X			X					X	X					X		X		X	X					X			
Canyon Towhee				X	X					X		X	X		X	X		X	X			X	X	X				X	X	X	
Spotted Towhee				X																									X		
Cassin's Sparrow															X	X															
Rufous-winged Sparrow															X																X
Rufous-crowned Sparrow													X		X	X		X				X					X			X	
Brewer's Sparrow			X	X			X	X				X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Chipping Sparrow							X																	X						X	
Swainson's Thrush																							X								
American Robin													X									X									
Northern Mockingbird	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sage Thrasher			X										X			X										X					
Bendire's Thrasher	X		X	X		X		X		X	X	X	X			X				X			X		X		X				
Crissal Thrasher				X	X	X	X				X	X	X		X					X		X		X		X		X			X
Curve-billed Thrasher	X	X		X	X		X	X			X	X	X		X	X		X	X	X		X	X		X		X	X			X
Le Conte's Thrasher		X			X																			X	X						X
European Starling	X		X		X		X	X	X				X	X	X													X			
Phainopepla			X	X	X		X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
Orange-crowned Warbler				X									X	X				X	X	X					X	X					X
Lucy's Warbler		X			X		X		X	X	X	X	X	X	X		X			X		X	X		X		X	X			X

(Table 7, continued)

Common name	N & S Maricopa Mountains												Sand Tank Mountains						Sauceda Mountains											
	Antelope Peak NE	Avondale SE	Avondale SW	Butterfield Pass	Conley Well	Enid	Estrella	Haley Hills	Laveen	Maricopa	Mobile	Mobile NE	Mobile NW	Montezuma Peak	Johnson Well	Bighorn	Blue Plateau	Lost Horse Peak	Kaka NW	S of Gila Bend	Platt Well	Hat Mtn	Hat Mtn SW	Tom Thumb	Midway NW	Midway SW	Smurr	Black Gap	Midway	Deadman Gap
Nashville Warbler				X																				X	X					
Virginia's Warbler																														X
Yellow-rumped Warbler		X	X				X	X					X	X	X											X	X			X
Black-throated gray Warbler																					X			X						X
Hermit Warbler																						X								X
Townsend's Warbler				X				X							X	X	X				X		X							X
Yellow Warbler													X			X							X			X				X
MacGillivray's Warbler				X											X	X							X			X	X			X
Wilson's Warbler			X	X			X	X							X			X		X		X	X	X	X	X	X			X
Common Yellowthroat	X																					X								
Yellow-breasted Chat													X																	
Western Tanager								X				X				X						X								X
Abert's Towhee	X	X	X					X	X	X	X	X	X		X											X				
Green-tailed Towhee		X	X	X			X						X	X				X		X			X					X		
Canyon Towhee				X	X							X	X		X			X	X			X	X	X				X	X	
Spotted Towhee				X									X																X	
Cassin's Sparrow															X	X														
Rufous-winged Sparrow															X															X
Sage Sparrow																									X					
Black-throated Sparrow	X	X		X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Lark Sparrow			X	X			X	X					X											X						
Black-chinned Sparrow																X							X							
Lark Bunting																														X
Savannah Sparrow																										X				
Lincoln's Sparrow																							X							
Song Sparrow									X	X				X									X					X		
Vesper Sparrow			X				X						X										X							X
White-crowned Sparrow			X	X			X									X	X	X	X	X				X	X		X	X	X	X
Dark-eyed Junco				X														X												
Rose-breasted Grosbeak																													X	
Black-headed Grosbeak								X				X		X							X		X							X
Northern Cardinal							X						X		X	X						X	X							
Pyrrhuloxia				X		X							X		X	X						X	X							
Blue Grosbeak										X	X	X																		
Lazuli Bunting													X				X													

Table 8. Non-native plants in the flora of the Sonoran Desert National Monument

AMARANTHACEAE

Amaranthus albus

ASTERACEAE

Conyza canadensis var. *glabrata*

Conyza coulteri

Lactuca seriola

Matricaria matricarioides

Sonchus asper subsp. *asper*

Sonchus oleraceus

BRASSICACEAE

Brassica tournefortii

Chorispora tenella

Sisymbrium irio

CARYOPHYLLACEAE

Herniaria cinerea

CHENOPODIACEAE

Salsola tragus

EUPHORBIACEAE

Euphorbia prostrata

GERANIACEAE

Erodium cicutarium

POACEAE

Avena fatua

Bromus rubens

Cynodon dactylon var. *dactylon*

Eragrostis cilianensis

Eragrostis lehmanniana

Hordeum murinum subsp. *glaucum*

Pennisetum ciliare

Phalaris minor

Poa annua

Polypogon monspeliensis

Schismus arabicus

SOLANACEAE

Solanum elaeagnifolium

Appendix: Photos

All photos are by Richard Felger unless noted otherwise.

Abbreviations are as follow:

RSF, Richard Felger

MC, Michael Chamberland

KM, Kathryn Mauz