



The Arizona  
Native Plant  
Society

# The Plant Press

## THE ARIZONA NATIVE PLANT SOCIETY

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contributed time and efforts to this issue.



## Baboquivari Mountain Plants

by Daniel F. Austin, Arizona-Sonora Desert Museum and University of Arizona

The Baboquivari Mountain chain comprises four mountain ranges—the Coyote, Quinlan, Baboquivari, and Pozo Verde Mountains. While most people do not distinguish these four, they are separated by deep valleys, have distinct geologic origins, and are composed of different types of rocks. The northern two-thirds of the chain is from the Jurassic Period (199–145 million years ago), varying between Early to Middle Jurassic when conifers were the dominant land plants. The southern third is from the Cretaceous Period (145–65 million year ago), when angiosperms appeared and *Tyrannosaurus rex* lived.

### Flora

The flora of the Baboquivari Mountain chain contains elements from four distinct regions — the Petran (Rocky Mountain) Montane Coniferous Forests, Madrean Montane Coniferous Forests, Chihuahuan Desert, and Sonoran Desert. Examples of the highest elevation Petran biome are the thistles (*Cirsium* spp.) with temperate affinities. Higher elevations also support species from the southern Madrean biome like New Mexico groundsel (*Packera neomexicanum*). The more tropical Chihuahuan Desert contributed plants like the white Zinnia (*Zinnia acerosa*). Sonoran Desert species grow on both slopes, but are most common on the western slopes, and include the Saguaro (*Carnegiea gigantea*).

Species richness is high if you count only species vs. area. For example, the Baboquivari chain has 785 species in ca. 134,457 acres (54,413 hectares). The much drier but larger Gran Desierto

*continued page 3*

**above** San Francisco River leatherpetal (*Graptopetalum rusbyi*) is one of the rare plants in the Baboquivari ranges. Photo courtesy Thomas Vize.

# President's Note

by Barbara G. Phillips [bgphillips@fs.fed.us](mailto:bgphillips@fs.fed.us)

*Coconino, Kaibab and Prescott National Forests, Flagstaff*

Did you miss the 2009 Arizona Botany Meeting? This is your opportunity to read about the floristic studies that were highlighted at that conference last February. And if you did attend, you now have articles from most of the presenters for future reference. I found it exciting to reconnect with old haunts — places I explored during graduate student days at the University of Arizona, or later doing rare plant surveys all over the state while with the Museum of Northern Arizona.

The Baboquivaris and the mountains of the newly proclaimed Ironwood Forest National Monument, described by Dan Austin and John Wiens, were the sites of my surveys for rare plants such as Kearney's blue star, Nichol's Turk's head cactus, Thornber pincushion, and Tumamoc globeberry. I spent a few days way back when with Tom Van Devender (who recently joined the AZNPS Board) and several others from Tumamoc Hill looking for packrat middens and collecting the modern flora in the Whipple Mountains (see Sarah De Groot's article on page 13). And Art Phillips and I even went to the Tehuacán Valley and northern Oaxaca (so wonderfully depicted by David Yetman) with Dr. Mason many years ago on a quest for pharmacologically-active plants. So reading these detailed descriptions brings back many memories for me.

Across the border, a fledgling organization, *Asociación para las Plantas Nativas de Sonora* (APNSAC), has taken on the mission of sharing knowledge, appreciation, and interest for the conservation of the native plants of Sonora, Mexico. APNSAC President Jesús Sánchez-Escalante says they would like to partner with AZNPS to better inform their members and the children and youth of Sonora.

Our regular columns have returned, with Doug Green reviewing the invasive species cards produced with assistance of a publication grant from AZNPS. Wendy Hodgson pitches for the expansion of the Plant Atlas Project of Arizona into southern Arizona and explains useful ways to use SEINet; and there is a Conservation Update by Laura Moser on invasive weed eradication efforts along the Verde River. Jessa Fisher so ably tells us about ethnobotany in her column of each issue of *The Plant Press*. Several members of AZNPS attended the United Plant Savers Conference at the Arizona Sonora Desert Museum October 17-18. This brought about a feeling of kindred spirit with people in the herbal industry and ethnobotanists regarding the preservation of Southwestern native species and habitats.

We would like to extend many thanks to Mark Bierner for his contributions while a Director and Vice-President of the Board. Many thanks also to Greta Anderson for her work as State Conservation Chair — while she recently resigned from that role, she will remain Chair of the Tucson Conservation Committee. Both provided valuable insights while on the Board and moved AZNPS forward strategically in its mission to promote knowledge, appreciation, conservation, and restoration of Arizona's native plants and their habitats.

# AZNPS President Honored with Asa Gray Career Achievement Award

by Karen Malis-Clark, *Coconino National Forest Deputy Public Affairs Officer*



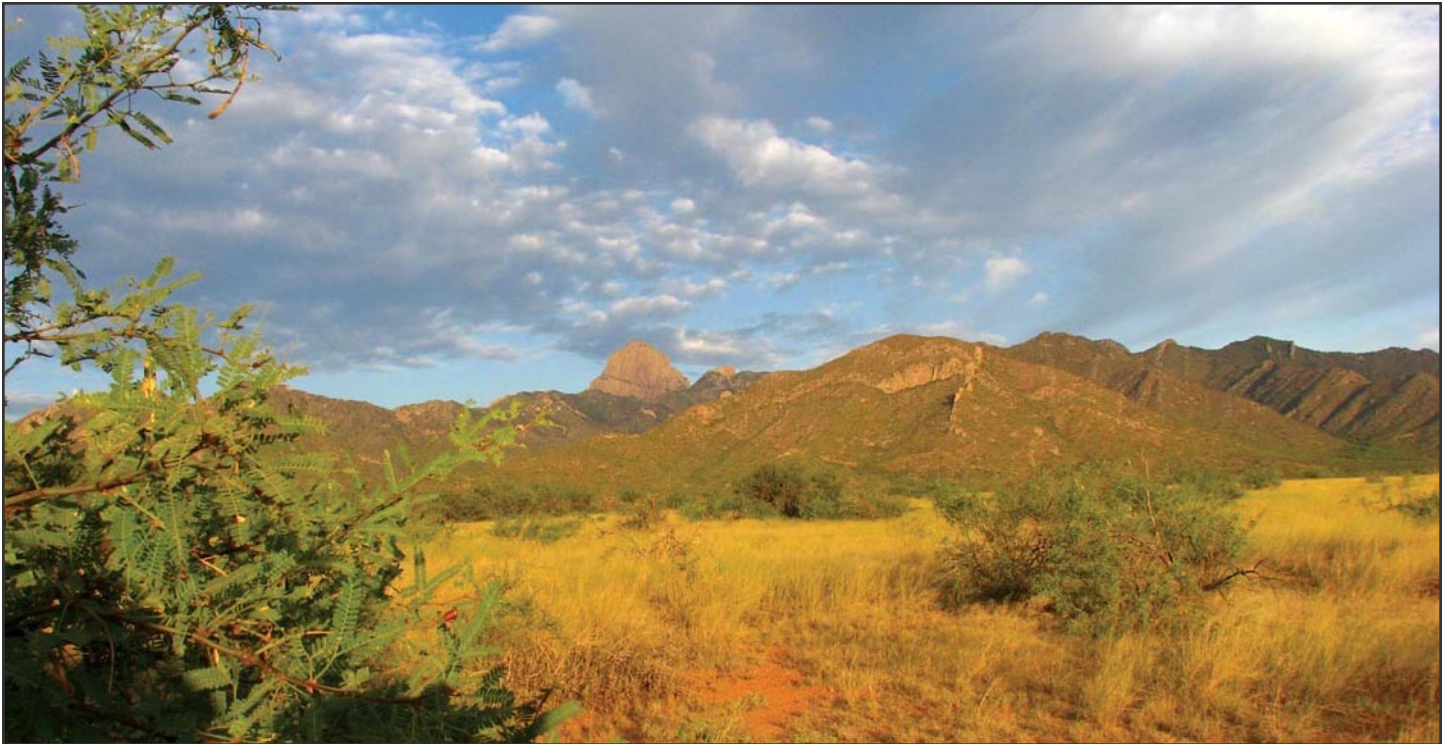
**above** Larry Stritch, National Botanist (left) and Richard Sawa, Acting Associate Deputy Chief, National Forest System (right) present Dr. Barbara Phillips with the Asa Gray Career Achievement Award. *Courtesy Karl Perry, Office of Communications.*

State President Barbara Phillips, Ph.D., was honored with the Asa Gray Career Achievement Award for 2008 at an awards ceremony May 6 in Washington, D.C. This award recognizes a U.S. Forest Service individual who throughout her/his career has demonstrated dedicated leadership, excellence in natural resource management, and outstanding commitment to working with other agencies, states, tribes, non-governmental organizations, and volunteers in the field of botany. Dr. Phillips has been the Zone Botanist for the Coconino, Kaibab and Prescott National Forests for over 19 years.

Dr. Phillips' botanical career spans four decades of leadership and innovation in plant conservation in the Southwest. She authored several plant recovery plans for the U.S. Fish and Wildlife Service and in the late 1990s was a key player in developing the Arizona Rare Plant Field Guide. She has worked in partnership with many organizations including The Arboretum at Flagstaff, the Museum of Northern Arizona, Northern Arizona University and the Desert Botanical Garden. Current emerging projects include the Native Plant Materials Program for northern Arizona and the Plant Atlas Project of Arizona (PAPAZ), initiated by the Arizona Native Plant Society.

The Asa Gray Award is named after one of the foremost botanists of the 1800s who produced taxonomic manuals used by generations of botanists.





**above** Sunrise on the Baboquivari Mountains from the grasslands in the Buenos Aires National Wildlife Refuge. *Courtesy the author.*

## Baboquivari Mountain Plants *continued*

in northwestern Sonora covers 3,706,578 acres (1,499,999 hectares), but only has 589 species. Still, the Baboquivaris have about the number of species expected when compared to adjacent Sky Island floras. For this Basin and Range area, Janice Bowers and Steve McLaughlin argued that elevation dictates species richness.

Plant communities are varied in the mountain chain due to elevation, slope, substrate, and moisture differences. The lower hillsides are dominated by desert grasslands. Since the late 1800s those grasslands have become increasingly invaded by Mesquite (*Prosopis velutina*) to form savanna-like areas. Riverine communities of oak-sycamore form a fringe along the seasonal waterways. Particularly on the north-facing slopes of valleys the vegetation is dominated by oak woodlands. South-facing slopes are mostly composed of grasslands, although they are increasingly covered by shrubs. The upper parts of the ridges are primarily oak-juniper woodlands with a sprinkling of Border pinyon (*Pinus discolor*).

There are numerous surprises in the flora. White-thorn acacia (*Acacia constricta*), Foothill palo verde (*Parkinsonia microphylla*) and Soaptree yucca (*Yucca elata*) are either rare or totally absent from much of the chain. These three species are common in surrounding areas. The perennial Devil's claw (*Proboscidea althaeifolia*) is abundant on the bajada of the nearby Sierrita Mountains, but is completely absent from the Baboquivari chain. Although no member of the genus *Loeselia* (Polemoniaceae) was previously known in the United States, it was found recently in Brown Canyon. Mark Potter (Rancho Santa Ana Botanic Garden & Claremont Graduate University) thinks that it is an undescribed species related to *L. ciliata*.

Several rare species are in the mountains. Kearney's bluestar (*Amsonia kearneyana*), Lemmon's milkweed (*Asclepias lemmoni*), and Mountain leather-petal (*Graptopetalum rusbyi*) have scattered populations in the chain. Range

### Plants mentioned in the text and their O'odham names

Scientific	O'odham
<i>Acacia constricta</i>	gidag
<i>Amsonia kearneyana</i>	none found
<i>Aristolochia watsoni</i>	none found
<i>Asclepias lemmoni</i>	ban wi:bam
<i>Baccharis salicifolia</i>	ñehol
<i>Carnegiea gigantea</i>	ha:sañ
<i>Cirsium neomexicanum</i>	gewul
<i>Commelina erecta</i>	none found
<i>Coursetia glandulosa</i>	none found
<i>Erythrina flabelliformis</i>	ba:wui
<i>Ferocactus covillei</i>	jiavuli
<i>Graptopetalum rusbyi</i>	none found
<i>Ipomoea hederacea</i>	bi:bhiag
<i>Jacquemontia agrestis</i>	bi:bhiag
<i>Packera neomexicanum</i>	none found
<i>Parkinsonia microphylla</i>	kuk cehedagi
<i>Phaseolus acutifolius</i>	ban baw
<i>Pinus discolor</i>	huk
<i>Proboscidea althaeifolia</i>	ban ihugga
<i>Prosopis velutina</i>	kui
<i>Quercus</i> spp.	toa
<i>Rivina humilis</i>	none found
<i>Simmondsia chinensis</i>	ioligam
<i>Yucca elata</i>	takui
<i>Zinnia acerosa</i>	none found

*continued next page*





**left** Pictographs are found in several places in the Baboquivari ranges. These are unusual for the region because of the dominant hand prints. **right** Palmer's spleenwort (*Asplenium palmeri*) is known from Arizona, New Mexico, and Texas, but is disjunct to Florida. *Photos courtesy the author.*

## Baboquivari Mountain Plants *continued*

extensions of Palmer's spleenwort (*Asplenium palmeri*), Baby bonnets (*Coursetia glandulosa*), and Emory's barrel cactus (*Ferocactus covillei*) were surprises. However, the most unexpected of the rare species is Midnight blue clustervine (*Jacquemontia agrestis*). Until 2002 this species was known only from collections made between 1925 and 1945 in Fresno Canyon of the Tohono O'odham Reservation. In 2002 the species was rediscovered to the east of the Altar Valley in Las Guijas Mountains. The vine was discovered again in 2007 on the Elkhorn Ranch in the Baboquivaris.

Although it seems illogical that the Caribbean and the mountains of southern Arizona would share any species, they do. For example, Dayflower (*Commelina erecta*), Blood-berry (*Rivina humilis*), and Ivy-leaf morning glory (*Ipomoea hederacea*) are locally abundant in the Baboquivari chain. In the Caribbean the Dayflower is most frequent in dry, sandy ridges; in the southwest it is mostly near streams and washes. Blood-berry is largely a swamp margin plant in the southeastern United States, but it grows near wash margins and streams in the mountains of the southwest. Ivy-leaf morning glory is abundant in valleys and wash edges throughout the southwest; it is a common climber in flood plains in the southeast.

### People

The first inhabitants of the region were the Hohokam (CE 400-1450). These people were replaced near 1450 by the O'odham. Old village sites are scattered along both margins of the mountains and in some areas are frequent. Those villages are now indicated by abundant rock and pottery fragments, and occasionally stones used for grinding food. Bedrock mortars are scattered throughout, and pictographs occur in some places.

Modern indigenous people in the Baboquivari range area are the Tohono O'odham. Beginning in 1692 when Padre Kino arrived,

there has been a series of influxes of Hispanic and Anglo peoples. All of these cultures used the local plants, although focusing on different species and using them in distinctive ways.

A study of 186 of the most common of 476 species in Brown Canyon showed that at least 82% have been used by one cultural group or another in the Southwest. More may have been used but records are faulty. Several others have closely related species that are used. Some of those used were the most important foods and medicines in the region, including Pipevine (*Aristolochia watsoni*), Desert broom and its relatives (*Baccharis* spp.), Coral-bean (*Erythrina flabelliformis*), Saguaro, Tepary bean (*Phaseolus acutifolius*), and Mesquite. Place names sometimes give an idea of how important plants have been to people. For example, what we now call Kitt Peak was *Bawuigam Do'ag* (Coral-bean Mountain) in the old O'odham song *Gidval Ne' nei* (Blue Swallow Song); today it is *Ioligam Do'ag* (Jojoba Mountain). An old O'odham name for the town of Sasabe is *kui tatk*, Mesquite root. *Batamote* is a Cahita word for Seep-willow (*Baccharis salicifolia*). The Batamote Wash drains across the Arivaca road from the Batamote Hills, which are between the Sierrita and Cerro Colorado Mountains; there is also a village called Batamote in northern Sonora.

The Baboquivari Mountains are pivotal in the ecology of the border region partly because the chain forms part of the eastern limit of the Sonoran Desert. The mountains have a 2,500-year period of involvement with humans, but that constitutes a minuscule fraction of their history. Since the mountains were born of volcanic activity in the Age of Dinosaurs, the Baboquivari chain has a long and complicated history that has resulted in a complex and constantly surprising flora.





# A Floristic Look at the Ironwood Forest National Monument

by John F. Wiens<sup>1</sup>, Nursery Horticulturist, Arizona-Sonora Desert Museum

## Introduction

Ironwood Forest National Monument (IFNM), just west of Tucson, was created in 2000 by President Bill Clinton under the Federal Antiquities Act of 1906, based on archeological sites and previous biological field work done by Desert Museum staff (Buck et al., 2000, Wiens 2001) and Pima County's Sonoran Conservation Plan (Pima County 2000). The boundaries encompass 133,000 acres; most is Bureau of Land Management (BLM) property, but there are also State Trust and private holdings within. This national monument is unusual in that it is administered by the BLM instead of the National Park Service. The BLM awarded the Desert Museum the contract for doing initial botanical studies, including developing a flora, creating vegetation maps, inventorying and mapping rare species, mapping invasive exotic weeds, identifying areas sensitive to disturbances and areas already impacted, and conducting a demographic survey of Desert ironwood trees, Palo verdes, and Saguaros (Dimmitt, et al., 2003).

## The flora

At this time, we have identified 586 taxa of plants in 82 families from IFNM. A species of note is the federally listed Turk's head cactus (*Echinocactus horizonthalonius* var. *nicholii*) (Bainbridge & Wiens, 1991). Former candidate species studied, but not awarded protection, are Parish Indian mallow (*Abutilon parishii*) (Van Devender, et al., 1994), Tumamoc globeberry (*Tumamoca macdougalii*), and Thornber pincushion (*Mammillaria thornberi*). There are two species within IFNM unique to Arizona. False grama (*Cathastecum brevifolium*) was known only from Mexico and trans-Pecos Texas, coming as near as central Sonora 140 miles to the south. We found it to be common on the quartzite hills east of Ragged Top (Wiens, 1990) and at the north end of the Silverbell Mountains. A single plant of Garumbullo (*Pisonia capitata*) found on Ragged Top is the only one known from the United States. This species is common in the Tropical Deciduous Forests of Sonora, Mexico, but occurs no closer to IFNM than Soyopa, 285 miles to the south (Wiens, 1990).

## Internal floristics

The man-made boundary of IFNM, based on ownership of sections, doesn't lend itself to understanding the area's biology.



above North of Ragged Top, plot F76, 2002. Courtesy Mark Dimmitt.

To better study it I chose to break it down into naturally defined units: valleys and mountain ranges.

From southeast to northwest, I'll start with Avra Valley. This huge valley separates the Tucson Mountains from IFNM. It has a gradual slope from 2,200 ft down to 1,825 ft. Soils are deep sandy, with some areas of heavy clay. The sandy soil and open habitat makes for good wildflower displays during rainy years. Within the Monument are 25,600 acres of this valley. Vegetation (following Brown, 1982) is mostly Lower Colorado River Valley (LCV) Subdivision of Sonoran Desertscrub. Creosotebush (*Larrea divaricata*) dominates, with White bursage (*Ambrosia dumosa*) and Saltbush (*Atriplex* sp.) also common. Washes are filled with Blue palo verde (*Parkinsonia florida*), Acacia species, Velvet mesquite (*Prosopis velutina*), and Desert hackberry (*Celtis pallida*). Two hundred sixteen taxa (37% of the total flora) in 44 families (54% of the 82 families in the flora) can be found here. There are 11 plants growing in Avra Valley that are found nowhere else in the Monument, including Sandpaper plant (*Petalonyx thurberi*), Golden desert trumpets (*Linanthus aureus*), Fleabane (*Erigeron arisolius*), Arizona blanketflower (*Gaillardia arizonica*), Tuberous sida (*Rhynchosida physocalyx*), Alkali mallow (*Malvella saggitifolia*), Field anoda (*Anoda pentaschista*), and Pointed cupgrass (*Eriochloa aristata*).

In the southwest corner of IFNM is the large Roskruge Mountain range. It covers nearly 20,000 acres within the Monument and nearly twice that to the south. Elevations range from 1,900 ft at the edge of Avra Valley to 3,262 ft at Dos Titos. Much of the range is granite, with some extrusive volcanics and mudstone. Vegetation is mostly Arizona Upland (AZU) Subdivision of Sonoran Desertscrub (Brown, 1982). Slopes are

*continued next page*

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## A Floristic Look at the Ironwood Forest National Monument *continued*

thick with Saguaros (*Carnegiea gigantea*), Foothill palo verde (*Parkinsonia microphylla*), and Desert ironwood (*Olneya tesota*), with an understory of Triangleleaf bursage (*Ambrosia deltoidea*) and Wolfberry (*Lycium* sp.). Washes are thickly vegetated, and some of the largest Desert ironwoods in IFNM occur here (Nabhan & Behan, 2000). There are 283 taxa (48%) in 56 families (68%) in the Roskrige Mountains; 18 are found only here, including more tropical species like Organpipe cactus (*Stenocereus thurberi*), Tephrosia (*Tephrosia vicioides*), and Sonoran bursage (*Ambrosia cordifolia*); grassland species such as Pea bush (*Dalea pulchra*), Three-seeded mercury (*Acalypha neomexicana*), and Western soapberry (*Sapindus drummondii*).

Northeast of the Roskrige Mountains lies Pan Quemado (Wiens, 1996), a low set of volcanic hills ranging from 2,100 ft to 2,650 ft in elevation. Vegetation in this 5,800-acre range is AZU, rich with Foothill palo verdes, but sparse with Saguaros, trailing into LCV at the edge of Avra Valley. Amazingly dense forests of Jumping cholla (*Cylindropuntia fulgida*) surround parts of this small range. Size and aridity limit the taxa found here to 253 (43%) in 50 families (61%). Only three species, all summer ephemerals, were found here and nowhere else in IFNM: Romero macho (*Pectis linifolia*), Apache Pass spiderling (*Boerhavia pterocarpa*), and Sorrel buckwheat (*Eriogonum polycladon*).

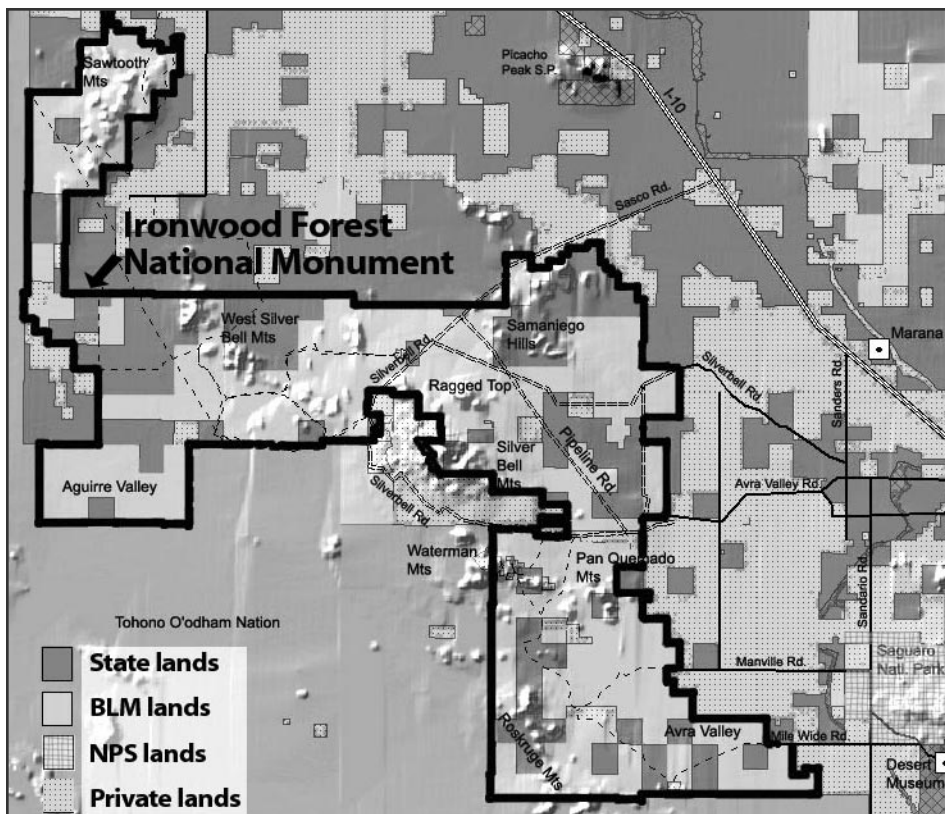
To the west of Pan Quemado are the Waterman Mountains. Although there are only 8,300 acres within the Monument, and

about the same to the west on the Tohono O'odham Nation, the Watermans are nonetheless an imposing, rugged range. Elevations range from 2,200 ft near Pan Quemado to 3,737 ft at Waterman Peak. Rock type is predominately limestone, with some mudstone and mineralized rock types. Limestone is a very xeric substrate, yet 299 taxa (51%) of plants in 60 families (73%) can be found here. In addition to Turk's head cactus, we found 16 species specific to the Watermans, including Elephant tree (*Bursera microphylla*), Flame flower (*Talinum aurantiacum*), Red monkey flower (*Mimulus rubellus*), Yellow trumpet flower (*Tecoma stans* var. *angustata*), Green Violet (*Hybanthus verticillatus*), Desert agave (*Agave deserti*), San Francisco leatherpetal (*Graptopetalum rusbyi*), Crucifixion thorn (*Canotia holacantha*), Turk's head cactus (see above), Hall's Panicgrass (*Panicum halli*), and *Parthenium incanum* (Asteraceae). The last three have definite affinities for calcareous substrates.

To the north, the Silverbell Mountains cover 14,000 acres with as much in private land to west (Wiens, 1991). At 4,195 ft Silverbell Peak is the highest elevation in the Monument. Andesite, with quartzite, limestone, and other mineralized rock types occur here. Although these mountains have mostly AZU vegetation, there is an interesting "jojoba chaparral" dominating northerly slopes at higher elevations. Here, Jojoba (*Simmondsia chinensis*), mixed with Mormon tea (*Ephedra nevadensis*), Catclaw acacia (*Acacia greggii*), and Arizona yucca (*Yucca arizonica*) form dense thickets. We found 306 taxa (52%) in 56 families (68%) in this range. Perhaps because of the lack of dramatic topographical

microhabitats, however, there are only nine unique plants here. These include Wormwood (*Artemisia ludoviciana*), Evening scented stock (*Matthiola longipetalae*), and Soap tree yucca (*Yucca elata*). A rocky area of Cocio Wash on the bajada of the Silverbells used to have permanent water, but unfortunately no longer does. Historic research and photos reveal that as recently as the early 1980s Coyote willow (*Salix exigua*), Cattail (*Typha* sp.), and Bulrush (*Scirpus* sp.) grew here.

Ragged Top lies just northeast of the Silverbell Mountains (Wiens, 2000). It is an extremely rugged peak of 3,907 ft formed of a volcanic neck of rhyolite. A southern bajada of andesite, quartzite hills to east, and large expanses of granite grass to northeast ring the peak. Huge cliffs and steep canyons on all sides create a myriad of microhabitats. Those on the south hold heat in the winter and channel summer rains to support more tropical plants. The north side is shady and stays cooler, giving habitat to grassland and woodland plants.



above The Ironwood Forest National Monument and surrounding lands.



This diversity in substrates and microhabitats becomes apparent in that we have found an incredible 403 taxa (69%) in 68 families (83%) at this small range. Furthermore, 59 plant species occur only here within IFNM. These include those with more tropical affinities such as Garambullo and False grama (mentioned above), Chuparrosa (*Justicia californica*), Indian mallows (*Abutilon abutiloides* and *A. mollicomum*), Plumbago (*Plumbago scandens*), and Wild balsam apple (*Echinopepon wrightii*). Other taxa may be relictual populations from cooler climate times when grassland and woodland plants dominated the area. These include Scrub oak (*Quercus turbinella*), Many-flowered gilia (*Ipomopsis multiflorus*), Brickellbush (*Brickellia californica*), Bullgrass (*Muhlenbergia emersleyi*), *Muhlenbergia monticola*, Goldback fern (*Pentagramma triangularis*), and Betsy (*Stachys coccinea*) (Wiens, 2000).



above Northeast Silverbell Mountains, plot F50, 2002. Courtesy Mark Dimmitt.

The nearby Samaniego Hills receive less precipitation as the LCV and weak AZU vegetation show. An area of less than 8,700 acres, we found only 231 taxa (39%) in 49 families (60%). Only two species were found here and nowhere else in the Monument, and both are exotic weeds: Prostrate pigweed (*Amaranthus graecizans*) and Charlock mustard (*Sinapsis arvensis*).

Northwest of the Silverbell Mountains lie the West Silverbell Mountains. This low 28,100-acre range of mostly volcanic tuff hills also includes the white granite Solo Peak and black basaltic Malpais Hill. Vegetation is weak AZU and LCV, with only 157 taxa (27%) in 41 families (50%). The only species found exclusively here was a spurge, Thymeleaf sandmat (*Euphorbia serpyllifolia*).

The vast Aguirre Valley lies mostly in the Tohono O'odham Nation west of the Waterman and Silverbell Mountains, and reaches into IFNM west of the West Silverbell Mountains. It is a very flat valley, draining north to become the Tat Momoli Valley west of the Sawtooth Mountains. The soil is deep and sandy to heavy clay. Although over 31,000 acres of the Aguirre Valley occur in IFNM, only 138 taxa (24%) in 35 families (43%) were found here. Two species found only here are another species of Crucifixion thorn (*Castela emoryi*) and Emory barrel (*Ferocactus emoryi*), which may find its easternmost range here.

The Sawtooth Mountains are at the north end of IFNM. Like Ragged Top, much of the Sawtooths are a rhyolitic volcanic neck with extrusive flows and an interesting area of stabilized sand dunes on the southwest side. At 16,000 acres, the Sawtooths range from LCV at the lower edges (the lowest point in the Monument is here, at 1,550 ft) to a very depauperate AZU vegetation on the slopes, topping out at 2,630 ft elevation. Greene Wash, a channelized portion of the Santa Cruz River,

cuts through the extreme northeast corner of the Monument here. A preliminary flora of this range published by Kathryn Mauz (1999) listed 208 species in 46 families. We were able to expand that to 313 (53%) in 56 families (68%) during our study. Greene Wash holds several of the 27 plants unique to the Sawtooths, including American speedwell (*Veronica americana*), Buttercup (*Ranunculus* sp.), and Sacred datura (*Datura wrightii*). Also found only in the Sawtooth Mountains are two wolfberrys (*Lycium californicum* and *L. macrodon*), and two tropical grasses, Cupgrass (*Brachiaria fasciculata*) and Bristlegrass (*Setaria leibmannii*).

### A floristic comparison with two nearby sites

Two nearby ranges with similar areas, elevations, and gross vegetation types to IFNM were chosen for comparison. The Tucson Mountains (Rondeau et al., 1996) are about 20 miles to the east of the southern half of IFNM, with rainfall averaging around 11.5 in/year. The Picacho "complex" (Wiens, unpublished) includes the Picacho Mountains, Granite Hills, Picacho Peak, Desert Peak, and the valley separating them, and is around 25 miles southeast of the Sawtooths. Annual rainfall here is around 8.2 in/year. Precipitation in IFNM varies greatly along its length, but averages 10.8 in/year.

In comparing floras, 70.3% of the 660 taxa in the Tucson Mountains and 86.2% of the 443 taxa of the Picacho complex can be found in IFNM. One hundred twenty-one taxa are found in IFNM but not in the Tucson Mountains. Of possible reasons the most likely appear to be water (Greene Wash and the numerous impounded washes) which is associated with 18 of these, and the eastern boundary for the natural ranges of low-desert species, which accounts for 25 species. Taxa in IFNM but

continued next page

## EDUCATION AND OUTREACH COMMITTEE REPORT

# New ways to interact with Arizona plants, people, and computers *by Wendy Hodgson, Education and Outreach Committee Chair*

Plant Atlas Project of Arizona (PAPAZ) continues to be a success, involving over 60 new volunteers who are helping botanists document plants on the Colorado Plateau, from inventorying springs near Marble Canyon and within the Canyon to better documenting plants at Hart Prairie and the Verde Valley. Wouldn't it be great to develop such a successful program for southern Arizona, involving botanists and volunteers from Tucson, Yuma and Bisbee/Sierra Vista? The biologically diverse Ruby/Arivaca area comes to mind since many Tucsonians have visited this area and are making a species list. Wouldn't a species list backed up with solid GPS data and specimens be even more valuable and rewarding? Let's put our heads and talent together and start up this type of program in southern Arizona, too!

SEINet (Southwestern Information Network) continues to be a tremendous asset to anyone interested in natural history collections, particularly plants. Did you know that it has an interactive key to many areas of the state such as the

Hassayampa River Preserve, Sierra Ancha Mountains Wilderness Area, Tumamoc Hill, Upper San Pedro, Organ Pipe Cactus National Monument and even Grand Canyon National Park? There are even keys to plants of numerous counties in New Mexico! With plant in hand and a little beginning botanical knowledge, you can key a plant out using this fun interactive key. Try it, you'll like it! You can also put together your own flora, complete with numerous photo images, of an area you are interested in, such as plants of the Patagonia area. Just type in Patagonia, Arizona, and a list of all collected plants will appear; you can also make a checklist, arranged by family. You can designate an area on a map and retrieve all those plants documented with specimens within your framed area. Want to know where a particular species occurs? Type in the species, check off all of the herbaria listed and you will have locations and collectors of that species (data for rare taxa are masked). SEINet is a wonderful program that everyone should know about and use. Visit [swbiodiversity.org/seinet/index.php](http://swbiodiversity.org/seinet/index.php) and have fun with it!

## A Floristic Look at the Ironwood Forest National Monument *continued*

not found in the Picacho complex number 203. Aridity may play into this, as could the fewer types of rock and substrates at the Picachos. The Picacho complex is also quite isolated from other mountains, which may limit botanical spread. Another likely reason is the limited exploration I have done there, versus IFNM.

It was interesting to look at ephemerals (annuals) in the floras. One would expect that drier areas would have a higher percent of their flora represented by ephemeral species. This appears to be the case, as ephemerals make up 42.3% of the Tucson Mountains flora, 45% at IFNM, and 45.1% of the drier Picachos. When looking at the percentage of annuals which are winter/spring specific ephemerals, the Tucson Mountains (60.9%) and IFNM (60.0%) are similar, and the Picacho complex is much higher (70.0%), showing it to be climatologically or biologically more favorable to cool-weather ephemerals. The opposite is apparent with summer-specific ephemerals, the Tucson Mountains (26.9%) and IFNM (26.8%) show the effects of more summer moisture than the Picacho complex (23.0%).

Succulents at the three sites showed an intriguing variability. The Tucsons have 37 taxa (5.6% of the flora), the Picachos have 23 taxa (5.2%) and IFNM has 47 taxa (8.0%). Looking at

chollas, prickly pears, and club chollas, one sees where the greater number at IFNM comes from. The 12 species and one variety at the Picacho complex, and 12 species, 2 varieties, and 4 hybrids at the Tucson Mountains, are eclipsed by 14 species, 3 varieties, and 11 hybrids found in IFNM. The location of the hybrids shows that most are grouped between the Roskruge and the Waterman Mountains. In this area Cane cholla (*Cylindropuntia spinosior*) and Staghorn cholla (*C. vericolor*) reach their northern limits, and Buckhorn cholla (*C. acanthocarpa*) finds its southern edge. Three other cholla species also occur in this immediate area, adding to the genetic mixing.

Finally, exotic species are a problem in all three floras. Ironwood Forest National Monument has 57 exotic species (9.7% of the total flora), the Tucson Mountains has 92 (13.9%) and the Picacho complex has 49 (11.1%). The proximity of the Tucson Mountains to long-time human habitation may account for the higher number there. Many of the exotics in the Picachos are associated with the CAP canal disturbance on the west and south sides. Most non-natives in the Monument are not environmentally threatening at this point. Only Buffelgrass (*Pennisetum ciliare*), Red brome (*Bromus rubens*), Mediterranean brass (*Schismus barbatus*), and Filaree (*Erodium*

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## CONSERVATION UPDATE

# Invasive Weed Treatments on the Verde River

by Laura P. Moser, Invasive Plant Specialist, Coconino National Forest Photo courtesy Coconino National Forest.

The purpose of this project is to treat small isolated populations of perennial invasive plant species in the riparian vegetation of the Wild and Scenic Areas of the Verde River watershed. The Verde River Comprehensive River Management Plan states "Invasive plant species should be managed so they do not displace or diminish native plant species." The plan called for invasive weed inventory to begin in 2005 and management and monitoring to begin in 2006. The objective is to protect the environment and enhance the natural conditions within the historic range of variability.

Giant reed (*Arundo donax*) and salt cedar (*Tamarix* spp.) were identified as the priority species for treatment in the project area for two reasons. They currently have relatively low presence in the riparian corridor and they have had recent rapid establishment after several flood events. These invasive perennial species have the potential to create large monocultures within riparian areas



that can change the appearance and flow of the Verde River. In comparison to the native species, these invasive species can degrade wildlife and fish habitat and make it difficult for recreationists to enjoy the area.

Coconino, Prescott and Tonto National Forests, with the help from volunteers, Prescott College students, private contractors, and Coconino Rural Environment Corps crews are working on this project. This diverse team has conducted spot treatments of salt cedar and giant reed, nearly eradicating them from 14 miles of National Forest shoreline. We have also treated over 20 localized areas of high density giant reed or salt cedar from Camp Verde to Childs. Treatment of invasive populations in the Verde River Wild and Scenic Area is a high priority in order to preserve the free-flowing characteristic of this river, to enhance watershed protection and scenic values, and to preserve natural conditions for native plants, fish, and wildlife.

*cicutarium*) are widespread. The first two pose the most threat as fuel for desert-destroying fire.



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above *Pachycereus weberi*, Quiotepec, Cuicatlán Valley, Oaxaca.

## The Valley of Tehuacán: Mexico's Cactus Heaven

by David Yetman, PhD.<sup>1</sup> Photos courtesy author.

By any measure the Sonoran Desert is rich in columnar cacti. Within its boundaries, eight species qualify for columnarhood, and a couple of species show pretensions in that direction.<sup>1</sup> The pride we feel in our desert's diversity of columnar cacti must be somewhat muted, however, when we acknowledge that the interlinked valleys of Tehuacán/Cuicatlán in southern Puebla and northern Oaxaca in southern Mexico are home to at least eighteen species of columnars<sup>2</sup> crowded into an area roughly one-fiftieth the size of the Sonoran Desert. The valleys, especially that of the tributary Valley of Zapotitlán, constitute true hotspots of cactus evolution with eighty-one species of cacti identified at present.<sup>3</sup> In addition to the cacti, at least ten agave species, probably more, are also present, along with an array of yuccas and closely related species, including the charismatic and often massive *Beaucarnea gracilis* and *Yucca periculosa*. Some researchers claim that thirty percent of the valleys' 2,700 plant species are endemic, though the more reliable figure is half that, impressive in itself. In addition, archaeologists have discovered vegetative remnants in caves that make the valleys the location of the earliest domestication of corn. The valleys may be the site of the origin of the genus *Neobuxbaumia*, from which the Saguaro is evolved.<sup>4</sup>

These interlinked valleys combine and discharge their meager waters into the wet Papaloapan Basin on the Atlantic coast, exhibiting upstream from their conjunction a profound

combination of habitats and cactus diversity. They comprise the Tehuacán/Cuicatlán Biosphere Reserve, a title bestowed by UNESCO due to their combined biodiversity and high rates of endemism. The Zapotitlán Valley, a side drainage of the Valley of Tehuacán, is especially rich in cacti and succulents.

Yet the presence of such a proliferation of columnar cactus species is not the most striking feature of the valleys. What stands out even more is the *density* of the great cacti, especially *tetechos* (*Neobuxbaumia tetetzo*) that form the great forests called *tetecheras* and the vast numbers of plants of other cactus species as well, including the *chico* ("little one," *Pachycereus weberi*), and three endemics, the *viejito* ("old man," *Cephalocereus columna-trajani*), the *baboso* ("slobberer," *Pachycereus hollianus*) and, in a couple of select places, the *órgano de cabeza roja* ("red-headed organ," *Neobuxbaumia macrocephala*). Vast numbers of *tetechos* crowd gentle slopes near Zapotitlán de Salinas, where the Mexican government has established a botanical garden, and occur on steeper foothills near Calipan, south of Tehuacán. Why the plants, which exceed 39 feet (12 m) in height, should grow in such huge numbers is puzzling and delightful. Equally interesting is the dense assemblage of cacti on at the base of bluffs that rise from the Valley of Tehuacán just east of Coxcatlán in the southern part of the valley. Nearly impenetrable groves of mixed *chicos*, *Stenocereus pruinosus*, and *Myrtillocactus geometrizans* with a few *baboso* thrown in, prosper on the pediments just above the valley floor on the east side of the

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north-south trending valley. As the gradient increases, the groves merge abruptly into nearly pure, impenetrable stands of *tetetzos* and the nurse plant *Mimosa luisana*.

The climate of the valley complex is mostly semi-arid, although in parts rainfall is sufficient to support rich pine-oak forests and robust thornscrub vegetation, with occasional pockets of tropical deciduous forest. For the most part desert scrub predominates. This is especially true in the Valley of Zapotitlán, where the landscape resembles that of the portions of the Sonoran Desert, although with fewer large leguminous trees such as Palo verdes and Ironwood, perhaps a reflection of centuries of firewood gathering and livestock grazing. The variety of habitats has led to high diversity of birds in the biosphere reserve (ca. 375 species) and bats (45 species in the region and environs) as well.

The valleys' staggering biodiversity is attributable in part to its convoluted topography. The canyons associated with Tehuacán and Cuicatlán are twisted in nearly all directions, providing a strange combination of sheltered and exposed slopes, a wide variety of soils, and a host of microclimatic conditions. The Río Salado flows roughly north to south, veering abruptly east at the point where it merges with the Río Grande that flows from the south-to-north Cuicatlán drainage. The cactus-rich Valley of Zapotitlán enters the Tehuacán valley from the west, originating at the continental divide. West of the divide, at the southwestern limit of the Zapotitlán Valley, begins Balsas drainage that empties into the Balsas Depression, home to at least fifty-four species of *Bursera* and perhaps eight endemic columnar cactus species, before reaching the Pacific Ocean.<sup>5</sup>

The Gulf of Mexico and the Pacific Ocean in this part of southern Mexico are only four hundred miles separated and air masses from both affect the climate. The interior valleys are enclosed by mountain ranges that rob the lower valley elevations of moisture, much to the benefit of the cactus and succulent flora, and, we must suspect, to the great satisfaction of nectar- and fruit-eating bats. To the east of the valleys' northern portion, the massive Sierra de Zongólica intercepts moisture from the Gulf and extracts most of it before it can reach the valleys, thus producing a large rain shadow. To the west and south a series of lower ranges wring most of the moisture of Pacific origin that remains after moist air masses pass over the Sierra Madre del Sur of Oaxaca and Guerrero. To the north the Sierra Tecamachalco and the high rim of the Basin of Mexico cut off any moisture that might creep in from the north. As a result, these valleys of tropical position experience meager annual rainfall—between ten and twenty inches (250-500 mm)—somewhat higher in the southern reaches of the Valley of Tehuacán. The moisture is sparse, ideal for the evolution of succulent plants but, in general, barely sufficient to support *milpa* (cornfield) agriculture.

Just how eighteen species of columnar cacti have come to populate the canyons is an intriguing question. The Cuicatlán Valley complex adds but one species (*Pachycereus grandis*) not found in the Tehuacán complex, while the Valley of Tehuacán/

*continued next page*



above *Tetechera* — a grove of *tetetzos* (*Neobuxbaumia tetetzo*), Calipan, Valley of Tehuacán.

<sup>1</sup> The eight Sonoran Desert species are: *Carnegiea gigantea*, *Lophocereus* [*Pachycereus*] *gatesii* (endemic), *Lophocereus* [*Pachycereus*] *schottii*, *Myrtillocactus cochal*, *Pachycereus pecten-aboriginum*, *Pachycereus pringlei* (endemic?), *Stenocereus gummosus* (endemic), and *Stenocereus thurberi*. The pretenders are: *Stenocereus alamosanus* and *Stenocereus littoralis*.

<sup>2</sup> The eighteen Tehuacán/Cuicatlán species are: *Cephalocereus columna-trajani* (endemic), *Escontria chiotilla*, *Isolatocereus dumortieri*, *Mitrocereus fulviceps*, *Myrtillocactus geometrizans*, *Myrtillocactus schenckii*, *Neobuxbaumia macrocephala* (endemic), *Neobuxbaumia mezcalaensis*, *Neobuxbaumia tetetzo*, *Pachycereus grandis*, *Pachycereus hollianus* (endemic), *Pachycereus marginatus*, *Pachycereus weberi*, *Polaskia chende* (endemic), *Polaskia chichiye*, *Pilosocereus chrysacanthus* (endemic?), *Stenocereus pruinosus*, and *Stenocereus stellatus*. Other researchers have listed *Stenocereus beneckii* and *S. griseus* as columnar cacti of the Tehuacán valleys. I have searched for both and found neither. I suspect (for ecological reasons) that *S. griseus* is not present. I still hope to find *S. beneckii* plants large enough to qualify as columnar cacti. They may be mere pretenders. Some publications claim up to thirty-six species of columnar cactus in the valleys, but this number is wildly inflated.

<sup>3</sup> Dávila, Patricia, María del Coro Arizmendi, Alfonso Valiente-Banuet, José Luis Villaseñor, Aljandro Casas, and Rafael Lira 2002. *Biological diversity in the Tehuacán-Cuicatlán Valley*. Biodiversity and Conservation 11: 421-442. Claims of valley endemism are overstated in the article. The authors incorrectly attribute endemism to three cactus genera: *Escontria*, *Mitrocereus*, and *Polaskia*. All three genera extend beyond the valley boundaries, the former two range far beyond the valley limits.

<sup>4</sup> After examining all described species of *Neobuxbaumia* (and two undescribed species), and without possessing any taxonomic credentials whatsoever, I agree with those who endorse referring the two genera to the same genus. Since the genus *Carnegiea* was described prior to the genus *Neobuxbaumia*, however, the former would have precedence.

<sup>5</sup> The apparent Río Balsas endemics include: *Backebergia militaris*, *Neobuxbaumia multiareolata*, *Pachycereus tepamo*, *Stenocereus frizzi*, *Stenocereus chrysocarpa*, *Stenocereus quevedonis*, *Stenocereus zopilotensis*, *Stenocereus* sp. (endemic?).

## The Valley of Tehuacán *continued*

Zapotitlán houses four species not found in the Cuicatlán complex (*órgano de cabeza roja*, *N. mezcalaensis*, *Polaskia chende*, and *P. chichi*). Each of the eighteen species has its own ecological demands, some highly specific, others not so rigid. The distribution maps still demonstrate our lack of plant exploration. Ranges of all species are probably understated. *Mitrocereus fulviceps* was long considered to be a Tehuacán endemic, and was still considered so by researchers as late as 2002. I have photographed robust *M. fulviceps* plants growing 31 mi (50 km) east of Oaxaca City, far beyond the valleys' limits. I've also found *tetechos* in a Pacific-draining valley some 62 mi (100 km) south of Oaxaca, well beyond its range described in some reports. *Viejito* and *baboso* appear to be bona fide endemics, occurring in both valleys.

Two species probably do not venture beyond the boundaries of the Valley of Zapotitlán: *chende* (*Polaskia chende*) and *órgano de cabeza roja*. If they do venture over the continental divide to the west, it is not by much. Their distribution is highly restricted, especially that of *chende*. I suspect that the *chende's* distribution is the narrowest of any North American columnar cactus. The closely related *Polaskia chichi* barely spills over into the Acatlán drainage to the west, which empties into the Balsas Basin. As far as I can tell, in the valley complexes *Pachycereus grandis* is confined to a single grove of massive plants on a hanging garden near Coyula, Oaxaca, far above the Cuicatlán valley floor. However, *P. grandis* also flourishes in the Río Acatlán drainage (Pacific) in Puebla and on steep, arid canyon slopes in the states of Morelos and nearby Guerrero.

The columnar cacti of the valleys are sorted by a variety of factors, including 1) SOILS: *Viejito* appears only on calcareous soils on steep north or northeast-facing hillsides, while *baboso* seems to require deep valley soils; 2) TEMPERATURE: only *Mitrocereus fulviceps* grows into the oak zone at the southern end of the Cuicatlán Valley and is not found near or on the valley floors, while *chico* only frequents the lower portions of the valleys; 3) EVOLUTION: *chende* seems to me so newly evolved from the *Escontria-Polaskia* complex that it has yet to expand beyond the western end of the Valley of Zapotitlán de Salinas; *Organo de cabeza roja* has expanded into a somewhat greater area, but its range is still limited to the western end of the same valley; 4) OTHER, AS YET UNKNOWN VARIABLES: *Myrtillocactus schenckii* appears to be very picky about where it grows; it is absent in most of the valleys, but quite comfortable in select locations, often many kilometers distant from each other. Meanwhile *Escontria chiotilla*, *Myrtillocactus geometrizans*, and *Stenocereus pruinosus* are nearly always on hand. *Pachycereus marginatus* and *Stenocereus stellatus* have been cultivated for fruits and for living fences for many centuries and are ubiquitous here and elsewhere in Puebla and Oaxaca. *Pilosocereus chrysanthus*, with spineless, edible fruits, is nowhere common, but abundant in the valleys and absent or nearly so beyond their limits. The very large *Isolatocereus dumortieri* has only spotty occurrences at very



above *Cephalocereus columna-trajani*. Cuicatlán is in the distance.

limited elevations in the valleys, but is common in the Valley of Acatlán to the west and extends to canyons well north of Mexico City.

In considering the vegetation and flora of the Valleys of Tehuacán/Cuicatlán we must remember that humans have probably lived there in considerable numbers since the end of the last ice age, or roughly 10,000 years, as verified by archeological investigators. Farmers have been raising corn in the valleys for roughly 7,000 years, as indicated by corn remnants. During that time the inhabitants have surely shaped the vegetation, encouraging or even cultivating the plants they found most useful and generally depleting the supplies of firewood. Various herds of livestock (notably cows, goats, and burros) have been gnawing and trampling the countryside for nearly 500 years, another potent factor in considering the distribution of plant species and the valleys' vegetation. We must also keep in mind that most of the columnar cacti in the valleys are of recent arrival, meaning that they have but 10,000 years or so of valley habitation. The newly arrived people of the valley and the relatively newly arrived cacti coexisted for thousands of years. All of the cacti are useful (or very useful) and the inhabitants incorporated them into their lives, just as they do now.

Archaeological studies reveal little about the deep history of valley dwellers. At the time of the Spanish Conquest in 1521, most of the inhabitants of the Valley of Zapotitlán were Popolocans, while those of the La Cañada (the Cuicatlán Valleys) were Cuicatecos. Both groups speak related languages now classified in the Oto-Manguean family. The Valley of Tehuacán had already been colonized by Aztecs (the name Zapotitlán is Nahuatl or Aztec), who speak a Uto-Aztecan language and were relative newcomers to the region, arriving some time in the fifteenth century. The salt springs near Texcala in Zapotitlán Valley were the only source of salt for nearly two hundred kilometers around and considerable sparring over control of the springs took place over the centuries. Aztecs ultimately wrested control from the Popolocans. Zapotecans from Oaxaca had conquered the Cuicatecos long before the region fell to the

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# Arizona Plants in California

by Sarah J. De Groot<sup>1</sup> Photos courtesy author.

“There are also some notable floristic differences between the eastern and western edges of the area” [the Sonoran Desert]. — Forest Shreve, 1964, *Vegetation of the Sonoran Desert*, p. 50.

The Whipple Mountains are located at the easternmost point of California, northwest of Parker, and southwest of Lake Havasu. The climate of the area is hot and dry, receiving on average only 119.5 mm (4.70 in.) of precipitation annually. Temperature ranges from a winter low of 5° C (41° F) to a summer high of 42° C (108° F). The core of the mountains is composed of Precambrian metamorphic rock, along with some tertiary volcanic intrusions (Figure 1). The plains around the mountains are of mixed alluvium, with numerous areas of desert pavement.

Plant communities within the mountains are typical of the Lower Colorado Valley. The dominant community is Creosote Bush Scrub. In addition, some plants grow directly on rocks, forming xerophytic communities. Desert washes support distinct vegetation types and many seasonal annuals (Figure 2). On the east side of the mountains, one can find foothill paloverde-saguaro communities, as well as some small sand dunes and areas of alkali sink (Figure 3). At the edge of the Colorado River and near Gene and Copper Basin Reservoirs, riparian plant communities may be found.



Figure 1 Volcanic bluffs in the upper part of the Whipple Wash drainage.

The study area for the Flora was defined along the Colorado River on the east and south, Highway 95 on the west, and Chemehuevi Wash on the north, for a total area of about 129,500 hectares (500 square miles). Using herbarium specimens and plants collected in the area during field trips (Figure 4), 385 different kinds of plants were documented. About 189 of these were annuals, of which 163 (86.2%) germinate in the winter, and 14 (7.4%) germinate following summer rainfall (De Groot 2007).

While many plants are found in both the east and west sides of the Lower Colorado Valley region of the Sonoran Desert, i.e., on both sides of the Colorado River, there are some notable exceptions. For example, the Saguaro (*Carnegiea gigantea*) is very common in Arizona, but is found at only a handful of

<sup>1</sup> Graduate Student, Rancho Santa Ana Botanic Garden and Claremont Graduate University

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## The Valley of Tehuacán *continued*

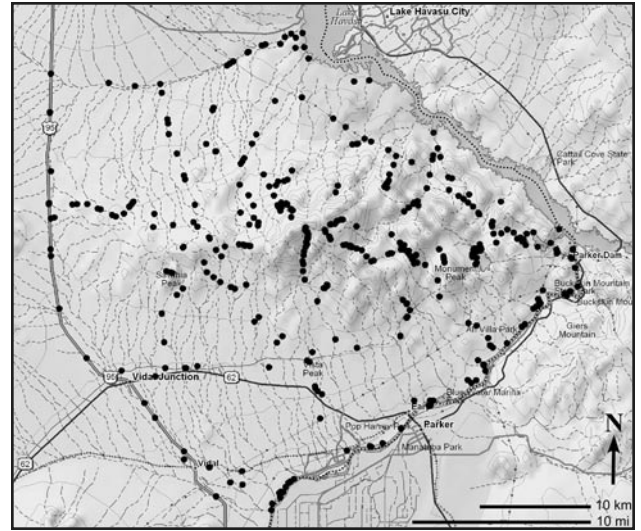
Aztecs. Aztecs settled in the Tehuacán Valley in the early fifteenth century as part of a military colonization scheme to maintain conquered peoples in a state of submission, and soon conquered Cuicatlán as well. The Aztecs acted as a wedge, splitting the existing Oto–Manguenan speakers. The division remains today. Aztec domination in the fourteenth and fifteenth century meant the peoples of the valleys would have been obliged to pay a heavy burden of tribute in the form of precious metals, salt, grain, tropical fruits (especially in the Cuicatlán Valley), and parrot feathers. The Valley of Mexico is somewhat too high for production of columnar cactus fruits, so in all probability these were rushed to the capital along with other goods. These dual requirements—subsistence and trade/tribute—undoubtedly played a powerful role in shaping the valleys’ vegetation. Corn horticulture requires frequent rotation of *milpas* (corn/bean/squash fields) and expanding populations would need to clear ever-increasing acreages to plant.

The valleys today reveal the ancient conquests and the dry, rather eroded hills reflect centuries of exploitation. The people Valley of

Zapotitlán are still mostly of Popoloca extraction and some native speakers remain, especially in and around the town of Reyes Metzontla, which also happens to be a cactus hotspot. Several small towns in the Valley of Tehuacán remain Nahuatl, with many native speakers visiting the city’s central market. The Valley of Cuicatlán, a major producer of tropical fruits, is now mostly Spanish-speaking. The once powerful Cuicatecos have long since been displaced, largely confined to impoverished villages perched on hillsides high above the valley floor. Zapotecs who conquered them a millennium ago retreated south to their ancestral home in the central valleys of Oaxaca during the Aztec conquest.

How these ancient peoples may have shaped the cactus vegetation of the Tehuacán/Cuicatlán valleys is largely conjecture, but with additional research and a focus on traditional uses and knowledge of these plants and corresponding genetic studies, some questions about the remarkable proliferation of the great cacti can be at least partially answered.





## Arizona Plants in California *continued*

locations at the eastern-most tips of California. Why is it not found west of the Colorado River?

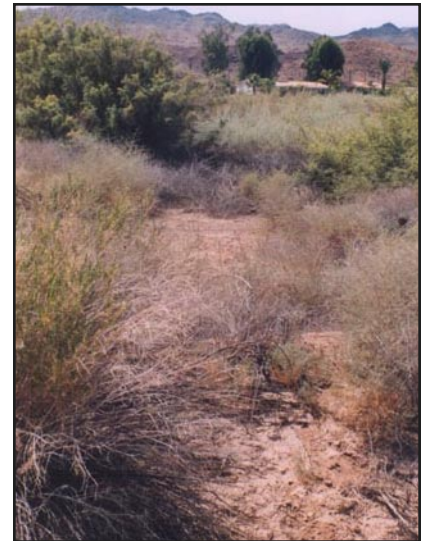
An examination of precipitation patterns in southern California and Arizona shows that summer precipitation increases to the southeast and decreases to the northwest. For example, Tucson receives about 59% of its annual precipitation during summer months, while Indio receives only 25%. Parker, on average, receives about one-third of its annual rainfall during the summer. However, summer rainfall is notoriously variable and spotty. In Indio, there are some years where no rainfall is received during the summer. In Parker, by contrast, most summers will have at least some rainfall.

This means that plants which are dependent on summer rainfall can survive in the Whipple Mountains, although the mountains lie at the western limit of these plants' ranges. These plants include the Saguaro, Small-flowered androstephium (*Androstephium breviflorum*), Red grama (*Bouteloua trifida*), Crucifixion-thorn (*Castela emoryi*), Glandular ditaxis (*Ditaxis clariana*), Spearleaf (*Matelea parviflora*), Arizona pholistoma (*Pholistoma auritum* var. *arizonicum*), Narrow-leaved psorothamnus (*Psorothamnus fremontii* var. *attenuatus*), Coues' senna (*Senna covesii*), and Sticky germander (*Teucrium glandulosum*). The presence of these plants, along with plants more often restricted to the Mojave Desert (which is found just north of the Whipple Mountains), and common plants found in all areas of the Sonoran Desert, create a unique flora since the Whipple Mountains area is more or less the only place where all of these plants have the potential to co-occur.

In addition to supporting these fairly common Arizona plants at the western edges of their ranges, the Whipple Mountains are home to several species that are rare in Arizona. Both Spiny Senna (*Senna armata*) and California Fan Palm (*Washingtonia filifera*) are frequently encountered in southern California deserts, and are somewhat common in the Whipple Mountains, but occur in few places in Arizona. Also rare in Arizona is the Whipple Yucca (*Hesperoyucca whipplei*), which no longer occurs in the Whipple Mountains but was present about 9,000 years

ago, based on packrat midden fossils (see Van Devender 1990).

The most exciting part of any scientific study is discovering and documenting new things. During this study, three species were discovered in the Whipple Mountains that previously had not been reported in California. A new site of Kofa Mountain barberry (*Berberis harrisoniana*) was verified and reported (Anderson and De Groot 2004). Also, Barestem larkspur (*Delphinium scaposum*) and Wand fleabane (*Erigeron oxyphyllus*) were documented for the first time as a result of this study (De Groot 2005). Who knows what other exciting discoveries await adventurous botanists willing to explore other mountains around the southwest?



**from top left** Figure 2. Bowman's Wash. Figure 4. Map of the Whipple Mountains area, with locations of plant collections marked as black dots. Figure 3. Alkali sink area next to the Colorado River.



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# Legumes of Arizona — An Illustrated Flora and Reference

by Mark Bierner, former AZNPS Director

*Legumes of Arizona — An Illustrated Flora and Reference* is a collaborative effort. It is organized and coordinated by a Steering Committee that includes botanical experts from three of Arizona's premier institutions: University of Arizona, Arizona State University, and Boyce Thompson Arboretum. In addition, the Steering Committee includes a renowned botanical illustrator, and the Committee has enlisted the aid of authorities on family Fabaceae from throughout the world.

Major challenges being addressed by the *Legumes of Arizona* initiative are:

- ❖ A lack of knowledge about one of the most important plant families in the world
- ❖ Challenges of arid lands agriculture
- ❖ Malnutrition in the human population
- ❖ The search for new drugs and other useful plant products

Problems associated with arid lands habitation, arid lands agriculture, and human nutrition are increasing at an alarming rate. Arid and semi-arid lands account for approximately 50% of the Earth's terrestrial surface, and these areas contain a disproportionate share of the malnourished segment of the world's human population.

In these areas, several thousand arid-land-adapted legumes have evolved over millions of years. These plants are, for the most part, little studied and little understood despite the fact that the legume family is one of the most economically and agriculturally important plant families in the world. It is the third largest family of flowering plants, and it is second only to the grass family (cereals, grains, etc.) in importance to humans. From protein-rich food plants such as peanuts, soy beans, lentils, peas, and beans, to forage plants such as medics and clovers, to medicinal/herbal plants such as sennas and vetches, to ornamental plants such as redbuds and wisterias, to poisonous plants such as locoweeds and crazyweeds, to the many species that host nitrogen-fixing bacteria in their roots, the legume family impacts almost every aspect of human existence.

The immediate goal of the *Legumes of Arizona* initiative is to produce and publish, both as a hard copy volume and an online database, Arizona's native, naturalized, and cultivated legume species. The Steering Committee views *Legumes of Arizona* as only a first step in a more expansive, very long-term effort to document legume species and their known/potential uses. Next might be *Legumes of the Desert Southwest*, then *Legumes of Arid Regions of the New World*, and eventually *Legumes of the World*. On a global scale, even the information that will be in *Legumes of Arizona* will be applicable anywhere in the world that has relatively similar environmental conditions. For example, a

legume crop that can be grown in southern Arizona could also be grown in various parts of Mexico, South America, Africa, Australia, Asia, etc.

Many legume species are native to arid lands, making them ideal for the agricultural industry of the water-challenged southwestern United States and other arid areas of the world. With a comprehensive reference and database available, it will be possible to make more informed decisions about which legume species have significant potential for arid lands use and production.

*Legumes of Arizona — An Illustrated Flora and Reference* will serve the needs of many groups including, but not limited to, farmers, horticulturists, landscapers, homeowners, botanists, herbalists, pharmacognosists, nutritionists, and a wide variety of plant researchers. As we search for new food crops, native plants for the horticulture industry, medicinally useful plants, plant oils and fibers, and even new technologies for fixing atmospheric nitrogen, this legume treatment will be an invaluable resource in the search for legume plants useful to society.

NOTE: This article includes passages written by Bill Feldman, former Director of Boyce Thompson Arboretum.



above *Clitoria mariana*.  
Courtesy Chris Kline

## Wildflower Posters in the classrooms!

We need help from members to get our wildlife posters, both the **Northern Wildflowers** and the **Desert Wildflower** posters, into our kid's classrooms where they can be used in lesson plans or just to stimulate interest in our native flora. These are going FREE to classrooms all over the state, but we need your help to facilitate getting them into schools and doing follow-up with teachers who may be interested in focusing on native plants. Many schools are starting small native plant gardens (very exciting) or doing extra plantings to enhance school grounds, or building food gardens. These are important activities for us all to be involved in. Parents and grandparents can help!

Send us a teacher's contact information, school name and address, along with classroom (so the posters get directly to him/her), and if you include your name and email or phone contact, we can add that to the letter that we send out with the posters for follow-up on helping at the school. Send to Nancy Zierenberg: nzberg4@cox.net

We so appreciate your help with this effort! Thank you!

# ASOCIACIÓN PARA LAS PLANTAS NATIVAS DE SONORA, A.C. (APNSAC): Spreading Knowledge and Appreciation of Plants

by José Jesús Sánchez Escalante<sup>1</sup>; Translated by Ana Lilia Reina-Guerrero, Director, AZNPS.

Before Europeans arrived in northwestern Mexico, the indigenous people of Sonora knew only native plants. The Spaniards who came to Mexico during the colonization period of northwestern Mexico brought European as well as tropical plants from the south. This enthusiasm for exotic non-native plants still prevails in our region. Thus in many cities in Sonora we find big trees like *yucatecos* (*Ficus nitida*) and *benjamins* (*Ficus benjamina*) or gigantic *ceibas* (*Ceiba pentandra*) that not only use large amounts of water, but also cause serious damage to sewage and water pipes, public buildings and private house foundations and walls.

Cities with desert climates, like Phoenix and Tucson in the neighboring state of Arizona, are fifty years ahead of us in the use of desert gardens. Also these cities have legislation to save water by landscaping with low-water-use plants. Thus in these gardens we see native plants like Foothill paloverde (*Parkinsonia microphylla*), Palo brea (*P. praecox*), Blue paloverde (*P. florida*), Ironwood (*Olneya tesota*), Mesquite (*Prosopis* spp.), agaves (*Agave* spp.), several species of cacti, as well as shrubs like *Vari prieta* (*Cordia parvifolia*), and a long list of seasonal herbs natives to Sonora.

Like other cities in Sonora, Hermosillo is beginning to switch to low-water-use plants. Some public areas are reforested with trees like Mesquite, Palo brea, Ironwood, and Feather tree (*Lysiloma watsonii*) among others. Unfortunately the mesquites most commonly planted are South American species (*Prosopis alba*, *P. chilensis*) and most of them have been planted without appropriate landscape designs. Because we live in a region almost without frost, Sonoran cities have a huge potential to create desert gardens more attractive than the ones in Arizona using a wide variety of Sonoran Desert plants, especially those with tropical origins like *torotes* (*Bursera* spp.) and *guayacán* (*Guaiaacum coulteri*).

In Sonora, there is a lack of regional identity with Sonoran native plants. For this reason it is necessary that the public be educated about the plants that grow naturally in their region (trees, shrubs, cacti, agaves, and seasonal annuals) that can be used in desert gardens. From an economic point of view, a boom in desert gardening would cause a public demand for native plants, opening a market opportunity for nursery production of these species.

Even with all the benefits from planting desert gardens, the public holds an enormous resistance to abandon their habit of gardening with exotic plants. This is in part a cultural heritage

that values tropical ornamentals and fruit trees, as well as an ignorance about and a low availability of native plants in the local nurseries. Thus, an important issue to consider is establishing botanical gardens with demonstration areas to educate the public about native plants and their use in residential gardens. Another big plus of planting a botanical garden is that it works both as a conservation area for native plants and for public education.

There is a regulatory need to use native plants in public and private gardens by the federal, state, and municipal governments. It is also clear that with these obligations, there also should be some incentives for the users, e.g., lower water use fees for people choosing desert gardens.

The above actions would increase the demand for native species, so the lack of availability needs to be addressed at the same time by promoting the establishment of native plant nurseries. The environmental government agencies like SEMARNAT should ease restrictions and simplify permits to help business or nursery owners commercially produce native plants. We should not forget this also represents a strategy for conservation of many species whose habitats currently are threatened.

Prior to 2006, the availability of information in Spanish on Sonoran native plants was very limited. With the exception of few books on medicinal plants and a catalog of grasses published by the *Secretaría de Agricultura y Recursos Hidráulicos* (SARH) in 1991, there are currently not many books in Spanish with information on Sonoran native plants. But for more than eleven years and through the USON Herbarium, the *Universidad de Sonora* has compiled a great amount of information about the wild plants of the State of Sonora. Specimens of ca. 2,500 species are vouchered and filed in the herbarium collection. The collection is for public use and can be consulted for a variety of information on the labels of native plants. Also, there is a catalog with information on 487 wild plants of Sonora on CD available at a low price in the USON Herbarium: [herbario.uson.mx](http://herbario.uson.mx).

The responsibility to educate is not only for the government or educational institutions, but also for citizens. Thus in August 2004, the *Asociación para las Plantas Nativas de Sonora, A.C.* (APNSAC) was founded as a non-profit organization with the mission of sharing knowledge, appreciation, and interest for conservation of the native plants of Sonora, Mexico.

Since it started, APNSAC members have carried out several activities to accomplish its mission and objectives. One of the

*continued next page*

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## Tribal Floras

by Jessa Fisher, Flagstaff Chapter member  
nightbloomingcactus@yahoo.com

There are twenty-one federally recognized Native American tribes who reside currently in the state of Arizona. Tribal reservation land in Arizona is a stunning 31,656 square miles. Arizona is the state in the lower 48 with the most reservation land. Tribes in Arizona then are caretakers for many plants and ecosystems spread throughout the state.

As Dr. Amadeo Rea explained in his 2006 Arizona Botany Meeting presentation, tribes might have a different way of looking at and categorizing their plants than scientific institutions do. *Emic* and *Etic* are two anthropological terms used to describe different perspectives on a situation. *Emic*, Amadeo described, is the “insiders, or people’s view” and *etic* is how outsiders look into a culture. For example, to the traditional Navajo, plants are equal to humans, as they are our brothers and sisters. Navajo Medicine Men will sing and pray to a plant and ask permission to pick a plant as a courtesy and a reciprocation and offering of thanks to the plant “people.” This *emic* view is so intricately intertwined with spirit and unseen forces, which the *etic* view does not always have the understanding or perspective to see.

Since tribes have such intimate relationships with the plants, a tribal flora is often done as an ethnobotanical assessment, focusing only on the plants that were used by the tribe in the traditional tribal boundary, which is often much larger than the current reservation boundary for a tribe. This contrasts to the more scientific idea of a modern flora, which focuses on identifying and cataloguing every plant species within a certain geographic area or political boundary. Both types of floras

main activities is field trips, where the participants learn about native plants in their natural environments, and identify non-native and invasive species. Members also record and take photographs of seasonal flowers to have a different vision of our regional landscapes, while at the same time acquiring or reinforcing a identity with their natural surroundings. All this is part of the basic rule: *We can not appreciate what we do not know.*

Other important activities are regular meetings and conferences, seminars, and training courses on regional native plants. These presentations and training sessions are either by APNSAC members or external specialists supporting the group.

To publicize its activities, the APNSAC has an online forum [www.apnsac.org](http://www.apnsac.org) where anyone can express their opinions or publish articles on native plants and their conservation. This forum also helps to send invitations and messages for members and the general public.



above *Mirabilis multiflora*, Colorado four o'clock, an important member of both the Hopi and Navajo ethnobotanical floras. Courtesy Jim Thomas.

involve collection of voucher specimens, which are kept in herbaria.

There are several examples of both types of flora collecting involving tribes in Arizona. In 1939 Alfred Whiting published the *Ethnobotany of the Hopi* through the Museum of Northern Arizona. It is a brilliant ethnobotanical work, but the flora of Hopi does need to be updated. *Nanise*, by Vernon Mayes and Barbara Lacy, is a detailed, although incomplete, ethnobotany of the Navajo, while the *Navajoland Plant Catalog*, a more complete flora, was done by Mayes and Dr. James Rominger in 1994. Also, two theses at Northern Arizona University are of interest. In 2006, Kristin Kampe finished her thesis on the “Medicinal Flora of the San Francisco Peaks,” addressing the plants used traditionally by tribes who view this area as a sacred collecting ground. In 1986 William Waddell presented his thesis, “Ethnobotany of the Northeastern Yavapai.” There are many other partial and complete tribal floras and ethnobotanical works out there for other Arizona tribes, and much room for more work in this important area of flora assessments.

For several years, the USON Herbarium and the APNSAC have jointly offered a workshop on Sonoran native plants to students from different programs in the *Universidad de Sonora*, which brings them to APNSAC activities. In 2008 participating students in this workshop founded the *Comité Juvenil de la APNSAC* (youth group), with activities accessed on their website *Búhos y Sahuaros: [estudiantes.apnsac.org](http://estudiantes.apnsac.org)*

Currently APNSAC has about 20 members, although this number has varied during the last four years. Today our interest is not that APNSAC grow in number of members, but that each of them participates more. We need people with great love to learn about native plants who have a willingness to commit to passing on this acquired knowledge and enthusiasm to the children and youth of Sonora. The successful future of the APNSAC depends on the adults and young people joining our group with true convictions and enthusiasm to love the wild plants of our state and their natural surroundings.



# Who's Who at AZNPS

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### Would you like to take a more active role in protecting Arizona's native plants?

There are open Board positions — please contact any of the above board members for more information on how you can get involved. You can also contact your local chapter (see back cover) for local volunteer opportunities.

## BOOK REVIEW

### Field Identification Cards for Invasive Non-Native Plant Species Known to Threaten Arizona Wildlands

by C. Douglas Green, *Phoenix Chapter President*

This relatively new release, published in October 2008 by the Sonoran Institute of Tucson, was also sponsored by the Arizona Native Plant Society, National Park Service, the Sonoran Desert Network, and the Colorado Plateau of Cooperative Ecosystem Studies Unit (CPCESU).

*Field Identification Cards for Invasive Non-Native Plant Species Known to Threaten Arizona Wildlands* is a well designed packet of data cards on 74 invasive, non-native plants. The cards are sizeable — 5 ½ inches wide x 8 ½ inches long — and are individually wrapped and sealed in a durable and flexible laminate cover. This allows them to be used outdoors as well as indoors. The cards are hole-punched in the upper left corner and the entire set is kept intact by a stainless steel ring which can be opened to add or remove cards for easy changes and updates — certainly a key feature of this packet. I find that a well-used rubber band comes in handy to keep the pages tidy and compact when not in use. These design features enable one to use the data cards come rain or shine (i.e., “in the field”) as well as at home, in the office, or lab.

Each species card is double-sided. On the front is the scientific, family and common names, and taxonomic code. The life form of the species is shown symbolically (tree, shrub, grass, aquatic, etc.), an “Impact Risk Level” coding shows how severe the impact the given species has upon the ecosystem, and a colored accent indicates the flower color for the plant. There is text identifying the key characteristics of the species with an emphasis on the following: growth, flowers, bracts, stems, leaves, fruits, seeds, and any other notes of interest. Photographs (mostly color) and some drawings illustrate the plant's inflorescences, leaves, and any other key features that need to be spotlighted. One can readily identify the invasive in question by comparing a field specimen to the images — after all, proper identification of an invasive is key!

The back of each species card indicates the elevation, eco-types invaded (i.e., dunes, scrub lands, riparian, forests, fresh water, grasslands, etc.), ecology and distribution information, suitable habitat (based on the Arizona Wildlands Invasive Plant Working Group study), a color-coded map of Arizona counties showing the extent of the invasion, and any additional colored photos. If available, there is information regarding treatment of similar invasives or look-alike native species so that there is no mistaking a native species for a non-native invasive. And finally, when applicable, a fire symbol is shown if a species provides the fuel necessary for ground fires.

The last few pages of the packet contain a short glossary of terms and descriptive and informative illustrations of principal flora parts.

All in all, this is a very excellent teaching and informational aid to those of us who are interested in invasive weeds or non-native plants. Although there was a separate listing/index of plants in this package, I think that this feature should have been made into its own protective, transparent page.

This packet can be purchased for approximately \$25 in Tucson (Sonoran Institute, 7650 E. Broadway Blvd, Ste. 203, 85710, 520.290.0828), in Phoenix (Sonoran Institute, 11010 N. Tatum Blvd., 85028, 602.393.4310), or via [www.sonoraninstitute.org](http://www.sonoraninstitute.org). I highly recommend the purchase!



# New Women's Violet tee shirts in the datura design!



These 100% cotton (not pre-shrunk) tees are more fitted for women, have a scoop neck and shorter sleeves than the standard datura tees. They are a lovely violet color, between a light lavender and the deep purple.

Price is \$16 each for members, \$18 for non-members, plus postage. \$3 for the first shirt and add \$1 per shirt sent to the same address.

## We are officially part of Basha's "Shop & Give" program!

When you shop at any Basha's, AJ's or Food City, a percentage of your purchase will come back to support your favorite Native Plant Society!

**It's simple:** At the cash register, tell them to attribute your purchase to **AZNPS #25053**. This is a super easy and effective way to help AZNPS bring in extra cash for our important efforts!

Thank you... and thank you Basha's!

## Clearance Sale on our landscaping booklets!

Originally created by the AZNPS Urban Education Committee, these booklets flew off the shelves due to the excitement over new xeric plant offerings (though some were not native to this country... the text in the booklets notes that), and due to the very low price we set to appeal to newcomers in our region. The booklets have done a great service to AZNPS over the years, keeping us flush with money to fund our educational projects through the years. We are grateful to the professional growers, landscapers and other committee members who developed these useful tools.

There is good growing information in these booklets and we are urging you to utilize that for formulating your own landscape plans and adding to them. We also urge that you consider growing our Arizona Natives instead of some of the suggestions in these booklets to use non-natives. Our plan is to keep plugging on production of several good native plant lists that we will eventually put onto our website to help people with landscape planning. If you have good photos of natives in habit that you would like to share for our educational purposes, please email those in reasonable quality to: [nzberg4@cox.net](mailto:nzberg4@cox.net)

All booklets are now available for retail sale at \$2 each. Wholesalers can order quantities of 50 or more at \$1 each, in any combination. We pay the postage! The following booklets are still in print: *Sonoran Desert Trees*, *Desert Shrubs*, *Desert Grasses*, *Butterfly Gardening*, and *Bird Gardening*.



## Upcoming Issue:

### Arizona's Hidden Botanical Treasures

Contact *The Plant Press* Technical Editor, Barbara Phillips, at [bgphillips@fs.fed.us](mailto:bgphillips@fs.fed.us) for more information on contributing articles, illustrations, photos, or book reviews on this topic... as well as themes you'd like to see us cover in future issues.



The Arizona  
Native Plant  
Society

*The Plant Press* is a benefit of membership in the Arizona Native Plant Society.

Suggestions are welcome for book reviews, and articles on plant use, conservation, habitats, and invasive species.



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## **New Members Welcome!**

People interested in native plants are encouraged to become members. People may join chapters in either Phoenix, Flagstaff, Prescott, Tucson, Yuma, or may choose not to be active at a chapter level and simply support the statewide organization. For more information, please write to AZNPS at the address below, visit the AZNPS website at **[www.aznps.com](http://www.aznps.com)** (temporary), or contact one of the people below.

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Flagstaff Chapter:  
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### **Membership Form**

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Chapter preferred:  State only  Flagstaff  Phoenix  
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Enclosed:  \$15 Senior (65+)  \$75 Sponsor  
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