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FIRES IN ARIZONA'S GRASSLANDS

Jon Titus

Like in 2002, this spring and summer have been big fire seasons for Arizona. All summer long, we watched as wildfires swept through Arizona until the monsoon rains put them out. In previous issues of The Plant Press, I have written about fire in Arizona's ponderosa pine forests, pinyon-pine-juniper woodlands, oak woodlands, and chaparral – all of these vegetation types burned this year. In this issue, I will summarize historic and current ecological patterns in Arizona's grasslands focusing on fire and grazing.

Arizona's beautiful grasslands are naturally quite flammable. These plant associations are dominated by summer perennial species that persist more than one year, such as grasses and forbs that grow, flower, then seed in response to summer monsoon rains.

Before the arrival of the Spanish, these grasslands burned frequently during early summer (May through early July) as a result of lightning strikes.

When rainfall is adequate, grasses sprout and grow rapidly within days after fire. Wintertime fires (December through March) were planned and set by Native American communities to attract game to the fresh sweet grass that sprouts from the roots following a fire. Their fires probably expanded grasslands into areas that were otherwise dominated by oak, mesquite woodlands, or the chaparral of California. These were typically cool fires, often just 400° F at the ground surface.

When the Spaniards first arrived in the Southwest, the grass tickled the tummies of their Spanish barb horses. Before Spanish colonization, these impressive grasslands were lightly grazed by light browsers such as antelope and deer. Large grazing mammals disappeared 12 thousand years before, coincident with the time settlers from Asia are supposed to have arrived. These grasslands were the products of ten thousand years of accumulated primary production. At first, the Spaniards and Mexicans were never able to build up huge herds of cattle because of frequent Apache raids. With the near-extermination of the Apache, cattle poured into Arizona by the millions - the cattle population in Arizona peaked in the 1890's at more than 1.5 million (Sheridan 1995). When a severe drought hit in the 1890's, the cows ate absolutely all grazing material and died of starvation in huge numbers! In just 20 years, 10,000 years of produc- ***cont'd. on page 5***

More Inside

PRESIDENT'S MESSAGE

Ken Morrow

"The Big Picture" was the theme for this year's annual meeting and retreat. What is the Big Picture? Although this year's gathering was held near the town of Oracle, there was no oracle to impart truth and clarity to the answer. The meaning of life may have to wait until next year's annual meeting.

This particular "Big Picture" is framed with Arizona's native plants. To envision the meaning of the Big Picture, we must begin with the Small Picture or many Small Pictures. Let's imagine a hardy band of ANPS members on a Catalina Mountain field trip. They're ambling along the trail, stopping every few yards to observe one particular plant or another. Someone calls attention to a group of *Tagetes lemmonii*, or Mt. Lemmon Marigold, beside the trail. It's early fall, so it's surprising that the plants are in full bloom. These woody perennials bloom again in the spring; sensitivity to day length may explain the phenomenon of spring and fall blooming. Several species of butterflies flutter about, visiting the open flowers. We pick and crush a few leaves to experience that unforgettable scent of marigolds. Then the group shuffles on to the next plant species - end of story.

But wait a minute – we need to raise other questions if we're going to expand the scope of this Picture. How has the marigold population in this area been holding up over the last 100 years? Are the numbers rising, falling, or remaining largely static, and why? And what about other plants found growing in conjunction with them? Are their populations maintaining themselves, or are recent changes in weather patterns having a negative effect?

Extending our range of observation over to yonder ridge, we see that this summer's fire season has been especially tough on the plant life there. Blackened remnants and bare dirt seems to be what remains. Not seen, but present nevertheless, are the soil seed bank and still-living root systems of tough perennials, like oaks and bear grass, that will determine the specific make-up of the next generation. Competition will be stiff between these native plants and exotics because this environment will encourage invasion of non-natives. Things may never be the same on that ridge for a long while, if ever.

Visually following the ridgeline downhill, we see the fresh scars from bulldozers creating streets and home sites for the latest development crowding against the forest boundary. This Big Picture is fraught with perils – habitat loss, pressure from exotics, and even climate change. It's tempting to return to gazing at marigolds. But we're the Arizona Native Plant Society! If we don't speak up and take action in defense of our native flora, who will?

The Big Picture requires that we take an active role in our communities through education and outreach, participate in conservation efforts, both directly and through affiliation with other groups who share similar goals. We've made some progress in these areas, of course, but need to do more as ombudsmen for native plants. The Society appreciates your interest and support, and encourages members to volunteer at the chapter or state level to work on those issues. And don't worry - there'll always be time to look at the marigolds!

SPRING 2003 MEMBERSHIP SURVEY:
Summary of Results

Joanne Basta

Who are the members of ANPS? How do mem-bers participate? Are members satisfied with the activities and products of ANPS? Does ANPS need to change its mission statement to more fully focus on Arizona native plants? In what direction should ANPS be going? The Spring 2003 Membership Survey was designed to answer these questions.

The last membership survey was conducted in 1998. The Board of Directors decided to re-survey the membership. Assisting us were six graduate students from the Public Administration Graduate Program of the University of Arizona. They chose ANPS as their program evaluation project out of a number of other options to study non-profit organizations. The students worked with us to develop the survey questions, compiled data, and submitted a comprehensive report of the survey results to the ANPS Board of Directors in May 2003. The following is a summary of these results that provide valuable information to help the ANPS Board make important decisions about our organization's direction.

Method and Limitations

In March 2003, the survey was mailed to all members who had an Arizona address, a total of 467 in-state memberships. Out of this number, 211 surveys were returned, yielding a 45% return rate. The chapter region breakdown of the members who returned the survey was compared to the proportional breakdown of the total in-state membership. The following table shows that the Southern Region was slightly over-represented in the returned surveys, and the Central and Northern Regions were slightly under-represented. This should be taken into account when interpreting the results. Another limitation was that only one survey was mailed to a household that may have had more than one member.

In-state Members Who Returned the Survey Compared to Total In-state Members

	Percentage Who Returned Survey	Actual Percentage of Memberships
Southern Region	69%	60%
Central Region	18%	22%
Northern Region	13%	17%

Who are ANPS Members?

The background of our members is necessary to create desirable activities and programs and to better understand who is attracted to an organization like ANPS. Current ANPS membership tends to be older, well-educated, and female. The mean age of the respondents was 56, with an age range from 23 to 92 years old. Sixty-one percent are female, 57% are working or a student, and 43% are retired. Nearly 50% of the respondents have a graduate degree, 35% have bachelor degrees, 8.7% have associate degrees, with the remaining percentage having high school degrees or equivalent. Eighty-three percent have Internet access and 81% use their e-mail regularly. A majority of the respondents have been members for at least four years or more.

What is Membership Participation in and Satisfaction with ANPS Activities?

The most frequently endorsed activities of participating members are: chapter meetings (35%); volunteering in various activities (36%); and the Annual Meeting (29%). Members who participated in activities said that they were satisfied with them. High satisfaction ratings (about 90%) were given to the field trips and chapter meetings. Lower satisfaction levels (around 60%) were given to conservation activities and workshops. Overall, 70% are satisfied with ANPS activities. Only 5% are dissatisfied, and 25% are neutral or undecided. In addition to member satisfaction, 87% of the respondents agreed that ANPS has increased their knowledge and appreciation of native plants, and 60% agreed that, because of ANPS, they now landscape more with native plants.

How Frequently Do Members Use ANPS Communications?

Nearly all (99%) of the survey respondents said they read The Plant Press, and over 80% find The Plant Press content interesting and easy to understand. The ANPS website has lower usage, with 37% of respondents saying they have used it. Of those who have accessed the website, 72% found its contents useful.

Has the Membership Purchased ANPS Products?

ANPS has increased the types

cont'd. on page 4

Survey (cont'd. from page 3)

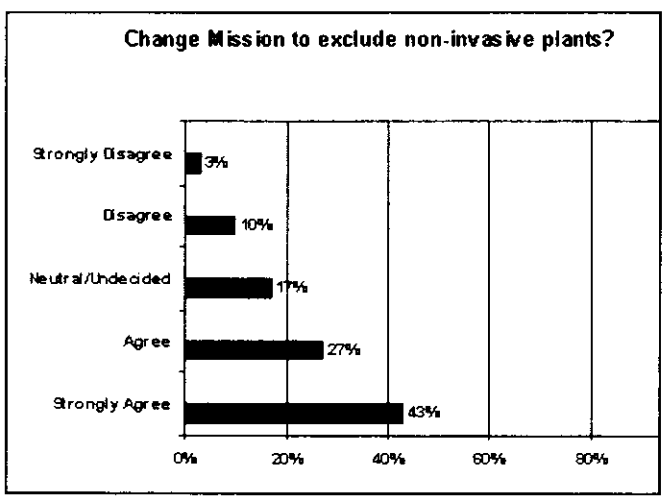
of products it sells. The organization developed a set of plant booklets, two wildflower posters and a T-shirt. The booklets were the most frequently purchased product (55%). Over 20% of the respondents indicated that they purchased the posters or T-shirts. Over 90% agreed that ANPS should continue to sell educational publications and posters to the public.

Should ANPS Change Its Mission Statement?
Our ANPS current mission statement:

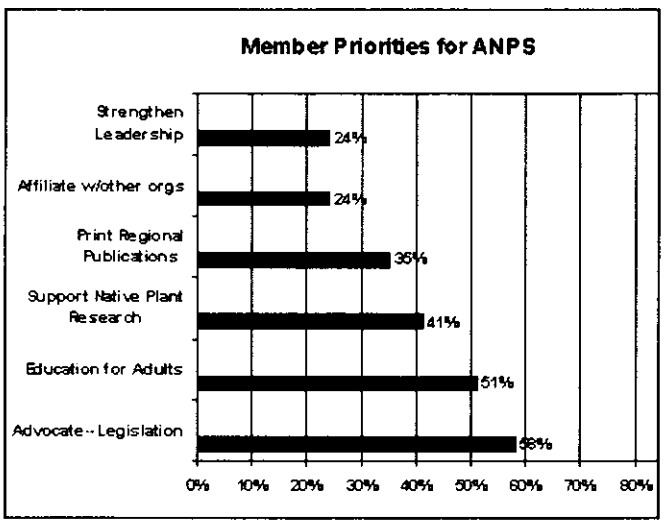
- To broaden knowledge and appreciation of plants and habitats native to Arizona
- To work to protect those native plants and habitats
- To encourage landscaping with native plants and other non-invasive plants appropriate to Arizona.

Members were asked whether the last statement — "To encourage landscaping with native plants and other non-invasive plants appropriate to Arizona" — should be changed to exclude the last phrase: "and other non-invasive plants appropriate to Arizona." The following bar graph shows that 70% of the respondents either agreed or strongly agreed that the mission statement should be changed. The remaining percentage was either undecided or disagreed.

What Should ANPS Priorities be for the Future?



Members were asked to prioritize ANPS future focus areas. The members' most frequently endorsed, top three priorities are: advocating for federal and state legislation that protects native plants; more educational workshops for adults; and supporting native plant research. A strong majority of members also agreed (77%) that ANPS should be more involved in conservation issues, and that the society should network with other environmental organizations (80%). The following graph shows the areas that respondents most frequently ranked as their top three priorities.



Conclusions—What Do These Results Say?
Our ANPS membership tends to be older well-educated Arizona residents. Most are satisfied with ANPS's current offerings, although a fair percentage (25%) are either neutral or undecided about them. The respondents' ranking of priorities indicates what activities ANPS can plan for the future. Advocating for legislation and supporting native plant research fall within ANPS's conservation focus, so the ANPS board will re-activate its Conservation Committee to address areas affecting Arizona's native plants and their habitats. More adult education workshops are another activity that could be increased.

Clearly, most of the membership reads The Plant Press. Since this is a major communication venue for ANPS, we will consider enhancing it. Most members have Internet access and use e-mail, so we can explore discussion lists and e-mails as other possible communication routes. Only a slight majority of members (52%) desire an electronic newsletter.

Finally, most of the respondents (70%) agreed that the ANPS mission statement should be changed to focus exclusively on Arizona native plants. The board will re-examine our mission statement to reflect our members' concerns about increased threats

cont'd. on page 14

tion was eliminated. The state was totally barren. Topsoil was washed or blown away because there was no vegetation to hold it in place. The new major industry became grinding up cow bone for fertilizer. Because of this ecological catastrophe, the vegetation of Arizona is very different than it was 125 years ago. Grazing has turned out to be the second most powerful shaper of Arizona's vegetation, with climate being first. The story of fire is inextricably linked with grazing.

Many herbaceous plants are able to survive fire as they store underground reserves and quickly re-sprout from below-ground buds, whereas woody plant seedlings and saplings often die because the buds were on stems that burned. Scattered mature trees are able to survive due to a protective layer of thick bark or have the ability to re-sprout. Animals survive in burrows because the temperature is at survivable levels at less than 4 inches below the surface. Pre-settlement fires were usually small and patchy in nature, so it was easy for larger animals to escape to nearby unburned habitats.

Nowadays, grassland fires also occur earlier in the season before lightning strikes (April and May) when the grasses are dry and susceptible to a human-caused spark. The 40,000-acre Ryan fire southeast of Sonoita, which occurred in April 2002, swept through the Audubon Research Ranch near Elgin. If you visit the Ranch today, you could barely see evidence that the Ryan fire ever occurred. With the cessation of grazing 30 years ago and the reinstatement of a natural burn regime, plant diversity in sample plots has more than doubled where success in controlling of non-native species is evident. Long-term changes are harder to gauge now with the different fire burning seasons that result in differences in the vegetation and wildlife populations; there may be higher mortality of baby birds and other immature wildlife that may be less prepared to escape during an early-season fire. Changing fire season may benefit non-native grasses that have greater flexibility in setting seed in response to fire as compared to native grass species.

In grassland, resources are typically distributed homogeneously. If you sample the soil here, there, or over yonder, you'll find roughly the same amount of nitrogen, phosphorus, organic matter, etc. at each sample site. Grasses are generally shallow-rooted and growth is closely coupled with the availability of soil moisture. Grasses grow when the soil is moist, typically in the summer. Root channels, animal burrows, and soil porosity are also evenly distributed and most biological processes are confined to the upper soil layers. Water that enters the soil, rather than running off, called rainfall infiltration, is enhanced in healthy grassland because complete canopy cover lowers the effective energy of raindrops. If raindrops are not stopped by foliage, they smash into the soil surface and clog the pore spaces, resulting in runoff rather than infiltration.

In grasslands, a large percentage of rainfall infiltrates the soil, and runoff is slight of both water and nutrients. Heavy grazing during the short summer wet season causes a dramatic decrease in grass cover and reduces the competitive potential of the grasses. Because cows rarely eat shrubs, grazed grasses compete less strongly with shrub seedlings. The shrubs increase because there is less competition from grass and more space and nutrients to expand. Trampling by cattle compacts the soil and reduces infiltration rates, also increasing runoff. Greater runoff transports water, nitrogen, soil, organic material, including seeds and other plant nutrients, out of the system, resulting in erosion. The net effect of grazing is the reduction of available soil moisture and nutrients and an increase in the heterogeneity of their horizontal distribution. With the removal of grass leaves by hungry cows, grass can no longer fuel a fire. Shrub seedlings that previously would have burned and died would live long and prosper.

Changes in flow patterns of water result in heterogeneity in soil moisture and cause a direct increase in shrub cover because shrubs can exploit the additional moisture that infiltrates where water accumulates during runoff. Shrub dominance leads to further heterogeneity of soil properties because effective rainfall infiltration is confined to areas directly under shrub canopies: water moves through the root channels of shrubs; soil under shrubs has greater porosity; and animals that prefer to locate their burrows under shrubs increase infiltration. In contrast, barren spaces between shrubs generate runoff and increase nutrient losses through soil erosion by wind and water. This leads to further shrub dominance and a further decrease in fire frequency.

The cycling of plant nutrients, largely controlled by biotic processes in all ecosystems, is progressively confined to the zone beneath shrubs. This leads to "fertile islands" that characterize shrub lands. The fertile island effect is reinforced by small mammals,

cont'd. on page 6

birds, arthropods, and other animals that live under shrubs. This is called a "positive feedback cycle" - the process is continually reinforced and is difficult to reverse. Furthermore, cows love to eat mesquite pods and distribute the seeds all over the place. This is the mechanism that transformed the grasslands once surrounding Oracle into mesquite woodlands.

The cycle keeps repeating, but how do we go about reversing these cattle-made changes in the land? If we want to "bring back" the grasslands, we must remove cattle (there's nothing left to eat anyway) and burn the vegetation like crazy. The trees and shrubs will decrease and, if seed sources are available and the system is not too degraded, the grasses will increase. Unfortunately, this "solution" is not enough. These areas may have passed a threshold whereby they cannot return. For example, trees and shrubs will decrease only if they do not re-sprout. Grass seed sources may not be available and the system may be too degraded by compaction and loss of topsoil. Most importantly, what kinds of grasses now dominate southern Arizona's grasslands and also love fire? Non-natives! These grasses were brought in to Arizona to halt erosion and provide fodder for cattle in degraded soils. These non-native grasses are now dominant! For example, Lehmann's and Boer's lovegrasses (*Eragrostis lehmanniana* and *E. chloromelas*) from Africa dominate grasslands across southern Arizona. The plains of Sonora are now pure bufflegrass (*Cenchrus ciliaris*). The USDA has introduced a cold-tolerant bufflegrass so that this virulent non-native can now spread even more!

Cows prefer to eat native grasses in summer - the non-native grasses are a less tasty last resort. The benefit of the non-natives was to control erosion in areas where native grasses could not establish. To give the natives a chance, controlled burns at Audubon Research Ranch are coupled with other treatments, such as herbicide application to the Lehmann lovegrass sprouts. Treatments such a phosphorus application and throwing on a ton of native grass seed may increase native competitiveness. Our understanding of this topic could be improved by current research. At Buenos Aires National Wildlife Refuge, the managers have burned to bring back the grassland habitat for the endangered Bobwhite quail and pronghorn. Dominant non-native grasses support fewer insect species, are much poorer in nutrients, and have very small seeds, so it is more difficult for wildlife species to raise their young on the non-native fare (Bock et al. 1986, Cox 1992).

You may have seen bumper stickers or billboards proclaiming "grazin' prevents blazin'," implying that if grasslands are grazed, grassland wildfires won't occur. Is this true? The answer is not so simple. If the land is heavily grazed and all of the biomass is removed, then it won't burn because there is no fuel. However, if a meadow contains any quantity of fodder for cattle at all, it is flammable! Grasses grow rapidly and quickly reach flammable status. Thus, the message of the bumper sticker is true only if we accept the fact that grasslands always should be overgrazed. On what grass-filled meadows will hungry cows feast? Where will the nests be for ground-nesting birds? Where will the deer and the antelope play?

Although each of the vegetation types discussed in this series share similar burning patterns, their individual responses to fire remain distinctive. Addressing the problems associated with wildfires will be complex, expensive and slow. There are no quick and easy solutions to these problems. Proposed solutions that involve removing our rights as Americans to challenge federal actions, as embodied by the "Healthy Forests Initiative," are particularly ineffective in providing long-term resolution to problems inherent in wilderness management.

Next issue...fire in Arizona's desert lands!

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Check out this URL to learn more about Arizona's grasslands at the Audubon Research Ranch:
<http://www.audubon.org/local/sanctuary/appleton/whatis.htm>

Also, check out this website for more information about fire in the Southwest:
<http://forestfire.nau.edu>

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TWO RARE PLANTS AND THE WARM SEASON FLORA OF A UNIQUE HABITAT IN PIMA COUNTY, ARIZONA:

The Pantano Formation, Claystone Member Deposits

Russell B. Duncan

The Pantano Formation's Claystone Member Deposits support a unique and localized edaphic plant community. The first focused botanical survey of this distinct plant community in eastern Pima County, Arizona was conducted from 15 July through 10 November 2002 during the summer rainy (monsoon) season and into the post-monsoon season. To document cool-season species, additional surveys are planned for 2003 during the winter-spring season (February through May) and during the summer to further document the warm season flora. A vegetation map is being prepared based on interpretation of color aerial photographs and ground-truthing. Voucher specimens are deposited at the University of Arizona Herbarium (ARIZ) with some duplicates to Arizona State University (ASU), New York Botanical Garden (NY), and the U.S. National Herbarium (US).

The preliminary study documented 163 plant species in 44 families (Table 1). Perennials, usually identifiable at any time of year, comprise the majority of the warm season flora. Four families make up 50% of the flora: Poaceae (19%), Asteraceae (15%), Cactaceae (9%), and Fabaceae (7%). Twenty-two species, including ten grasses, are non-natives. The Arizona Rare Plant Committee (2001) classifies two of the species in the area as rare: needle-spined pineapple cactus (*Echinomastus erectocentrus* var. *erectocentrus*) and heathleaf wild buckwheat (*Eriogonum ericifolium*).

The Pantano Formation's Claystone Member Deposits (hereafter called Pantano clay deposits or just clay deposits) are located near Cienega Creek in eastern Pima County, approximately 43 km (27 mi) southeast of downtown Tucson. Geologically, these clay deposits date from the Oligocene to early Micocene. They are composed of fine-grained siltstone and claystone with localized gypsum beds, along with fine to coarse grained sandstone and conglomerates of various sizes (Drewes 1977, Balcer 1984, Richard et al. 2002, Spencer et al. 2002). The Pantano clay is low-alkali, high-alumina, composed of kaolinite and illite clay minerals useful for making bricks and as a source of alumina in cement production (see Houser 1992 and authors therein). Calcareous rich soils are also common.

Topography in the area varies from near level to low rolling hills. Elevations range from ca. 1000 to 1200 m (3300 to 4000 ft). Gullying, primarily from geological erosion, occurs on some of the clay soils, forming sparsely-vegetated badlands topography. Some lowland areas are covered with a stony, desert pavement surface overlying the clay deposits that generally lack in plant life, particularly woody perennials (Figure 1). The characteristic vegetation types are desertscrub and desert grassland with elements from both the Chihuahuan and Sonoran deserts. Turner's (1974) vegetation map of the Tucson area includes the clay deposit area.

Among the more common or conspicuous perennial plants of the area are creosote bush (*Larrea divaricata*), acacia (*Acacia constricta*, *A. greggii*, and *A. neovernicosa*), mesquite (*Prosopis velutina*), range ratany (*Krameria erecta*), mariola (*Parthenium incanum*), shrubby coldenia (*Tiquilia canescens*), and various cacti (mostly *Opuntia engelmannii* and *O. macrocentra*). Common grasses in the area include fluff grass (*Erioneuron pulchellum*), curly mesquite grass (*Hilaria belangeri*), bush muhly (*Muhlenbergia porteri*), tobosa (*Pleuraphis mutica*), and California cottontop (*Digitaria californica*). The presence of both *A. constricta* and *A. neovernicosa*, the latter being representative of the Chihuahuan Desert (Brown 1982, R. Felger, pers. comm.), indicates that this is a confluence of the Sonoran and Chihuahuan deserts in southeastern Arizona. Localized stands of creosote bush fit the description of the Chihuahuan Desert ecotoype (e.g., Brown 1982:172-173), being shorter and more open at the base, having sparser foliage and straighter stems than their Sonoran Desert counterparts.

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Two Rare Plants *(cont'd. from page 7)*

Several normally dry washes drain into nearby Cienega Creek, dissecting the area. These washes support xeroriparian scrub habitats with denser vegetation than the surrounding upland (non-riparian) habitats dominated by acacia, mesquite, tobosa (*Hilaria mutica*), and other species. Except along nearby Cienega Creek, there is no natural perennial surface water in the immediate study area but there are a few artificial features such as clay mine pits and cattle tanks having standing water year-round or for extended periods. These mesic sites support wetland and bordering riparian habitats with emergent obligate aquatic plants like sedges (*Cyperus* spp.), cattail (*Typha domingensis*), and broadleaf deciduous trees and shrubs such as Frémont cottonwood (*Populus fremontii*), Goodding willow (*Salix gooddingii*), and seep willow (*Baccharis salicifolia*).

The Pantano clay deposits are located near the center of the geographic range of needle-spine pineapple cactus (*Echinomastus erectocentrus* var. *erectocentrus*) in Arizona. Documented occurrences of this rare taxon include eastern Pima County, the border with northwestern Cochise County, and extreme southeastern Pinal County (Benson 1969, Arizona Rare Plant Committee 2001). Needle-spine pineapple cactus is associated with upper alluvial fans having substrates deriving from both sedimentary and igneous rocks in desert grasslands at elevations of 914 to 1310 m (3,000 to 4,300 ft). Uncommon in the overall clay deposits, needle-spine pineapple cactus may be locally abundant at some sites (Arizona Rare Plant Committee 2001). For example, on one west-facing slope more than 130 plants were counted in a single 30 x 30 m quadrant.

The most significant discovery in the Pantano clay deposits is heathleaf wild buckwheat (*Eriogonum ericifolium*), representing the first record of this species from Pima County, its most southern location in Arizona (Duncan and Reveal 2003). The nearest known population had been in the Verde Valley of Yavapai County, 282 km (175 mi) to the northwest.

Until recently there were three recognized varieties of *E. ericifolium* (Reveal and Henrickson 1975, Reveal 1976), each being widely disjunctive. Two are in Arizona (var. *ericifolium*: Yavapai Co., Verde Valley and var. *pulchrum* (Eastwood) Reveal: Coconino Co., Meteor Crater and vicinity near Winslow). The third variety is in California (var. *thornei* Reveal & Henrickson: San Bernardino Co., New York Mountains). Recently, Shultz (1998) elevated the latter to species status. Given her rationale, it would be reasonable to re-establish *E. pulchrum* (Duncan and Reveal 2003, J. Reveal, pers. comm.).

Until now, Arizona populations of *E. ericifolium* were known only from Tertiary gypsiferous limestone lakebed deposits in the Verde Valley. Both *E. pulchrum* and *E. thornei* occur on sedimentary substrates, including coarse sands derived from limestone and copper-rich quartzite gravel, respectively (Shultz 1998, J. Reveal, pers. comm.). This newly-discovered population of *E. ericifolium*'s habitat is assumed to contain gypsum but this needs clarification.

Specimens of this rare sub-shrub *E. ericifolium* were collected in the Pantano Formation on 30 November 1984 by John Anderson of the U.S. Bureau of Land Management. The species ranking of Anderson's specimens, deposited at Arizona State University's Herbarium (ASU), remained unknown until 21 September 2002, when Marc Baker identified them as *Eriogonum ericifolium* or a new taxon. My first specimens were collected on 21 July 2002. John Anderson is not entirely convinced that my specimens are *Eriogonum ericifolium* but could be more closely related to *Eriogonum microthecum* group (J. Anderson, pers. comm. 2003). On 10 April 2003, Elizabeth Makings and Jack Whetstone collected specimens of what could be another collection of *Eriogonum ericifolium* near the Old Contention Mill site on a terrace along the upper San Pedro River in Cochise County in southeastern Arizona (E. Makings, ASU, pers. comm. 2003).

The newly-discovered *E. ericifolium* population has a geographically limited range in Pima County, undoubtedly because its habitat is strongly restricted. The most recent surficial geology maps indicate that the total extent of naturally-exposed claystone deposits is less than 1,000 ha (Richard et al. 2002, Spencer et al. 2002). Within this limited area of exposed clay deposits, the distribution of *E. ericifolium* appears to be even more restricted but occasionally locally abundant, requiring additional studies to determine the total distribution of the species.

Land ownership in the Pantano clay deposits area is mainly Arizona State Trust and, to a lesser extent, Pima County and private holdings. Because *E. ericifolium* is rare in Pima County, land management agencies should prevent impacts resulting from clay

cont'd. on page 9

mining, urban development, off-road vehicle use, livestock grazing and trampling, construction of roads and utility corridors, and non-motorized recreational activities. *E. ericifolium* may not be resilient to recovery from surface disturbances. So far, it has not been found in mined areas.

No *E. ericifolium* is on federal lands in Pima County that could afford it some protection from development pressures. Its distribution and security within the existing Cienega Creek Natural Preserve boundary are limited. Undisturbed portions of State Trust Lands where the species mainly occurs should be considered for acquisition for conservation purposes through the State of Arizona's Preserve Initiative and Growing Smarter Grant programs.

Conservation measures are necessary, including protection under Arizona Native Plant Law. In the interim, no new clay mines should be opened or expanded until the distributional status of the species in the Pantano Formation's Claystone Member Deposits is better understood.

Acknowledgements

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Table 1. Warm season flora of the Pantano Formation, Claystone Member Deposits near Cienega Creek, Arizona. All plants were documented from 15 July - 10 November 2002. Selected synonyms are included in brackets and some species include comments. Non-native species are indicated with an asterisk (*). Species classified as rare according to the Arizona Rare Plant Committee (2001) are indicated with a dagger (†).

Current Names and Selected Synonyms

PTERIDOPHYTES - FERNS AND FERN ALLIES
Pteridaceae - Maidenhair Fern Family
Astrolepis cochisensis (Goodding) D.M. Benham & Windham ssp. *cochisensis* [*Notholaena cochisensis* Goodding. *N. sinuata* var. *cochisensis* (Goodding) Weatherby]. Scaly cloak-fern.
Astrolepis sinuata (Lagasca ex Swartz) D.M. Benham & Windham ssp. *sinuata. Cheilanthes sinuata* (Lagasca ex Swartz) Domin. *Notholaena sinuata* (Lagasca ex Swartz) Kaulfuss]. Star-scaled or wavy cloak fern.
Cheilanthes parryi (D. C. Eaton) Domin. [*Notholaena parryi* D. C. Eaton]. Parry's lipfern.
Notholaena standelyi Maxon. Standley lipfern.
Selaginellaceae - Spike Moss Family
Selaginella arizonica Maxon. Arizona spike-moss.

GYMNOSPERMS - CONE-BEARING PLANTS
Cupressaceae - Cypress Family
Juniperus coahuilensis (Martínez) Gaussen ex R.P. Adams. Redberry juniper.
Ephedraceae - Joint fir Family
Ephedra trifurca Torrey ex S. Watson. Long-leaved joint fir.

ANGIOSPERMS - FLOWERING PLANTS
Dicotelydons
Acanthaceae - Acanthus Family
Anisacanthus thurberi (Torrey) A. Gray. Desert honeysuckle.
Aizoaceae - Carpet Weed Family
Trianthema portulacastrum Linnaeus. Horse purslane.
Amaranthaceae - Amaranth Family
Amaranthus fimbriatus (Torrey) Bentham. Fringed amaranth.
Amaranthus palmeri S. Watson. Palmer's amaranth, careless weed.
Tidestromia lanuginosa (Nuttall) Standley. Woolly tidestromea, honeysweet.
Apocynaceae - Dogbane Family
Haplophyton crooksii Linnaeus. Cockroach plant.
Asclepiadaceae - Milkweed Family
Metastelma arizonicum A. Gray [*Cynanchum arizonicum* (A. Gray) Shinners]. Milkweed vine.
Asteraceae - Sunflower Family
Adenophyllum porophylloides (A. Gray) Strother [*Dysoddia porophylloides* A. Gray]. San Felipe fetid marigold.
Artemesia ludoviciana Nuttal ssp. *sulcata* (Rydb.) Keck. White sage.
Baccharis salicifolia (Ruiz and Pavón) Persoon [*Baccharis glutinosa* Persoon]. Seep willow.
Baccharis sarothroides A. Gray. Desert broom.
Baileya multiradiata Harvey & A. Gray ex Torrey. Many-flowered desert marigold.
Brickellia coulteri A. Gray var. *coulteri.* Coulter's brickellbush.
Encelia farinosa A. Gray var. *farinosa.* Brittlebush.
Ericameria laricifolia (A. Gray) Shinners. [*Haplopappus laricifolius* A. Gray]. Turpentine bush.
Erigeron divergens Torrey & A. Gray. Desert fleabane.
Gutierrezia microcephala (de Candolle) A. Gray. Snakeweed.
Heterotheca psammophila Wagenkn [*H. subaxillaris* (Lamarck) Britton & Rusby sensu Kearney & Peebles]. Camphor weed, telegraph plant.
Hymenoclea monogyra Torrey & A. Gray ex A. Gray. [*Ambrosia monogyra* (Torrey & A. Gray ex A. Gray) J.L. Strother & B.G. Baldwin]. Burrobrush.
Isocoma tenuisecta Greene [*Happlopappus tenuisectus* (Greene) Blake]. Burro weed.
Parthenium incanum Kunth. Mariola.
Pectis papposa Harvey & A. Gray. var *papposa.* Desert chinchweed.
Porophyllum gracile Bentham. Odora.
Psilostrophe cooperi (A. Gray) Greene. Paper flower.
Senecio lemmonii A. Gray. Lemmon groundsel.

cont'd. on page 11

Two Rare Plants *(cont'd. from page 10)*

Stephanomeria pauciflora (Torrey.) A. Nelson. Desert straw.
Thymophylla pentachaeta (de Candolle) Small [*Dyssodia pentachaeta* (de Candolle) B.L. Robinson.]. Dogweed.
Trixis californica Kellogg var *californica.*
Verbesina encelioides (Cavanilles) A. Gray. Yellowtop, cowpen daisy.
**Xanthium strumarium* Linnaeus. Common cocklebur.
Zinnia acerosa (de Candolle). A. Gray. (*Z. pumila* A. Gray). Desert zinnia.
Bignoniaceae - Bignonia Family
Chilopsis linearis (Cavanilles) Sweet ssp. *arcuata* (Fosberg) Henrickson. Desert willow.
Boraginaceae - Borage Family
Tiquilia canescens (de Candolle) A. T. Richardson. [*Coldenia canescens* de Candolle] Shrubby coldenia.
Brassicaceae - Mustard Family
**Brassica tournefortii* Gouan. Sahara mustard.
Lepidium sp. cf. *lasiocarpum* Nuttall ex Torrey & A. Gray. Sand peppergrass.
Physaria gordonii (A. Gray ex S. Watson) I. A. Al-Shehbaz & S. L. O'Kane [*Lesquerella gordonii* (A. Gray) S. Watson]. bladderpod.
Cactaceae - Cactus Family
Cylindropuntia arbuscula (Engelmann) F.M. Knuth [*Opuntia arbuscula* Engelmann]. Pencil cholla.
Cylindropuntia fulgida (Engelmann) F.M. Knuth var. *fulgida* [*Opuntia fulgida* Engelmann var. *fulgida*]. Jumping or chainfruit cholla.
Cylindropuntia spinosior (Engelmann) F.M. Knuth [*Opuntia spinosior* (Engelmann) Toumey. Cane cholla.
Cylindrountia leptocaulis (de Candolle) F.M. Knuth [*Opuntia leptocaulis* de Candolle]. Desert Christmas cactus.
Cylindropuntia versicolor (Engelmann) F.M. Knuth [*Opuntia versicolor* Engelmann]. Staghorn cholla.
Echinocereus faciculatus (Engelmann) L. Benson. [*E. fendleri* Engelmann var. *robustus* L. Benson]. Hedgehog cactus.
†*Echinomastus erectocentrus* (J.M. Coulter) Britton & Rose var. *erectocentrus* (J.M. Coulter) L. D. Benson [*Neolloydia erectocentra* (J.M. Coulter) L.D. Benson. *Sclerocactus erectocentrus* (J.M. Coulter) N.P. Taylor]. needle-spined pineapple cactus This taxon is considered rare because it has a restricted distribution both globally and on a regional scale, but it may be locally fairly common (Arizona Rare Plant Committee 2001). Some taxonomists recognize two varieties of *E. erectocentrus*, var. *erectocentrus* and var *acunensis*, however, Kartesz (1994) does not recognize any varieties, however D. Pinkava, Arizona State University (in litt.), believes that the two varieties are distinct but not separable according to Benson's (1969) key. Variety *acunensis* is currently classified as a "Candidate" species for listing as threatened or endangered under the Endangered Species Act (USFWS 2001). As recently as 1993 variety *erectocentrus* was considered a federal Candidate 2 species but no longer has any special status with the USFWS (58 FR:51177).
Escobaria vivipara (Nuttall) Buxbaum var. *bisbeeana* (Orcutt) D.R. Hunt [*Coryphantha vivipara* (Nuttall) Britton & Rose var. *bisbeeana* (Orcutt) L.D. Benson. Bisbee spinystar, Bisbee beehive cactus.
Ferocactus wislizenii (Engelmann) Britton & Rose. Fishhook barrel cactus.
Mammillaria grahamii Engelmann [*M. microcarpa* Engelmann]. Fishhook pincushion.
Opuntia engelmannii Salm-Dyck ex Engelmann var. *engelmannii* [*O. phaeacantha* var. *discata* (Griffiths) Benson & Walkington]. Engelmann's prickly pear.
**Opuntia engelmannii* Salm-Dyck var. *linguiformis* (Griffiths) Parfitt & Pinkava [*O. lindheimeri* Engelmann var. *linguiformis* (Griffiths) L. Benson]. Cow's tongue prickly pear. Established in one area where trash was dumped.
Opuntia macrocentra Engelmann [*O. violacea* var. *macrocentra* L. Benson]. Black-spined prickly pear.
**Opuntia microdasys* (Lehmann) Pfeifl Established in one area where trash was dumped.
Opuntia santa-rita (Griffiths & Hare) Rose. [*O. violacea* Engelmann var. *santa-rita* (Griffiths & Hare) L. Benson]. Purple prickly pear. Only growing in one area where trash was dumped, which suggests that this species is not locally native.
Chenopodiaceae - Goosefoot Family
Atriplex canescens (Pursh) Nuttall. Four-wing saltbush.
Chenopodium neomexicanum Standley. New Mexico goosefoot.
**Salsola tragus* Linnaeus [*S. australis* R. Brown. *S. iberica* Sennen & Pau. *S. kali* of authors]. Russian thistle or tumbleweed.
Convolvulaceae - Morning Glory Family
Evolvulus alsinoides Linnaeus. Arizona blue eyes.
Cucurbitaceae - Gourd Family
Cucurbita digitata A. Gray. Coyote gourd.
Euphorbiaceae - Spurge Family
Ditaxis neomexicana (Müller Argoviensis) A. Heller [*Argythamnia neomexicana* Müller Argoviensis].
Euphorbia abramsiana L.C. Wheeler [*Chamaesyce abramsiana* (L.C. Wheeler) Koutnik].

cont'd. on page 12

Two Rare Plants *(cont'd. from page 11)*

Euphorbia arizonica Engelmann [*Chamaesyce arizonica* (Engelmann) Arthur]. Golondrina.
Euphorbia florida Engelmann [*Chamaesyce florida* (Engelmann) Millspaugh]. Spruge
Euphorbia gracillima S. Watson [*Chamaesyce gracillima* (S. Watson) Millspaugh]. Spurge.
Tragia nepetaefolia Cavanilles. Noseburn.
Fabaceae - Legume Family
Acacia constricta Bentham. White-thorn acacia.
Acacia greggii A. Gray. Catclaw.
Acacia neovernicosa Isley [*A. vernicosa* Standley. *A. constricta* var. *vernicosa* (Standley) L.D. Benson]. Viscid acacia, Chihuahuan white thorn.
Calliandra eriophylla Bentham. var. *eriophylla* Bentham. Fairy duster.
Hoffmanseggia glauca (Ortega) Eifert [*Caesalpinia glauca* (Ortega) Kuntze]. Hog potato, Indian rush pea.
Dalea neomexicana
Dalea pogonathera
**Medicago sativa* Linnaeus. Alfalfa.
**Melilotus indicus* (Linnaeus).
**Parkinsonia aculeata* Linnaeus. Mexican palo verde.
Parkinsonia microphylla Torrey [*Cercidium microphyllum* (Torrey) Rose & I.M. Johnston]. foothill palo verde.
Prosopis velutina Wooton [*P. juliflora* var. *velutina* (Wooten) Sargent]. Velvet mesquite.
Senna covesii (A. Gray) H.S. Irwin & Barneby [*Cassia covessii* A. Gray)]. Desert senna.
Fouquieriaceae - Ocotillo Family
Fouquieria splendens Engelmann. Ocotillo.
Krameriaceae - Ratany Family
Krameria erecta Schultes [*K. parvifolia* Bentham]. Range ratany.
Krameria grayi Rose & Painter. White ratany.
Loasaceae - Stickleaf Family
Mentzelia affinis Greene. Triangle-seed blazing star.
Malpighiaceae - Malpighia Family
Janusia gracilis Gray. desert vine.
Malvaceae - Mallow Family
Abutilon incanum (Link) Sweet. Indian mallow.
Herissantia crispa (Linnaeus) Brizicky. Bladder mallow.
Hibiscus coulteri Harvey ex A. Gray. Desert rose-mallow.
Hibiscus denudatus Bentham. Rock hibiscus.
Sphaeralcea ambigua A. Gray. Desert globe mallow.
Martyniaceae - Unicorn plant Family
Proboscidea parviflora (Wooton) Wooton & Standley ssp. *parviflora* [*Martynia parviflora* Wooten]. Devil's claw.
Nyctaginaceae - Four o'clock Family
Allionia incarnata Linnaeus sensu lato. Trailing four-o'clock.
Boerhavia coulteri (Hooker f.) S. Watson var. *palmeri* (S. Watson) Spellenberg [*B. spicata* Choisy var. *palmeri* S. Watson]. Spiderling.
Polygonaceae - Buckwheat Family
Eriogonum abertianum Torrey. Wild buckwheat.
Eriogonum deflexum Torrey. Skeleton weed.
†*Eriognonum ericifolium* Torrey & A. Gray [*E. mearnsii* Parry]. Heathleaf wild buckwheat, Yavapai buckwheat. This collection represents the first record of this species in Pima County and is the most southerly locality in Arizona. The nearest other population is 282 km to the northwest in the Verde Valley of Yavapai County. In Arizona this species is considered rare because it has a geographically limited range due to specific habitat requirements. Within Pima County the distribution of *E. ericifolium* appears to be even more restricted (but occasionally locally abundant). Whether or not the new Pima County population represents a new taxon will be determined at a later date by J.L. Reveal and R.B. Duncan.
Portulacaceae - Portulaca Family
Portulaca oleracea Linnaeus. Common purslane.
Talinum aurantiacum Engelmann. Flame flower.
Ranunculaceae - Crowfoot Family
Clematis drummondii T & G. Texas virgin's bower.
Resedaceae - Mignonette Family
Oligomeris linifolia (Vahl ex Hornemann) J.F. Macbride. Desert cambess.
Rhamnaceae - Buckthorn Family

cont'd. on page 13

Two Rare Plants *(cont'd. from page 12)*

Condalia warnockii M. C. Johnston [*Condalia spathulata* (A. Gray) M. C. Johnston]. Crucillo.
Zizyphus obtusifolia (Hooker ex Torrey & A. Gray) A. Gray. Graythorn.
Salicaceae - Willow Family
Populus fremontii S. Watson ssp. *fremontii*. Frémont cottonwood.
Salix gooddingii C.R. Ball. Goodding's willow, Goodding's black willow.
Scrophulariaceae - Figwort Family
Maurandya antirrhiniflora Humboldt & Bonpland. Snapdragon vine.
Penstemon parryi A. Gray. Parry's penstemon.
Solanaceae - Potato, Nightshade Family
Datura discolor Bernhardi. Desert datura.
Lycium andersonii A. Gray. Anderson's wolfberry.
Lycium berlandieri Dunal. Berlandier wolfberry.
Lycium excertum A. Gray.
**Nicotiana glauca* Graham. Tree tobacco.
Nicotiana obtusifolia M. Martens & Galeotti [*N. trigonophylla* Dunal. *N. palmeri* A. Gray]. Desert tobacco.
Physalis sp. cf. *crassifolia* Bentham. Desert ground cherry.
Solanum elaeagnifolium Cavanilles Silver-leaf nightshade.
Tamaricaceae - Tamarix Family
**Tamarix ramosissima* Ledebour. Salt cedar.
Ulmaceae - Elm Family
Celtis pallida Torrey. Desert hackberry.
Verbenaceae - Vervain Family
Aloysia wrightii (A. Gray) Heller. Oreganillo.
Glandularia gooddingii (Briquet) Solbrig [*Verbena gooddingii* Briquet]. Desert verbena. Goodding verbena.
Viscaceae - Mistletoe Family
Phoradendron californicum Nuttall. Desert mistletoe.
Zygophyllaceae - Caltrop Family
Kallstroemia grandiflora Torrey ex A. Gray Arizona poppy, Arizona caltrop, orange caltrop.
Larrea divaricata Cavanilles spp. *tridentata* (Sessé & Moçiño ex de Candolle) Felger & Lowe [*L. tridentata* (Sessé & Moçiño ex de Candolle ex de Candolle) Coville] Creosote bush.
**Tribulus terrestris* Linnaeus Goathead, puncture vine.

ANGIOSPERMS - FLOWERING PLANTS
Monocotelydons
Agavaceae - Agave Family
**Agave americana* Linnaeus. Century plant. Locally established in an illegal trash dump area along with non-native cacti.
Agave palmeri Engelmann. Palmer agave.
Dasylirion wheeleri S. Watson. Desert spoon.
Yucca baccata var. *brevifolia* L. D. Benson & R. A. Darrow [*Yucca brevifolia* Schott ex Trelease; *Y. arizonica* McKelvey; *Y. confinis* McKelvey; *Y. thornberi* McKelvey; *Y. treleasei* J. F. Macbride]. Thornber's yucca, banana yucca.
Yucca elata Engelmann. Soap-tree yucca.
Cyperaceae - Sedge Family
Cyperus esculentus Linnaeus. Yellow nut grass, Yellow nut sedge.
Cyperus squarrosus Linnaeus [*C. aristatus* Rottbell]. Dwarf sedge.
Eleocharis palustris (Linnaeus) Roemer & Schultes [*E. macrostachya* Britton].
Scirpus americanus Persoon [*S. olneyi* A. Gray of western authors. *Schoenoplectus americanus* (Persoon) Volkart ex Schinz & R. Keller]. Tule, bulrush.
Juncaceae - Rush Family
Juncus bufonius Linnaeus. Toad rush.
Poaceae - Grass Family
Aristida adscensionis Linnaeus. Six-weeks three-awn.
Aristida purpurea Nuttall. Purple three-awn
Aristida ternipes Cavanilles var. *ternipes*. Spider grass.
**Avena fatua* Linnaeus. Wild oats.
Bouteloua aristidoides (Kunth) Grisebach. Six-weeks needle grama.
Bouteloua barbata Lagasca. Six-weeks grama.
Bouteloua curtipendula (Michaux) Torrey. Side oats grama.
Bouteloua hirsuta Lagasca. Hairy grama.

cont'd. on page 14

Two Rare Plants *(cont'd. from page 13)*

**Bromus rubens* Linnaeus [*B. madritensis* ssp. *rubens* (Linnaeus) Husnot]. Red brome.
Chloris virgata Swartz. Feather grass.
**Cynodon dactylon* (Linnaeus) Persoon. Bermuda grass.
Digitaria californica (Bentham) Henrad [*Trichachne californica* (Bentham) Chase]. California cottontop.
**Echinochloa colonum* (Linnaeus) Link. Jungle ricegrass.
**Eragrostis lehmanniana* Nees. Lehmann lovegrass.
Erioneuron pulchellum (Kunth) [*Tridens pulchellus* (Kunth) A.S. Hitchcock]. Fluff grass.
Heteropogon contortus (Linnaeus) Roemer ex Schultes. Tanglehead.
Hilaria belangeri (Steudel) Nash. Curly mesquite grass.
Leptochloa fusca (Linnaeus) Kunth. ssp. *uninervia* (J. Presl) N. Snow. [*Leptochloa uninervia* (J. Presl) Hitchcock & Chase]. Mexican sprangletop.
Leptochloa viscida (Scribner) Beal. Sticky sprangletop.
**Melinis repens* (Willdenow) Zizka. [*Rhynchelytrum repens* (Willdenow) C.E. Hubbard. *Rhynchelytrum roseum* (Nees) Stapf & C.E. Hubbard ex Bews]. Natal grass.
Muhlenbergia emersleyi Vasey. Bull grass.
Muhlnebergia porteri Scribner ex Beal. Bush muhly.
Panicum obtusum Kunth. Vine mesquite.
Pappophorum vaginatum Buckley [*P. mucronulatum* Nees.]. Pappus grass.
**Pennisetum ciliare* (Linnaeus) Link [*Cenchrus ciliaris* Linnaeus]. Buffel grass. Fairly common in habitats along roadways, railroad beds, and in clay mine areas.
**Pennisetum setaceum* (Forsskal) Chiovenda. Fountain grass. Uncommon in ruderal habitats along roadways, railroad beds, and in clay mine areas.
**Phragmites australis* (Cavanilles) Trinius ex Steudel [*P. communis* Trinius]. Common reed.
Pleuraphis mutica Buckley [*Hilaria mutica* (Buckley) Bentham]. Tobosa.
**Sorghum halepense* (Linnaeus) Persoon. Johnson grass.
Sporobolus airoides (Torrey) Torrey. Alkali sacaton.
Sporobolus wrightii Munro ex Scribner. Sacaton.
Typhaceae - Cattail Family
Typha domingensis Persoon. Cattail.

Member Survey *(cont'd. from page 4)*

to Arizona's native plants and habitats. We will re-look at our ANPS booklets, particularly the booklet on desert trees, to see whether, in future editions, to include trees that are not native, but are desert-adapted and nice additions to a landscape. Within ANPS, there have been heated discussions about "what is native" and how to consider whether a plant is native to Arizona or not. Plants are habitat-bound, unbounded by politically-drawn geography. While these questions may never be fully answered, engagement of members in these discussions is seen as healthy and necessary. Before the ANPS makes any final decisions on these matters, please let your perspectives be known, on this or any other matter, to the ANPS Board of Directors. As a member, your input is crucial. THANK YOU!

WILD Kids

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Ciénegas - Unique Habitats of the Southwest

Ciénegas (or *ciénagas*) are small, shallow wetlands found in the southwest. The word **ciénega** comes from the Spanish word *cieno* which means mud. Ciénegas are often fed by springs or by a geologic formation that forces ground water to the surface. Like all wetlands, ciénegas play a very important role in the environment. When runoff from rains and snow melt is high, ciénegas absorb excess water until it gradually drains away. In drier periods ciénegas hold moisture, even after open bodies of water have disappeared. Ciénegas help cleanse the environment by mixing nutrients and oxygen into the water, and by filtering out and neutralizing sewage and toxins. For wildlife, ciénegas provide nutrient-rich food and a resting place. Sometimes ciénegas are referred to as 'nurseries' because many animals breed and raise their young there. The unique aquatic and semiaquatic ciénegas of the southwest were, and still are, a valuable resource for people and wildlife.

Ciénegas and Wildlife

Ciénegas are often described as "oases," surrounded by arid or semi-arid lands. These oases provide food, water and shelter for many different animals. Some ciénegas have developed isolated and unique flora and fauna of their own. In fact, many species of frogs, snails, and fish are found in ciénegas as remnant populations from times when riparian areas were more widespread.

Quitobaquito pupfish

Several small fish are adapted to living in ciénegas, where low levels of dissolved oxygen exist and water temperature may fluctuate rapidly. The **desert pupfish** is only about 3 inches long, but can survive conditions that would kill fish many times its size. It can endure temperatures over 100°F or below 50°F. The pupfish also has a remarkable ability to tolerate high salinity levels in ciénegas, where the water may be two to three times saltier than ocean water. (Scientists are studying pupfish to look for answers to problems related to human kidney function and disease.) A close relative of the desert pupfish, the **Quitobaquito pupfish**, is native only to Quitobaquito Springs, in Organ Pipe Cactus National Monument.

The **Gila topminnow** is also an inhabitant of ciénegas. Only 2-2½ inches long, this fish is usually found at the surface of the water, feeding on insect larvae and vegetation. It is being studied by scientists to determine how it can tolerate intense exposure to sunlight, yet avoid skin cancer. The Gila topminnow and desert pupfish are currently listed as endangered due to loss of ciénega habitat from pumping of groundwater, damming of rivers, and diversion of waterways. Introduction of non-native fish, such as the mosquito fish, are a threat to native fish because they compete with and prey upon topminnows and other native fish.

The **Gila chub**, named for the Gila River Basin for which it was first described, is associated with ciénegas and deep pools where cover is abundant. The Gila chub has been extirpated from a number of ciénegas and streams in Arizona, but with adequate habitat protection and reintroductions into key, historically occupied streams, there is a good chance that this species will not become endangered.

Beavers were once commonly found in Arizona ciénegas. Due to their natural behavior of constructing dams, beavers are instrumental in creating wildlife habitat. The ponds that form behind beaver dams raise the water table, resulting in increased vegetation and aquatic habitat. By the early 1900s, beaver populations had sharply declined due to trapping and loss of riparian habitat. However, in 1999, beavers were reintroduced into the San Pedro River in southeastern Arizona.

Ciénegas and People

People have historically settled in areas where surface water is available; ciénegas were no exception. In fact many Arizona ciénegas are named after the people who settled nearby (Bingham Ciénega, Hooker Ciénega, O'Donnell Ciénega, etc.). For prehistoric cultures, ciénegas were reliable sources of water for crop irrigation. By the mid-1800s, ciénegas were also an important source of water for livestock. Whereas Arizona native herbivores (deer, pronghorn, and bighorn sheep) are adapted to drought conditions, cattle and sheep must have water daily.

Ciénegas, such as San Simon Ciénega located along the Arizona-New Mexico border, were used as watering stops for pioneers, military, and surveying expeditions. Fort Huachuca and other military forts were established near ciénegas and natural springs. But these same bodies of water which were necessary for survival were also a source of mosquitos, and were associated with malaria, encephalitis, yellow fever, and other diseases. As a result, many ciénegas were drained for health reasons. By 1930, few ciénegas remained due to deliberate draining and unintentional draining through pumping of ground water.

In 1937, C.C. Wheeler wrote this account depicting earlier times of "swamplands" along the Gila River -

> "Many Lagoons or slews were located along the Santa Cruz, two very large ones at Calabasas formed by the overflow of the Sonoita Creek and Santa Cruz, with others along the stream. The condition at Calabasas on account of this swampy land malaria was very bad and settlers suffered greatly with Chills and Fever and many were obliged to move away from that section." *

The following old song was written by an unknown author (sung to the tune of Old Dan Tucker.)

The people here in Arizony
All look very pale and bony.
They shake and ache and burn and shiver
Up and Down the Gila River.
I'm freezing in the heat of day,
I feel like winter's here to stay.
I'm too cool for the month of June,
So bring me quinine with a spoon. *

* Barbara Tellman. *Arizona's Changing Rivers: How People Affected The Rivers*, Water Resources Research Center, College of Agriculture, The University of Arizona, March, 1997.

1. Choose one of the following ciénegas to research: Bingham, Empire, or Canelo Hills. Next, do some research to collect information about the ciénega you have chosen. Use the internet, library resources, or contact natural resource agencies or conservation organizations to answer the following questions:
   a. Where is the ciénega located?
   b. For what or whom is it named?
   c. How has the ciénega been modified by people?
   c. What was/is the importance of the ciénega to people and wildlife?
   e. Are measures being taken to preserve the ciénega?
2. In C.C. Wheeler's account he mentioned Calabasas. Where is Calabasas, Arizona? What other information can you find out about this city?
3. In the song above: Why do you think the author wrote "they shake and ache and burn and shiver?" What was the purpose of quinine?
4. The Monkey Springs pupfish once lived in Arizona springs. Historically, where was it found in Arizona? What happened to it?
5. Prior to 1800, thousands of beavers lived along the San Pedro River. What ecological benefits did beavers provide for wildlife? Use the internet and other resources to look for information about the importance of beavers to early settlers in Arizona. What are some problems beavers can cause for people?
7. "Ciénega" comes from a Spanish word. List some other Spanish words related to water. (Check an AZ map).

(This WILD Kids supplement was funded by the Bureau of Reclamation.)

WILD Kids

4-6 Published by the Arizona Game & Fish Department - Education Branch and the Heritage Fund Number 28

Ciénegas

Ciénegas ("see-en'-ee-gas") are small, shallow wetlands, found in southern Arizona. The word **ciénega** comes from the Spanish word *cieno* which means mud. Ciénegas provide habitat for aquatic insects, birds, amphibians, reptiles, mammals, and a few types of fish.

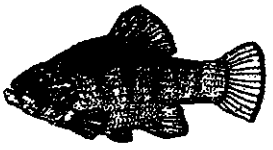
Ciénegas play a very important role in the environment. When runoff from rains and snow melt is high, ciénegas absorb excess water until it gradually drains away. In drier periods ciénegas hold moisture, even after open bodies of water have disappeared. Ciénegas help mix nutrients and oxygen into the water, and can filter out and neutralize sewage and toxins. For wildlife, ciénegas provide nutrient-rich food and a resting place. Sometimes ciénegas are referred to as 'nurseries' because many animals breed and raise their young there.

Las ciénagas son humedales pequeños poco profundos que se encuentran al sur de Arizona. La palabra ciénaga proviene de *cieno*, que significa fango. Las ciénagas proporcionan un hábitat para los insectos acuáticos, aves, anfibios, reptiles, mamíferos y algunos tipos de peces.

Las ciénagas juegan un papel muy importante en el medio ambiente. Cuando los escurrimientos de la lluvia y la nieve son abundantes, las ciénagas absorben el exceso de agua hasta que se drena gradualmente. En períodos de sequía, las ciénagas almacenan la humedad, aún después de que los cuerpos de agua han desaparecido. Las ciénagas ayudan a mezclar los nutrientes y oxígeno en el agua, y pueden filtrar y neutralizar los residuos y las toxinas. Para la fauna silvestre, las ciénagas proporcionan alimento rico en nutrientes y un lugar de descanso. Algunas veces, las ciénagas son llamadas "guarderías" porque muchos animales se reproducen y cuidan de sus crías ahí.

Ciénega Fish (Los peces de la ciénaga)

The **Desert Pupfish** lives in ciénegas, where the water temperature may exceed 100 degrees. Pupfish can also survive in small ciénegas where the water may be 3 times saltier than ocean water.

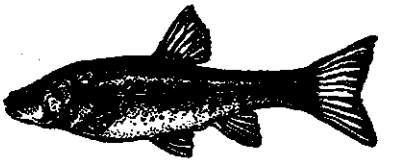


El **pez cachorrito del desierto** vive en las ciénagas, donde la temperatura del agua puede sobrepasar los 100 grados. El cachorrito del desierto también puede sobrevivir en pequeñas ciénagas donde el agua con frecuencia es 3 veces más salada que el agua de mar.

The **Gila Topminnow** is about 2" long and feeds on insects and vegetation at the surface of the water. Scientists are studying topminnows to learn how they can tolerate intense exposure to sunlight without developing skin cancer.

El **Gutopote de Sonora** es de aproximadamente 2" de largo y se alimenta de insectos y la vegetación en la superficie del agua. Los científicos estudian a los gutopotes para aprender cómo pueden tolerar la exposición intensa a la luz sin desarrollar cáncer en la piel.

The **Gila Chub** is a secretive fish that spends much of the day under cover of aquatic vegetation. It is an omnivore that feeds in the evening on insects, plants, and other fish.



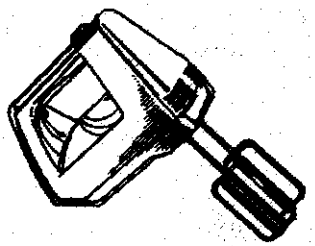
La **Carpa de Gila** es un pez reservado que pasa la mayor parte del día bajo la protección de la vegetación acuática. Es un omnívoro que se alimenta por las noches de insectos, plantas y otros peces.

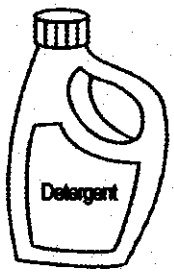
Wetland Metaphors

Using metaphors can be a fun way to compare two different things. A metaphor is a figure of speech for which one thing is spoken of as if it were another. An example of a metaphor is "A tree is a home." A tree is not actually a home, but it can be thought of as a home because it provides shelter for wildlife. Look at each of the drawings below. How does each represent a metaphor for a ciénega?

Metáforas del humedal

Usar metáforas es una forma divertida de comparar dos cosas diferentes. Una metáfora es una forma de expresión en la que se habla de una cosa como si fuera otra. Un ejemplo de una metáfora es "Un árbol es un hogar". En realidad un árbol no es un hogar, pero puede considerarse como uno porque proporciona protección para la fauna silvestre. Observa los siguientes dibujos. ¿Cómo representa cada uno una metáfora para una ciénaga?





(detergente)

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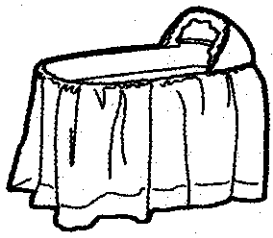

THE TUMAMOC GLOBEBERRY

Julia Fonseca

I first heard of the Tumamoc globeberry when I began working at Pima County in 1986. The species had just been listed under the Endangered Species Act. The Tumamoc globeberry's new status as an endangered species started rumors that several ongoing flood control projects might grind to a halt. At that time, there were thirty isolated populations of Tumamoc globeberry located in Pima County, Arizona and five were known in Sonora, Mexico. Known globeberry plants numbered 2,300 in the U.S. and 60 in Mexico (April 29, 1986; 51 FR 15906). All known populations were in the Arizona Upland subdivision of Sonoran Desert scrub, where habitat then was (and still is) being lost to urban and agricultural development, conversion to livestock pasture, and off-road vehicle traffic.

Illustration by Bill Singleton

Curious, I asked where I might see the "globeberry" and was told to walk across the street. The globeberry turned out to be a wonderfully shy vine, hiding amid trees and shrubs that act as nurse plants, providing support for the vines. The Tumamoc globeberry (*Tumamoca macdougalii*) is a perennial vine in the gourd family, marked by lacy leaves and a delicate stem. The plant can only be found in the late summer or fall: the stems rise from large tuber-like roots during the summer monsoons. The flower is not showy, but the fruits are attractively red and succulent, dangling festively from the vine. The berries are relished by wildlife[1], so seeing them before the wildlife does is a treat. The immature berries look like tiny green-striped watermelons.

In June 1993, the U.S. Fish and Wildlife Service proposed to take the globeberry off of the endangered list, basing their proposal on a Bureau of Reclamation (BOR) contract to survey and study in the U.S. and Mexico. This 1986 study greatly increased our understanding of the globeberry[2]. The study was required to deliver an opinion as to the potential biological effects of the Central Arizona Project (CAP). The study found that the globeberry is less habitat-specific than was believed at the time it was listed as endangered.

The major habitat of the globeberry is remote desert where few threats exist or are expected. The globeberry has a large, extremely remote range in the U.S. and Mexico, suggesting that significant populations of the globeberry are secure for the foreseeable future[3]. Because populations found during the surveys existed in remote habitats, showed ability to withstand some habitat degradation and did not need a specific habitat, the Service determined that the Tumamoc globeberry did not warrant continued protection of the Act.

If better information had been available at the time the globeberry was listed as endangered, the species might never have received protection under the ESA. Prolonged debates can be avoided for all vulnerable species if better scientific information is available to include the occurrence of species, population size, history of habitat degradation, and how to protect and care for the land. Historically, federal agencies have not requested funding to gather information until there is apparent evidence that plant species are at risk. Organizations like our Arizona Native Plant Society can play an important role by assisting federal, state, and local authorities before they make decisions that will affect plant species.

After listing the globeberry as endangered, the federal government made efforts to do population surveys, life history and biological studies, a transplanting project, and monitoring. These federal projects were a result of Endangered Species Act mandates for informal or formal consultation with the U.S. Fish and Wildlife Service. These surveys, conducted throughout the species range in the U. S. and Mexico, proved the earlier

cont'd. on page 17

LATE SPRING SIGHTINGS

Chris Trask

This past spring, we had an unexpected, late-season show of wildflowers. The magnificent bloom of 2001 was not matched, but the spring show offered more than just a few surprises. The first element needed to anticipate a decent spring bloom was lacking – sufficiently cold, heavy rain in late October to early November. Weather events later in the winter offset that deficiency and gave us a prolonged blooming period that lasted well into May. The unusually cooler weather of late spring provided us with incentive to explore areas that we would normally hesitate to visit at that time of year. One such place is the Deer Creek drainage along the eastern face of the Mazatzal Wilderness.

Variations in elevation and geological features give the Mazatzal Wilderness a diversity of life zones, offering us an opportunity to observe a substantial variety of botanical communities within a short driving distance from Phoenix. Some trails, such as Deer Creek, Barnhart, and City Creek, are easily accessible so we can visit a number of these life zones during a simple day hike.

Recent improvements to the Deer Creek trailhead have made this area more enjoyable for the casual hiker. I visited the Deer Creek trail in early May of this year, taking advantage of the cooler weather to visit lower elevations, anticipating that I could add new species to my already overflowing checklist. After leaving the parking area and just before descending into Deer Creek, I found numerous specimens of White Ball Acacia (*Acacia angustissima*) that I had only found previously in the Devil's Canyon area near Superior.

As I travelled up the trail, I saw numerous, more pedestrian varieties of Grand Collomia (*Collomia grandiflora*), Scarlet Four O'Clock (*Mirabilis coccinea*), and Barestem Larkspur (*Delphinium scaposum*). There were isolated specimens that defied my immediate identification such as Mexican Skullcap (*Scutellaria potosina*), Range Ratany (*Krameria parvifolia*), and Feather Dalea (*Dalea formosa*). I had filled the first page of my notebook by the time I reached the confluence with the northern fork of Deer Creek, far beyond my initial expectations.

Climbing by the creek, the canyon became narrower where the vegetation was dominated by juniper scrub. The increasing sound of cascading water expressed the steepness of the canyon bottom. Just after climbing the first set of switchbacks, the trail passed through a meadow along the south face of the canyon. The meadow was carpeted with poppies and lupines that were well past their prime. A few weeks earlier, this would have been a solid carpet of gold and blue. On occasion, I heard the light snap of a seedpod bursting open, scattering seeds in every direction.

A ledge was the home for a good-sized community of Strawberry Hedgehog Cactus (*Echinocereus engelmannii*). It was time to head back. Just before reaching the wilderness boundary, I noticed a small strike of lavender color close to the ground and I looked more closely. A tall, slender flower with a single stalk had four narrow lavender petals, widely separated, and four sharp, narrow green sepals diagonally between the petals. Perhaps this was something that was in the early stages of withering, but I noticed more specimens scattered over a quarter acre. I knew that I had seen a similar flower along the Salmon River in Idaho the previous year, so I made a reference to that earlier sighting and took more than the usual one or two photos. This flower, I later learned, was another elusive Arizona native, a Diamond Clarkia (*Clarkia rhomboidea*), named after George Rogers Clark. Diamond Clarkia is a suitable companion for the Southwestern Lewisia (*Lewisia brachycalyx*), named after Meriweather Lewis, found nearby along the road

cont'd. on page 17

Sightings (cont'd. from page 16)

leading to the Barnhart trailhead.

Shortly after exiting the wilderness proper, I saw specimens of California Fremontia (*Fremontodendron californicum*) that I'd seen earlier along the Barnhart Trail. California Fremontia is found in four places in Arizona, far removed from the larger community of this species along the Sacramento Valley in California.

My sightings of Diamond Clarkia and California Fremontia, along with my sightings of Leopard Lily (*Fritillaria atropurpurea*) two years earlier, are more than sufficient incentive to revisit the Mazatzal Wilderness at different times during the year. New sightings are more than a remote possibility.

Globeberry (cont'd. from page 15)

assumptions incorrect on the frequency and distribution of *Tumamoca*[4].

The case of the Tumamoc globeberry illustrates how the Endangered Species Act protects species against endangerment until more information is gathered that would prove or disprove whether the organism is endangered. Listing under the ESA provides the impetus and, in some cases, funding for research and species monitoring. Federal protection can be increased or removed in response to this new information.

When the globeberry was removed from the endangered list, buffelgrass was not considered to be a major threat to the Tumamoc globeberry. In Sonora, Mexico[5] millions of acres of globeberry habitat have been bulldozed and converted to buffelgrass. Buffelgrass is invading desert areas in Pima County and, in some places, has established dense patches that are maintained by fire. Several populations have been lost, according to biologist Sue Rutman, who worked on the species in the 1980s. No current evaluation of the globeberry habitat is available.

Footnotes:

[1] Reichenbacher, F.W. Status and distribution of Tumamoc globeberry (*Tumamoca macdougalii Rose*). Tempe, AZ: Arizona State University, Department of Botany. 1985a, 83 pp.; Reichenbacher, F.W. Tumamoc globeberry studies in Arizona and Sonora, Mexico. Final report prepared for the U.S.D.I. Bureau of Reclamation, Phoenix, Arizona. 1990, 109 pp.

[2] Reichenbacher, F.W. Tumamoc globeberry studies in Arizona and Sonora, Mexico. Final report prepared for the U.S.D.I. Bureau of Reclamation, Phoenix, Arizona. 1990, 109 pp.

[3] "Rules and Regulations." Federal Register, 58, no. 116 (Friday, June 18, 1993).

[4] Reichenbacher, F.W. Tumamoc globeberry surveys on the Tohono O'odham Nation, Pima and Pinal Counties, Arizona. F.W. Reichenbacher and Associates report to Bureau of Reclamation, Arizona Projects Office, Phoenix, Arizona. 1987, 27 pp.; Biosystems Analysis, Inc. Surveys for Special Status Plant Species Along the Central Arizona Project, 1987. Phoenix, AZ: U.S.D.I. Bureau of Reclamation, Arizona Projects Office. 1988, 20 pp.

[5] Yetman, D. and A. Burquez. "Buffelgrass-Sonoran Desert Nightmare." The Arizona Riparian Council Newsletter. 7, no. 3 (Autumn 1994).

Barb Skye Siegel and Doug Siegel join the group as they are toasted for being selected as a Dynamic Duo at the Compass Health Care Gala Banquet, September 21, 2003.

They were honored for their continuing work at coordinating the Sonoran Desert Weedwackers. Under their direction for the past three years, this group has been removing invasive buffelgrass and fountain grass from Tucson Mountain Park.

Congratulations Barb and Doug!

THE BIG PICTURE:
Review of the 2003 State Meeting in Oracle, AZ

Priscilla Titus & Nancy Zierenberg

Because ANPS has not held the annual state meeting in the Tucson area in the last 13 years, the board decided to go all-out this year and make it a weekend-long retreat! What better place to spend a crisp September weekend than the base of the Santa Catalina Mountains south of Oracle?

The thirty-five people who participated had quite an enjoyable time together. We heard excellent presentations, were fed good, hearty meals at the Triangle Y Ranch Camp, and were soothed with delightful entertainment around the campfire. Fred Terry, the singing beekeeper from Oracle, kept everyone up past bedtime. Fred regaled us with stories, his creative songs about local fauna and characters, and provided a tasting of honey varieties from desert plants (i.e. saguaro). If you weren't able to join us, Fred will be at the farmer's market at St. Phillips Plaza in Tucson every Sunday with his honey, pollen and CDs!

We learned a lot: desert plant adaptations from around the world, the plight of urban saguaros, what our recent membership surveys revealed, what's happening with Sky Islands monitoring and a new proposed wilderness in SE Arizona, permaculture and restoration efforts along the Santa Cruz River, how to identify grasses, and much, much more. On the field trips, we were graced by lush, green growth from the recent rains, particularly in recently burned areas. Ah, the four-o-clocks! Richard Felger offered discounted, signed copies of his fabulous books. The new and beautiful ANPS T-shirt was unveiled!

We elected three new State board members, presented the 2003 publications awards, and presented an appreciation award to Barb Skye Siegel for whom this year's theme was chosen to honor her broad vision and hard work. Many thanks to all the presenters, field trip leader, workshop hosts, and organizers who made this special event a reality!

The group has not yet decided where to assemble for our next annual meeting, so please suggest a site or volunteer to host next year's meeting! We have a continuity book to help you plan. Perhaps you could plan the annual meeting to coincide with an event in your area so that your local engagement can be enhanced by our help and participation. Send us your thoughts at anps@aznps.org – we can help you put out the word!

. . . BUT WHO IS NANCY Z, YOU ASK ?

Aloha! I'd like to introduce myself . . . I'm the new Administrative Assistant to the ANPS Board, but also to you, the membership. I am keeper of the member database, all ANPS merchandise, and will function as a central communication hub for the society; getting people connected to information and to other people. Need help? Email me at anps@aznps.org or write to the ANPS P.O. Box address.

In celebration of this year's annual meeting and retreat the last weekend of September, we have a new ANPS T-shirt. Using Margaret Pope's Sacred Datura drawing on a dark purple shirt, we've produced a stunning native plant shirt representing many areas of our state. We are reprinting our first shirt, her native hibiscus with twining scarlet creeper on a dark tan shirt that is also a knockout. Please see the ANPS website for pricing and ordering information (www.aznps.org).

If you haven't renewed your membership, you can support ANPS by doing that soon. Several membership categories are accessible on our helpful website. You will receive a reminder next year, the month your renewal is due.

cont'd. on page 19

Nancy Z (cont'd. from page 19)

One more favor – Our snowbird members and those of you who change your address should PLEASE send us a change of address notification before each move. It saves us money if you notify us if your address changes. If you don't, we pay the post office to send your new address to us. USPS tosses your newsletter if they cannot forward it.

Talk about ANPS when you're with your circle of friends and acquaintances. Many people are unaware that ANPS exists and many people are curious about native plants. The Conservation Committee is cooking up lots of fun activities that benefit native plants, ANPS and you. We want you and your friends to be involved.

INTRODUCING OUR NEW BOARD MEMBERS . . .

Kevin Dahl is executive director of Native Seeds/SEARCH, a conservation group working to preserve Native American crop seeds in the U.S. Southwest and northwestern Mexico. He has a degree in ethnobotany from Prescott College, where he also serves as adjunct faculty. He authored *Wild Foods of the Sonoran Desert* and has written numerous popular articles about the indigenous use of plants. Kevin was on the board of ANPS in the 1980s when he served as editor of The Plant Press.

Lisa Floyd-Hanna earned her B.S. in biology and her M.S. in botany from the University of Hawaii. She earned her Ph.D. in environmental, population and organismic biology from the University of Colorado and has held faculty positions in Massachusetts, Colorado, and Arizona. She and co-owner Bill Romme of San Juan Ecological Research in Durango, Colorado have worked various vegetation projects, often related to fire history and fire effects. Currently, she is the Program Coordinator of the Environmental Studies Program at Prescott College, Prescott, Arizona and a Research Associate for the Post Fire Assessments (BAER) at Mesa Verde National Park. Lisa edited Ancient Pinon-Juniper Woodlands: A Natural History of Mesa Verde Country, 2003 and published works relating to the San Juan Mountains' ecology.

Carianne Funicelli, Conservation Chair, is a vegetation ec ogist who works with the Harris Environmental Group, Inc. (HEG), an environmental consulting firm in Tucson, Arizo Carianne specializes in Sonoran Desert plant ecology, and h vast experience in making recommendations for appropriate native landscaping and re-vegetation, in surveying and documenting plant species and communities, and in conducting research projects. Carianne's special interest in saguaro dem graphics and ecology was cultivated during her employment at Saguaro National Park. She earned her B.A. in botany from Prescott College.

Currently, **Erika Geiger** is a Ph.D. candidate at the University of Arizona who has three research projects. She has been quantifying the response of plant communities to fire season and presence of a nonnative grass from southern Africa at the Huachuca Mountains' base. This year, she initiated a field experiment to study germination and longevity of seeds of *Agave palmeri* and is analyzing the distribution of *Eragrostis lehmanniana.* Her undergraduate work includes botany with concentration on grasslands and nonnative species, and invasive plant management. One project as intern with the National Audubon Society Appleton-Whittell Research Ranch, was assisting Dr. Steve McLaughlin (University of Arizona) in compiling a Ranch flora. Her graduate studies focus on range management, particularly long-term changes in plant communities at the Buenos Aires National Wildlife Refuge.

ANPS ANNOUNCEMENTS

Horace Miller Publications Grant: The ANPS is soliciting proposals for the next Grant awards. The deadline for submissions is March 31, 2004. Awards will be announced on June 15, 2004. Please visit our website for more information at www.aznps.org

Volunteer Opportunities:

Legislative Watch: We need someone who can watch for ANPS legislative concerns at the county, state, and national level to alert an ANPS email list of members to solicit their concern or support. (e.g., listing buffelgrass on the Noxious Weed List.)

Grants Search: We need someone to search for grants that match the ANPS mission of education about natural environments. (e.g., workshops for school and community groups)

Outreach Opportunities: Because one of the primary charters of ANPS is education, we need members to notify us of events where we should be present with a staffed display.

For more information about these and other volunteer ANPS opportunities, please contact Marilyn Hanson at mfhanson@mindspring.com, or at the following address:

ARIZONA NATIVE PLANT SOCIETY
P.O. Box 41206, Tucson AZ 85717

BOOK REVIEWS & ANNOUNCEMENTS

Sanders, Jack. The Secrets of Wildflowers. Guildford CT: Globe Pequot Press. 2003, 304 pages. $24.95.

This new wildflower book invites repeated browsing. It cannot be classified as a wildflower identification book, although it can be used that way. It's not a book about ethnography, although you can learn about how human cultures have used plants. It's not a scientific study of flowers either. This book tells stories about wildflowers - interesting facts, how people used them, how they were named, and whether they have native or imported origins. Sanders spices up the mix with quoted poetry. Both the quality color photos and line drawings beautifully illustrate the text.

Organized by blooming season, the author moves us from spring to late summer and fall. Most flowers in the book are from the cooler parts of North America and Europe, although the Arizonan may recognize flowers seen in Arizona's higher country. Sanders describes problems caused by invasive species, such as loosestrife.

Four pages on blue flag iris are an example of the many facets Sanders explores for a single wildflower. Sanders begins by quoting Thoreau: "This is a little too showy and gaudy, like some women's bonnets." The iris description contains findings of an early 20th century naturalist and various aspects of the iris. The next section, entitled *Regal History*, quotes Longfellow, followed by ancient Greek and Egyptian views of the iris, French and English traditions, and the iris's use as food, drugs, and dye. A sidebar describes the iris borer moth. Lastly, Sanders places the common wild iris in context of the 90 genera and 1,800 Iridacea species.

Here are a few fun tidbits from other chapters:

"Wild geranium pollen has a rather unusual color. While pollen grains of most plants are orangish, wild geraniums are bright blue. 'Seen through the microscope, this blue pollen is quite a curiosity,' wrote F. Schuyler Mathews in 1895."

"Tanning flower. Tannin, the substance used in tanning hides in the leather making process, is usually obtained from tree bark. In Ireland, however, there were few trees. In 1727, the Irish Parliament awarded 200 pounds to one William Maple for discovering that the root of tormentil (*Potentilla reptans*) was so rich in tannin it could be used to tan leather."

"Several species of beetles make their summertime home on milkweed and only milkweed. But one variety, *Labidomera clivicollis*, often moves elsewhere for the winter. It seeks out the thick, fuzzy, curled-up leaves of the common mullein as a place to hibernate."

And Agatha Christie's: "Hateful stuff-bindweed! Worst weed there is! Choking, entangling and you can't get at it properly, runs along underground."

This is not a book that most people would read from start to finish, but you would dip into it from time-to-time, finding something new.

Review submitted by Barbara Tellman, frequent contributor, and previous Plant Press editor

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Hagedorn, Herman. The Magnate. 330 pages. $12.00.

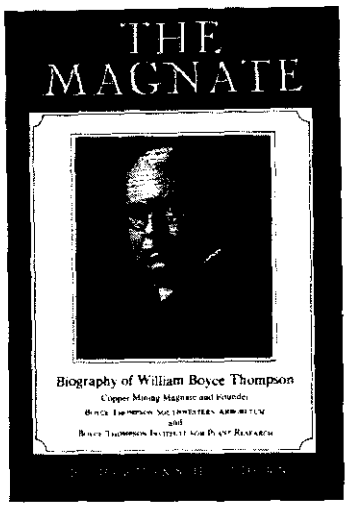
Available once again! It was last reprinted in 1977, and supplies have dwindled in recent years. Even rare book shops were hard-pressed to provide more than an occasional copy of Herman Hagedorn's biography of Arboretum founder Col. William Boyce Thompson: "The Magnate."

Arboretum members who have been requesting this out-of-print book in recent years will be pleased to learn the 330-page volume has been reprinted and is once again available from the Boyce Thompson Arboretum bookstore.

"This is a very good book: both highly readable and highly relevant," said Arboretum Director Dr. William R. Feldman. "I per- ***cont'd. on page 21***

Books (cont'd. from page 20)

sonally found that it was fascinating in three particular areas. First, by describing the Wild West atmosphere of Western Montana during the post Civil War era, the reader is taken to a long-gone time and place of great interest.



"Alder Gulch, the birthplace of William Boyce Thompson and 19th century Helena were rip-snortin', Gilded Era mining towns in the proud tradition of "the Devil take the hindmost" 19th century Americana.

"Second, is of course, the story of the The Colonel himself, what a tremendous blend of pirate and visionary he was! Not until he was forty did he strike it rich, then he was dead at age 61. During his forties and fifties he was one of the wealthiest men in America.

"His relationship with Arizona began when we were just a Territory of the United States, and continued through our "roaring 20s". A Westerner by birth and upbringing, he truly loved the Sonoran Desert, particular this region around Superior.

"The founding and early development of the Arboretum is prominently featured in this fascinating biography. And, finally, there is the Colonel's one appearance on the World Stage with the 1917 relief mission to Russia.

"And what an incredible time to be in St. Petersburg! The summer of 1917, when Russia was ruled briefly by the non-Czarist and non-Communist Provisional Government under Kerensky was a pivotal time in the history of that great and troubled land. This episode is also closely and well-covered by Hagedorn.

Originally published as a hardback in 1935 by Reynal and Hitchcock, the book is now in its second reprint, with permission from McIntosh and Otis. The Arboretum would like to thank self-publishing author Mike Rupp ("Bird's Eye Guide to 101 Birding Sites in Phoenix") for his extensive help and advice in stewarding this book through republication. We also wish to credit Roswell Bookbinding in Phoenix with providing Boyce Thompson Arboretum with a most competitive rate (and exceptional service), allowing us to republish this book at a reasonable cost.

Copies of The Magnate are available for $12.00 each in the Arboretum bookstore, or by mail for $17.00 including all shipping and handling. To order a copy please visit the Arboretum soon, or call bookstore staff at 520.689.2723.

Submitted by Paul Wolterbeek of Boyce Thompson Arboretum in Superior, AZ

Busco, Janice and Nancy R. Morin. Native Plants for High-Elevation Western Gardens. Gene Balzer, photographer. Golden, CO: Fulcrum Publishing. 2003, 356 pages. $29.95.

Enhanced with full-color photographs of 150 plants, Native Plants For High-Elevation Western Gardens by horticulturalist Janice Busco and Nancy R. Morin (Executive Director of The Arboretum at Flagstaff, Arizona) is an informed and informative guide to native plants which is especially appropriate for gardeners and horticulturalists who live in regions of the American West at altitudes of 4,000 to 12,000 feet above sea level and higher. Offering basic information, advice for growing and nurturing, and enhanced with full-color photographs of 150 plants selected especially for their low-maintenance requirements and popularity, Native Plants for High-Elevation Western Gardens is an authoritative and practical catalogue which is especially recommended for high-altitude gardeners who need reliable information and advice on selecting what to plant.

Midwest Book Review has granted The Plant Press permission to reprint its review that appeared on Amazon.com September 15, 2003. Nancy Morin, a published expert on North American flora, is an ANPS Board member.

STRATEGIC PLANNING SUMMARY

Marilyn Hanson, Recording Secretary

Editor's Note: Under the astute leadership of Barb Skye Siegel, the ANPS Board of Directors conducted several strategic planning sessions in 2002 and 2003 to lay the groundwork for building on our organization's 25-year history of successes. We hope you will find the notes by our recording secretary, Marilyn Hanson, informative and inspiring, as well as useful, as each of you helps to strengthen our organization through your participation.

On Saturday, September 14, 2002, eleven members of the ANPS board of directors and advisors met to discuss the strategic direction of the society. Under Barb Skye Siegel's direction, the group reviewed past and present goals, and outlined future goals, including short-term goals for the coming year of 2003. Barb noted that 2000-2001 goals were infrastructure, membership survey, and community outreach. ANPS has begun many activities in these areas.

When Barb joined the group in 1996, the emphasis was on field trips during which members learned about native plants and their taxonomy. She believed the group has lost some of this focus. Connecting with national conservation issues would generate more energy. To help the organization grow, we should involve members in board activities and increase the organization's appeal to younger people. The organization needs to achieve more cohesiveness across the state. While there is a dedicated core of new volunteers, the transition the organization has undergone since Horace Miller's death has been tough because his extensive knowledge has been lost to ANPS.

What are the ANPS goals?

Volunteer recruitment, management and recognition
Volunteers should be recruited for specific projects and be involved on committees at the chapter level. The member list should be available for the board and the chapter officers to use. The membership should be surveyed again. *Accomplished Spring 2003.*

Conservation and preservation of native plants
In the past, ANPS had produced white papers outlining our policies on a variety of issues. Those papers should be revisited. The organization should reevaluate what it is doing for the community. Forming alliances with other conservation groups would strengthen the organization's position. *Reinstated the committee.*

Education and Outreach
We should emphasize education by reaching out to schools and librarians. If ANPS obtains an ISSN for The Plant Press, the publication would join a worldwide database to expose our wealth of specialized plant knowledge to a much broader audience. ANPS could have a native plant certification program to expand the organization's reach to new audiences. *Reinstated the committee.*

Position Statements
The group agreed that ANPS needs to be cautious in making public position statements on conservation issues because we are a not-for-profit entity. The Board must approve all position statements.

Conservation Advocacy
ANPS should be a part of the Native Plant Conservation Campaign. The organization has lobbied in the past for local native plant law. We need an update and to reapply pressure. ANPS needs a more activist role. *Joined Native Plant Conservation Campaign.*

Finances
ANPS may not be generating enough money for the Publication Grant. The organization needs to reevaluate how much to offer in the future while assuring that income is paying for expenses. ANPS gained a little in 2002. A budget could be created after year-end.

Goals for 2003

Develop working committees
Every quarter, committees need to meet face-to-face at various locations around the state. If they meet immediately prior to the board meeting, they could report to the Board the same day. Ideally, they should have at least one member from each chapter. Each Chapter Treasurer should be on the Finance Committee. Meeting dates and times for committee meetings could be communicated to the group via the chapter newsletters and the ANPS website. The committees should decide on how to achieve the following goals:

cont'd. on page 23

Planning (cont'd. from page 22)

Develop a cohesive financial infrastructure
A system of recording inventory and sales is in place at the state level. Chapters need to develop a budget and communicate with the State Treasurer. Chapter Treasurers must establish a recording system to evaluate their purchase and sales of ANPS products.

Establish conservation goals
ANPS should communicate with other organizations about Arizona's Native Plant Law. ANPS should create a white paper to define to what degree we should be involved in native plant conservation issues, both statewide and nationally. ANPS should develop alliances between different statewide organizations, concentrating on invasive species, native plant law, plant diversity, and habitat preservation.

Increase membership
ANPS should heighten our visibility by participating in workshops and neighborhood fairs. Every chapter should have a membership chair. The group could broaden its audience to include schools and libraries. A membership survey would serve to know our audience. Members need incentives to actively participate.

Increase education and outreach
ANPS should increase involvement in formal and informal education, perhaps influencing curriculum. ANPS should increase event participation, such as placing tables at conservation fairs and other public events. ANPS should recommend educational materials and activities to target parents and teachers.

ANPS ARCHIVES

Marilyn Hanson, Recording Secretary

Editor's Note: During her tenure on the Board of Directors, Marilyn has dedicated many long hours digging through dusty boxes to make our historical records highly organized into easily browsable hanging files. It will probably take ANPS awhile to fully appreciate the significance of her efforts at preserving our organization's valuable intelligence. Thank you, Marilyn!

ANPS has accomplished much in the last 25 years. Our work during the 1990s is particularly impressive. Board members may wish to revisit earlier ANPS projects and ideas to see what groundwork was developed on various, ongoing issues and problems.

Unfortunately, we do not have a physical space for an ANPS Library for our resources. If an ANPS member or Committee Chair wants to delve into the past activities of ANPS or check out the activities of other native plant organizations, they may obtain these resources through Nancy Zierenberg, our ANPS Administrative Assistant.

ANPS members are welcome to use these resources to generate ideas for programs or chapter projects.

Categories of ANPS Resources

1. Plant Press issues from 1977-2002
These issues have a wealth of information that is still very pertinent today. Some of the same conservation problems we had ten years ago are still being fought today.

2. Native plant journals from many states from 2000
We receive these issues in reciprocity from other native plant organizations. The issues from other western states might be of particular interest to Board members.

3. ANPS Board minutes from May 1977 to the present
Some of the minutes are missing throughout the 80s, but it is obvious that ANPS has worked hard over the last 25 years to establish policy on a variety of issues. Much of what has been discussed in the past is still pertinent today.

4. Horace Miller's ANPS records from 1977-1999
These notes are extensive and very detailed. In this collection and the previous one, there are policy papers on field ethics, conservation and revegetation. Others are works-in-progress.

5. ANPS Tucson Chapter Newsletters, 1984-1995
A quick glance through these papers reveals a very active chapter working on conservation issues. Over the years, we've had a wide variety of speakers at chapter meetings.

6. Two identical binders with notes about ANPS Annual Meetings, 1984-2002
Along with guidelines and a timeline, each year includes registration and program ideas. There are also financial notes and information about numbers of participants.

CONSERVATION COMMITTEE REPORT

Carianne Funicelli

For the past couple of years, the Arizona Department of Agriculture has added many species to the Noxious Weed List. Many ANPS members have written letters during the comment period to support adding the invasive species of buffelgrass (*Pennisteum ciliare*) and fountain grass (*P. setaceum*) to this list. Dr. Edward Northam, of the Arizona Department of Agriculture, gives this following update:

"Our noxious weed rule-making endeavors have been extended. We originally intended to submit our proposed rule changes to the Arizona Secretary of State's office in February. However, during January a 30-day formal comment period opened for our noxious weed seed rule (this rule regulates noxious weed seed contaminates in bags of planting seed). Due to confusion in the seed production / marketing industry about the differences between our noxious weed rules (R3-4-244 and R3-4-245) and our noxious weed seed rule (R3-4-403), Arizona Department of Agriculture's administrators decided to combine all three rules into one docket and extend the rule-making process for another year. This means all three rules are in the informal portion of the process again, but when we establish the formal process (which includes an official public hearing with testimony from the public) all three rules will be considered at once. When we submit our proposed changes to the Arizona Secretary of State, we will advise everyone who submitted informal comments of our request to establish a formal comment period. Likewise, when the formal comment period is officially designated, we will again inform comment participants when those dates are set. Due to some other agricultural regulatory rule-making efforts during the past 3 months, work on our noxious weed rules has been put aside until summer. Hopefully by late summer we will be able to complete this rule-making effort."

The newly-reformed Conservation Network is off and running! We're working on a Conservation Action Plan to prioritize our efforts and generate supporting tasks for us to accomplish. Our goal is to have tasks at a variety of different levels so that anyone who wants to participate will be able to do so. We meet the last Wednesday of each month (beginning in October) at 58 East 5th Street, Tucson. In order to be a participating ANPS member, it's not necessary for you to attend meetings. You can participate by becoming active in our ANPS conservation activities!

If you would like to be a part of our network, please email me at CFunicelli@heg-inc.com or call 520.991.9101.

SOCIETY NEWS

In memorium: On Monday, September 22, 2003, Denny Ladwig had a fatal heart attack while playing handball. Denny and Lois Ladwig spent many hours creating and hosting our ANPS website. Our deepest sympathies reach out to Lois and her family.

A special thank you: According to our records, when renewing their memberships, the following ANPS members chose to contribute in our higher dollar membership categories (Lifetime, Patron, Sponsor) rather than the "basic" ones (Individual/Family, Senior/Student, Organization, Commercial).

Lifetime Members:
DOUGLAS T. WHITNEYBELL

Patrons:
JOSIAH & VALERIE AUSTIN
FRANCES B. McALLISTER
PAMELA SAALBACH & MARK
JAMES L. TOWNSEND

Sponsors:
MICHAEL McTIGUE
MARGARET B. THOMAS

Please consider upgrading your membership category when you renew your membership so ANPS can grow into a financially nimble organization that can more effectively influence native plant agendas.

Thank you again!: Once again, Doug Green garnered $200 for the ANPS from his former employer, 3M, as an acknowledgement of his volunteer service to the ANPS. It is earmarked for education and outreach.

Congratulations to ANPS: Stone Canyon Adventures chose ANPS as one of its "North America's Desert Experts" because our website showed good content, layout, and ease of use. Stone Canyon Adventures is the definitive site for useful, interesting information about North American deserts. To learn more, visit www.StoneCanyonAdventures.com

EDUCATION / OUTREACH COMMITTEE REPORT

As the new Chair for the Education and Outreach Committee, I encourage you, our ANPS members across the state, to contribute your ideas on education and outreach activities. Join us in our efforts by becoming a member of the Committee!

What is the purpose of Education / Outreach?
First and foremost, our Education and Outreach Committee exists to support the ANPS mission:

To broaden knowledge and appreciation of plants and habitats native to Arizona,
To work to protect those native plants and habitats, and
To encourage landscaping with native plants and other non-invasive plants appropriate to Arizona.

Our committee's focus is to look outward from the ANPS organization to the regions and communities of Arizona, their citizens, and the organizations and institutions that impact the ANPS mission (both positively and negatively). We need to take the diverse work of our membership – especially Chapter and Conservation Committee programs – and project it to target audiences throughout Arizona.

Outreach:
An organization of only 600 or so members is not going to succeed alone. Extending our mission to broader audiences will give us momentum. To begin, we'll target specific organizations with which we can form long-term partnerships and alliances. This direct action – going well beyond relatively passive education programs – will help us succeed. In the past, ANPS benefited from partnering with like-minded organizations. The Outreach agenda will assure that ANPS targets the right groups, systematically reaches out to them and maintains accountability for success. We can help other ANPS chapters, committees, and individual members across the state to meet their agendas by coming together as one team.

Education:
ANPS has the knowledge and mission to inform people outside our organization about native plants and their associated issues in Arizona. Our unique focus forms a strong base for education.

We can apply our expertise to many potential audiences:
- State Legislators and Officers
- County, city and town officials (including zoning boards) who make decisions affecting habitat
- University programs related to our mission and their students
- K-12 education
- Community organizations

Far more challenging, but equally necessary, is to influence how our habitat is being handled in Arizona's burgeoning property development community. We can offer "how to" education and expertise to:
- Developers, landscape designers, builders, and their professional associations
- Homeowners and Homeowner Associations
- Realtors who may influence decisions by new homeowners
- The supporting industries for landscaping: nurseries, landscapers, retail outlets, etc.
- Road and highway departments with beautification programs.

We need your input to set effective targets. We also need to be clear and consistent on the change we want from these groups.

Next Steps:
Our Committee's immediate need is for your input and involvement. Our goal is for all ANPS members across the state to know that they have an active outlet for their native plant interest. You will be a full partner in our Committee's role within the larger ANPS organization.

Building on earlier work of others this year, our Committee will provide a standard display and messaging to each regional chapter for their use in activities and community events. This education and outreach tool consists of a tabletop display board with text and visuals, table banners, literature trays, and state-focused literature that has a consistent ANPS "brand" and message.

Our Education and Outreach Committee is an extension of you, our members. Please share your ideas and become involved if you can. Together we can achieve our mission!

ANPS MERCHANDISE

You can purchase ANPS T-shirts, booklets, and posters from our local chapters or by mail order.

In addition, you can find posters at Saguaro Park - East and West, Tohono Chul Park, the Audubon Society, Arizona Sonora Desert Museum, Organ Pipe National Monument, Boyce Thompson Arboretum, and Desert Botanical Garden (Obtain through Kathy Rice, Phoenix Chapter President, who works there.)

ANPS T-shirts
Sacred Datura: Dark Purple only (Gilden Ultra, 100% cotton) in S, M, L, XL, and XXL
$16.00 each (members), $18.00 (non-members) plus $3.00 shipping / handling.
Please add $1.00 for each additional T-shirt mailed to U.S. addresses. For international orders, please contact Nancy Zierenberg.

ANPS Booklets
Desert Accent Plants, Desert Butterfly Gardening, Desert Bird Gardening, Desert Grasses, Desert Ground Covers and Vines, Desert Shrubs, Desert Wildflowers

Prices per booklet ordered:

Quantity	
1-9	$2.25 each (any combination of titles)
10-49	$1.75 each (any combination of titles)
50+	$1.25 each (any combination of titles)

Price per booklet ordered includes postage for U.S. addresses only.

Non-U.S. Prices (shipped via airmail; no quantity discounts)

Canada/Mexico:	$2.75 each (price includes postage)
All others:	$4.25 each (price includes postage)

ANPS Posters
Wildflowers of Northern Arizona, Sonoran Desert Wildflowers

Retail:
$14.00 each (non-members)
$12.00 each (ANPS members)

Shipping and Handling:
$2.50 for first poster & $.50 each additional poster mailed to the same address (U.S. addresses only)

Wholesale:

10-49	$8.00 each
50+	$7.20 each

Shipping and handling are an additional charge depending on the size of the order. Please contact ANPS for specifics on shipping costs.

Please send your order to:

Arizona Native Plant Society
P.O. Box 41206
Tucson AZ 85717

For order forms, please visit the ANPS website at www.aznps.org

Don't forget people on your list for the upcoming gift-giving season. Thank you for your order!

BOARD & VOLUNTEER PROFILES

ANPS BOARD

Ken Morrow, Queen Creek	Acting President	torote@mindspring.com
Marilyn Hanson, Tucson	Recording Secretary	mfhanson@mindspring.com
Joanne Basta, Tucson	Director, Interim Treasurer	JBasta@theriver.com
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Kathy Rice	Central Arizona Chapter	krice@dbg.org
Jeff Kreamer	Southern Arizona Chapter	jeff.kreamer@wwm.pima.gov

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Linda Wells	Accountant	lindawells@cox.net
Nancy Zierenberg	Administrative Assistant	anps@aznps.org

The Plant Press is published three times a year and is a benefit of membership in the Arizona Native Plant Society.

Thank you Contributors! *Many thanks to the authors, editors, illustrators, photographers, and supporters who contributed to this issue. The knowledge and skills you have shared with ANPS members are valuable and very much appreciated! We especially thank the Arizona Game & Fish Department for its help in our ability to deliver our insert for school children.*

NEW MEMBERS WELCOME

People interested in native plants are encouraged to become members. People may join chapters in Central, Northern, or Southern Arizona, or may be members only of the statewide organization. For more information, write to ANPS at the address below, visit the ANPS Website at www.aznps.org, or contact one of the people below.

State Interim President	Ken Morrow	602.828.8265
Northern AZ Chapter President	Nancy Morin	928.214.2543
Central AZ Chapter President	Kathy Rice	602.808.9304
Southern AZ Chapter President	Jeff Kreamer	520.318.0914

Membership Form

Name
Address
City **State** **Zip**
Phone Number

Chapter preferred: __ State __ Central __ Northern __ Southern

Enclosed:

__ $ 15 Senior (65+)/Student
__ $ 35 Organization
__ $ 75 Sponsor
__ $1,000 Lifetime
__ $ 20 Family/Individual
__ $ 50 Commercial
__ $100 Patron

Mail to: Arizona Native Plant Society
P.O. Box 41206
Tucson AZ 85717
www.aznps.org

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