



The Arizona
Native Plant
Society

In this Issue:

Plant Atlas Project of Arizona

- 1-3 A Partnership for
Plants
- 4-6 PAPAZ Project Areas
- 7-8 Flora of the Upper
Verde River
- 8 Central Arizona Fossil
Creek
- 9-10 The Kane and Two
Mile Ranches
- 11 The Flora of Ruby,
Arizona
- 12 Kanab Canyon and its
Tributaries

Plus

- 10 The Southwest Plant
Conservation Alliance
is Born!
 - 14 Honoring Phil Jenkins
- ### & Our Regular Features
- 6 Spotlight on a Native
Plant
 - 13 Book Review
 - 15 Who's Who at AZNPS
and more!

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Budding Botanist Vera Markgraf collecting plants in Vermilion Cliffs National Monument.

The Plant Atlas Project of Arizona: *A Partnership for Plants*

by Kate Watters¹ and Wendy Hodgson². Photos courtesy the authors.

Arizona is the fourth most floristically rich state in the U.S. with perhaps as many as 4,200 vascular plant species. Geographically Arizona interfaces with five North American deserts, with a tremendous range of landforms and elevations, and corresponding temperature and rainfall regimes. Arizona has a stunning diversity of landforms such as the Grand Canyon and the Colorado Plateau which create numerous habitats for plants. All of these features contribute to the state's amazing diversity of plant life. Not only does Arizona have a high number of species, its plants are unique in the world. Arizona has 178 endemic taxa that grow nowhere else. The responsibility to manage these resources is great. Thirty three percent of Arizona is public land that is managed by several agencies, whose responsibilities are challenging to say the least. Arizona is being impacted by many pressures, including population growth, invasive species, and inappropriate development. Even though population growth is concentrated in urban areas, its effects are nonetheless of consequence on the state's wild lands that are used for recreation and other purposes.

The best land management practices rely on knowing what occurs where, and with plants, floristic studies are the means to provide such information. Jim Miller, Dean and Vice

¹Grand Canyon Trust. ²Desert Botanical Gardens.

continued next page

The Plant Atlas Project of Arizona (PAPAZ) *continued*

President for Science at the New York Botanical Garden stated that “There is urgency in describing the plants of the world. I don’t think we have any capacity to understand and take care of nature unless we can identify it.” Unfortunately, today the significance of floristic studies is undervalued; with less funding allocated to field research and less training for field botanists. This has severely hampered our understanding of what and where species occur in Arizona. Over the last 60 years an average of approximately 12 new species records have been reported. However, many areas have not been surveyed nor had their plants documented with herbarium collections.

In the wake of fewer professionally trained field botanists the importance of citizen involvement is greater than ever. This is why in 2008 we formed the Plant Atlas of Arizona Project, (PAPAZ) comprised of the Grand Canyon Trust (GCT), Desert Botanical Garden (DBG), Arizona Native Plant Society (AZNPS), Museum of Northern Arizona (MNA), Northern Arizona University (NAU), and the U.S. Forest Service (USFS). This partnership trains volunteer botanists to document scientifically the plant diversity of Arizona with voucher plant specimens. This idea comes from a similar effort, the San Diego County Plant Atlas Project, headed by Dr. Jon Rebman, Curator of Botany, San Diego Natural History Museum. That program was developed to document better the flora of San Diego County using trained volunteers.

How do volunteers learn the intricacies of vouchering plant species? They participate in annual weekend botany boot camp training sessions. Botanists-in-training learn plant identification, collection, and processing skills through field and classroom trainings from regional botanists. In turn, they bring high-level technical skills to assist with not only

floristic projects, but also have become critical to monitoring rare and invasive species projects and documenting baseline conditions at springs. Since PAPAZ was developed, the partnership trained nearly 125 volunteers who have donated over 4,000 hours of their time and collected, identified and processed 2,000 plant specimens for regional herbaria. Volunteers have also entered the valuable data provided by the specimens into the web-based Southwest Environmental Information Network (SEINet). SEINet is a database of over two million specimens, primarily from the Southwest, from 34 herbaria (including several Arizona herbaria, Brigham Young University, and New York Botanical Garden). Specimen data, distribution maps, and images are accessible to anyone who has access to a computer, thus connecting plants, collections, and vast amounts of information to a much wider audience than previously possible.

The collective documentation efforts of PAPAZ coordinators and volunteers have greatly improved our knowledge of

plant diversity and distribution in northern Arizona. Collecting trips to Tent Rocks and Cottonwood Basin in the Verde Valley have added 52 species to that area. At Hart Prairie, we began with a list of approximately 240 species and added approximately 30. Updated checklists and photographs of these two projects are on SEINet. Initial surveys in Paria Canyon in 2008 added 27 new species to the Vermilion Cliffs National Monument flora and 37 to Paria Canyon. Those results convinced the Bureau of Land Management and Native Plant Conservation Initiative to fund floristic research in the area.

The future of PAPAZ is unlimited but will require a statewide commitment. The GCT will continue to share expertise with volunteer recruitment, coordination, and floristic projects on the Colorado Plateau. The role of the

Many people have seen their lives transformed by delving into the world of plants.

The Plant Atlas Project of Arizona Projects

Arizona’s varying landscapes contribute greatly to its floristic biodiversity. Each site, unique in topography, elevation, and annual precipitation, denotes its individual characteristics through its assortment of vegetation. Documentation of this vegetation will provide more knowledge and direction as land managers develop future management plans and policies. Numerous opportunities exist to assist with all phases of PAPAZ and help record Arizona’s entire flora. The articles in this issue describe some of the many floristic studies accomplished or underway throughout Arizona. To learn more about PAPAZ collecting sites, volunteer opportunities, or to contact a coordinating botanist, visit the Grand Canyon Trust’s webpage at www.gcvolunteers.org/trainings_botanists.html. — Doug Ripley

right: Field training for Budding Botanists.





from left ASU graduate student Frankie Coburn teaching how to collect plants. Budding Botanist volunteer training opens doors to the plant world.

DBG can be expanded to include the development and management of a centralized website, volunteer education, and coordination of floristic projects across the state. The development of a website will provide up-to-date reports on training, floristic progress and plant lists, educational information, including training handbooks, and volunteer profiles. The AZNPS will raise the profile of PAPA Z through chapter level involvement by offering and coordinating presentations, workshops, and field trips.

Our hope is to extend the regional scope to the entire state of Arizona in cooperation with other important herbaria (including Arizona State University, University of Arizona, and Cochise County) and local organizations. By identifying key areas for floristic documentation throughout the state we will have a more complete record and understanding of Arizona's diverse plant life. Through our project activities, we will also build a constituency of knowledgeable land stewards and conservation advocates, create opportunities for people to learn about and appreciate the native flora, and promote ongoing education and careers in botany and plant conservation by engaging and educating new and existing Budding Botanist volunteers and student interns.

Approximately 35 percent of PAPA Z volunteers have provided continuing assistance in ongoing plant conservation work. Several have become the coordinating botanist for their own flora, and some have independently pursued college and graduate-level coursework in the field of botany following their work with PAPA Z. This is a win-win situation, by providing a means for interested volunteers to develop and hone valuable skills while surveying areas otherwise not visited. Would you like to have your life change for the better, roam over botanically un-chartered territory while unlocking the mysteries of the plants that surround you? Would you like to do this while at the

same time contributing towards a scientifically based product that will help ensure the protection of our amazing plants and plant habitats? If the answer is yes, PAPA Z is for you.

For more information on PAPA Z, visit the Grand Canyon Trust website, www.gcvolunteers.org/trainings.html or for a really quick run-down, try the FAQ at www.gcvolunteers.org/documents/PAPAZFAQ.pdf.



Note from the Contributing Editors

Sometimes there just aren't enough hours in the day, days in the week, weeks in the month, to get everything done that you have on your plate. This issue is in your hands now because of the dedicated board members who found or creatively carved the extra hours from their busy schedules to bring you these stories from the Plant Atlas Project of Arizona. We are grateful to Barb Phillips who got everything started, to the many board members who contributed their time crafting the articles herein, and to Doug Ripley who pulled it all together into one cohesive piece at the end.

Due to various time constraints we have only been able to publish one issue this year and last. We will re-establish our scheduled two issues a year beginning in 2013. If you would like to be a part of our effort, please contact Barb Phillips (bagphillips@yahoo.com) and Doug Ripley (ripley@powerc.net)

Thank you for your continued enthusiasm for Arizona's wealth of native plants and for the Arizona Native Plant Society!

PAPAZ Project Areas

by Connie Cowan, Museum of Northern Arizona. Map courtesy the author.

The Plant Atlas Project of Arizona (PAPAZ) in northern Arizona is proceeding into its fifth collecting season. Numerous volunteers and coordinating botanists, Budding Botanists, have documented the flora at several unique locations throughout Arizona. These research sites have expanded vastly over the years and current projects include Hart Prairie northwest of Flagstaff, House Rock Valley and Kanab Creek on the North Rim, the Verde Valley Botanical Area and Tent Rocks / Cottonwood Basin in the Verde Valley, Grapevine Springs near Prescott and the Upper Basin, just south of Grand Canyon on the Kaibab National Forest. More and more volunteers are being trained in all aspects of researching and recording Arizona's flora. This allows Budding Botanists to participate in every task from the identification and data collection to plant pressing and mounting. At each of these sites, additional species have been discovered that were not previously recorded and the supporting documentation obtained will be extremely beneficial in determining land management and conservation practices. While a number of plant specimens have been collected in past seasons, there are many years of work ahead as well as many other opportunities to assist with PAPAZ.

HART PRAIRIE PRESERVE

Coordinating Botanist: Gisela Kluwin

Hart Prairie is a large, high elevation meadow on the west side of the San Francisco Peaks. Located northwest of Flagstaff and managed by The Nature Conservancy, this 245 acre preserve is surrounded by aspen forest and old growth ponderosa pine, with mixed conifers on the steeper slopes above. This site contains several springs and a stream that supports a unique riparian community within the meadow.

Human influences have modified this preserve in a number of ways. Fire suppression, altered hydrology, and the impacts of domestic and wild ungulates have distorted this setting and are continuing to cause significant changes. The Nature Conservancy is experimenting with various restoration techniques and monitoring the outcomes throughout the landscape. Restoration is important here due to the plethora of species that occupy this preserve. Numerous birds, mammals, reptiles, amphibians, and butterflies have been identified over the years by The Nature Conservancy. Also, close to 300 plant species are known to exist at this preserve, including one of the largest known occurrences of Bebb willow (*Salix bebbiana*). The Bebb willow population is significant not only due to its size, but because it occurs on what is considered the driest known site for the species.

The effects occurring throughout this preserve could be detrimental to the Bebb willow in addition to the other unique species that occupy the landscape. This willow population is serving as an indicator for the overall health of the riparian community. This location has the greatest canopy coverage by Bebb willow than any other population and augments the understory diversity significantly. Other sensitive species here include Blumer's dock (*Rumex orthoneurus*) and Rusby's milkvetch (*Astragalus rusbyi*). Beginning in 2009, Budding Botanists began partnering with The Nature Conservancy to further develop the historical plant list and document the existing species. In 2011, 15 new species were added to the list, for a total of 189 vouchered specimens. The study area has been expanded to incorporate some of the surrounding U.S. Forest Service lands, including both Fern Mountain and Bismarck Lake. The information gathered by the Budding Botanists at this site will assist The Nature Conservancy and U.S. Forest Service in developing land management plans.

VERDE VALLEY BOTANICAL AREA

Coordinating Botanist: Max Licher

The Verde Valley Botanical Area was established to support the management and conservation of the Arizona cliffspice (*Purshia subintegra*), a federally listed endangered species endemic to central Arizona. Located on the east side of the Verde River near Cottonwood, the Verde Valley Botanical Area is under the management of the Coconino National Forest. This site encompasses the northeast portion of the Sonoran desert scrub community and is composed of limestone soils and cliffs.

Several other sensitive species reside in this area including Verde Valley sage (*Salvia dorrii* ssp. *mearnsii*), Ripley's wild buckwheat (*Eriogonum ripleyi*), heath-leaf wild buckwheat (*Eriogonum ericifolium* var. *ericifolium*), Hualapai milkwort (*Polygala rusbyi*), and Tonto Basin agave (*Agave delamateri*). Due to the increase in human population in the Verde Valley, fragmentation and degradation is occurring throughout this plant community, creating impacts on national forest lands and affecting the success of these sensitive plant species. The importance of documenting the extent of these species and developing a better understanding of the biodiversity of this plant community is extremely important now.

A compilation of inventories by former Verde Valley Botanist Bob Denham and by Norm Herkenham of Dead Horse Ranch State Park is currently being used to document the flora. This list contains approximately 533 species of

vascular plants, 92 which were collected by Budding Botanists to date, and five are new additions from 2011. With only 17 percent of the original plant list documented, numerous collecting trips will be necessary for this project area.

TENT ROCKS / COTTONWOOD BASIN

Coordinating Botanist: Max Licher

The Tent Rocks / Cottonwood Basin area, managed by the Coconino National Forest, contains a combination of unique geological features and several perennial springs in the lower elevations of the Verde Valley southeast of Camp Verde. These features, resembling tepees or cones with holes or caverns, have developed over time from physical and chemical erosion of volcanic fumaroles. The fumaroles are the result of volcanic ash falling to a calcium rich water surface, which turns to steam and vents upward through the ash. No other similar geologic formation occurs anywhere else in Arizona, and their location, in such an arid to semi-arid environment, has facilitated the unusual weathering.

The formations vary in shapes and size and are unvegetated, while their surroundings are occupied by a variety of grasses, shrubs, forbs, and cacti, creating quite a contrast. The underlying volcanic tuff soils seem to support an unusually rich flora of both annual and perennial wildflowers. The combination of upper Sonoran desert scrub habitat and the springs adds incredible diversity to this project area. Disturbances, including grazing, recreation, and dispersed camping have impacted the vegetation.

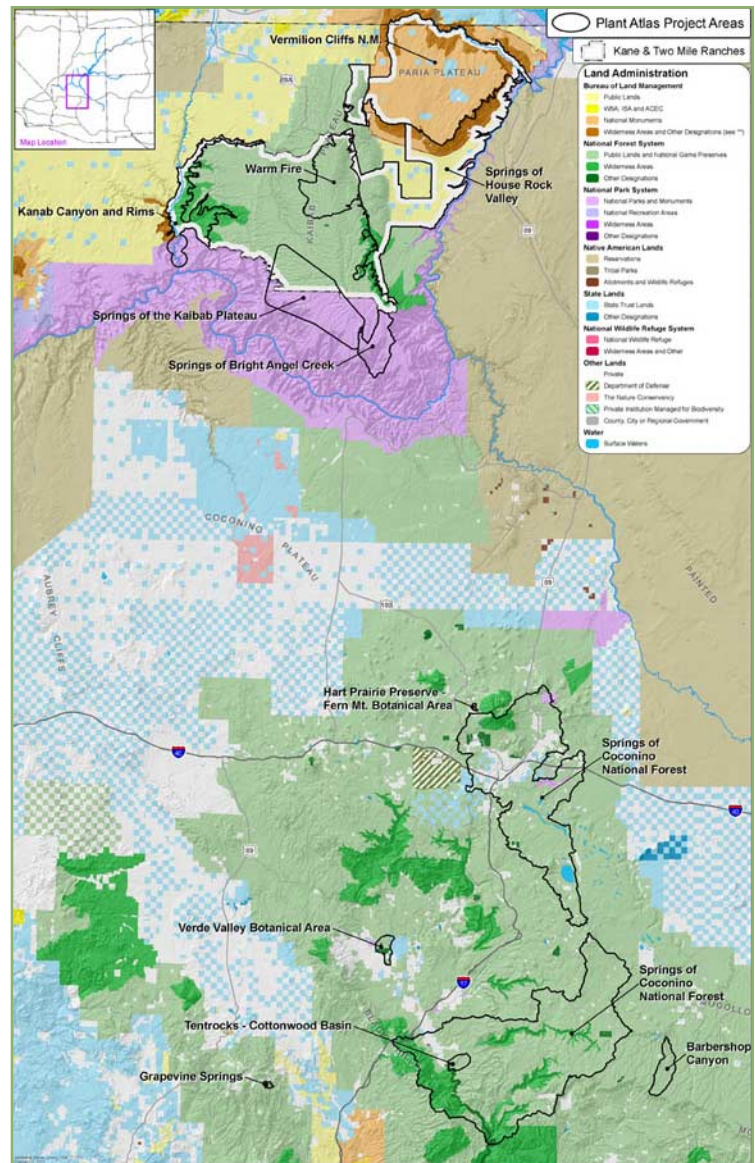
The PAPAZ study area has been expanded to include part of Wingfield Mesa to the west, and the rest of the main wash below both springs down to the Verde River. A list based on observations in the area contains almost 300 species of vascular plants, of which 237 have been documented with vouchered collections. In 2011, six additional species were added to the list. Few species are left to find and collect, but this flora will assist in the management decisions and protection of such an unusual area.

UPPER BASIN

Coordinating Botanist: Kirstin Olmon

The Upper Basin is comprised of pinyon-juniper woodland and ponderosa pine forest interspersed with open meadows and oak woodland. It sits in a topographic depression in the northeast corner of the Tusayan ranger district of the Kaibab National Forest located just south of the Grand Canyon National Park. This area is known for its archeological relicts of the Anasazi and Cohonina peoples.

Only incidental plant collecting has been done in the Upper Basin in the past and it is likely that several endemic and rare species will be identified by the Budding Botanists. The



Map of PAPAZ Project Areas in Northern Arizona.

Kaibab limestone outcroppings provide a unique habitat and could possibly host the threatened Fickeisen Plains cactus (*Pediocactus peeblesianus* ssp. *fickeiseniae*). A total of 274 plant collections have been acquired so far and 69 of these are new taxa to the area. Plans for this season include a complete flora of The Upper Basin, so numerous collecting opportunities will be available at this site.

GRAPEVINE CANYON

Coordinating Botanist: Sue Smith

Grapevine Creek is an upper tributary to Big Bug Creek on the eastern flank of the Bradshaw Mountains, southwest of Dewey. The area was designated a Botanical Area in 1997, due to its perennial creek fed by 12 springs. This designation prohibits livestock grazing, overnight camping, and the use of motorized vehicles.

Perennial springs support a mixed conifer/deciduous woodland in an area otherwise dominated by a chaparral

continued

SPOTLIGHT ON A NATIVE PLANT **Lemon Lily** *by David Stith*

Lemon lily (*Lilium parryi*) is the only true lily (the genus *Lilium*) native to Arizona. It is an herbaceous perennial that inhabits the mid to upper elevations of the mountain ranges of Southern California where it is uncommon and Southeastern Arizona where it is rare. It has also been found in the Sierra Los Ajos in Sonora, Mexico. It is named for Dr. Charles Christopher Parry who was among the first to collect it along with John Gill Lemmon in the San Bernardino Mountains of California in the summer of 1876. It grows primarily along shaded mountain streams but can also be found in bogs and meadows.

In Arizona the species has been reported in the Santa Rita, Huachuca, and Chiricahua Mountains. Accounts from the Chiricahuas and Santa Ritas are sporadic. The majority of the Arizona populations occur in the Huachuca Mountains in

Miller, Carr, Ramsey, and Bear Canyons with the largest population occurring in Miller Canyon. In 1989 an additional population was discovered in Huachuca Canyon.

The stems can grow to a height of six feet and support as many as thirty flowers; however, many plants have only a few flowers. The leaves are mostly lanceolate to narrowly elliptic to oblanceolate. They are alternate in young plants and both alternate and whorled in mature plants. The stem originates from a rhizomatous bulb consisting of segmented scales.



The four-inch trumpet-shaped flowers are lemon yellow in color for which it gets its name. The tepals are often sparsely speckled. The flowers open just before sunset and are deliciously fragrant, attracting hawk moths such as the white-lined sphinx (*Hyles lineate*) and the elegant sphinx (*Sphinx perelegans*) as well as many other insects. In Arizona they bloom in May and June and fruit in July and August.

The fruit are composed of a three-chambered capsule which may contain one hundred seeds stacked like coins within the pod. The seeds are hydrophobic and can be carried away in the current of a stream or blown across the surface of the water. Few of the seeds will ever grow to mature plants.

Predators include gophers which feed on the bulbs, and deer and bear which consume the fruit. Boring insects may also damage the flowers and consume the seeds.

Throughout its range the lemon lily has suffered greatly from human activities. While not on the endangered species list, it is listed as a G3 (Vulnerable Species) by NatureServe and the California and Arizona Heritage Programs. Hence, wherever it is found it should be considered a sensitive species requiring monitoring and protection. It has been and remains the object of restoration efforts in both Arizona and California. Idyllwild, California hosts an annual Lemon Lily Festival.

PAPAZ Project Areas *continued*

shrubland community. In addition to the springs the variation in elevation from 5,100 feet at the eastern entry to the Botanical Area to 6,972 feet at the top of Big Bug mesa results in a uniquely diverse mix of plant species in a relatively small area. The canyon is steep-sided, and it is possible to be standing in chaparral on a south-facing slope looking across the canyon at Douglas-fir (*Pseudotsuga menziesii*) and down into the canyon at Arizona alder (*Alnus oblongifolia*) and Arizona walnut (*Juglans major*). Collecting requires a hardy group willing to hike and explore the area.

Side canyons where springs originate provide habitat for cutleaf coneflower (*Rudbeckia lacinata*) and (*Aconitum columbianum* ssp. *columbianum*). The stream is lined with

golden columbine (*Aquilegia chrysantha*), and damp rock outcroppings support scarlet cinquefoil (*Potentilla thurberi*) and pink alumroot (*Heuchera rubescens*).

The Prescott National Forest manages this 880-acre Botanical Area, protecting and maintaining the riparian area and watershed conditions. No known inventories have been made for this area. A beginning list based on observations was developed in 2010 and a total of 81 plant specimens have been collected, with 67 collected in 2011. As a fairly new PAPAZ site, collecting trips are already scheduled for 2012.



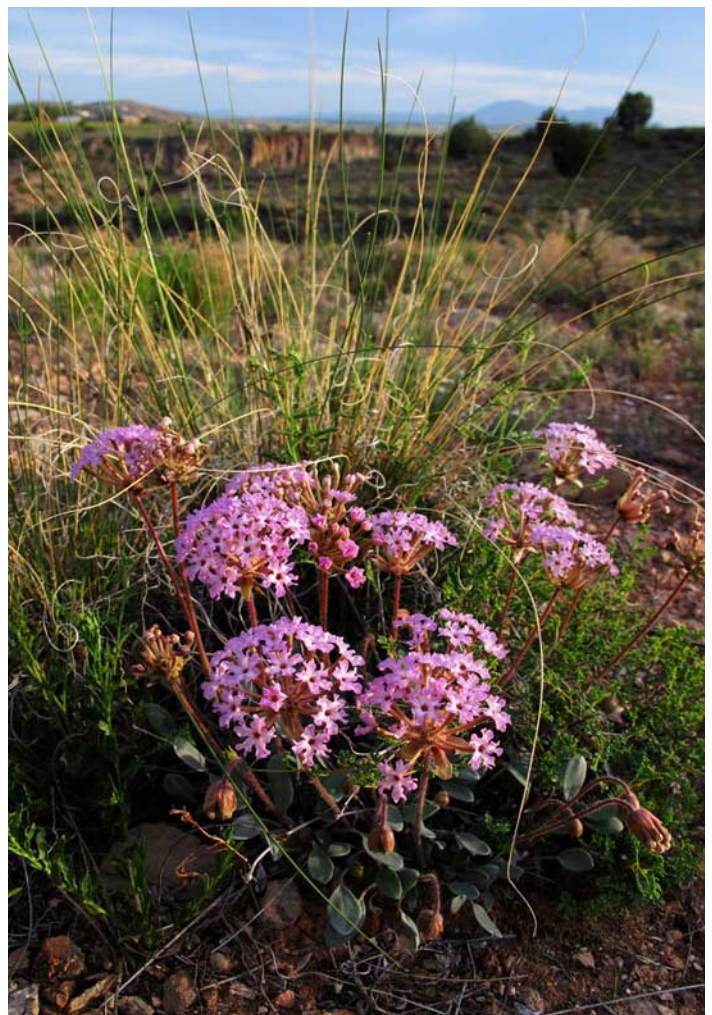
Flora of the Upper Verde River

by Frankie S. Coburn. Photos courtesy the author.

The Upper Verde River flows through the Central Highlands of Arizona from its headwaters southeast of Paulden in the Chino Valley, downstream approximately 45 river miles to the town of Clarkdale, in the Verde Valley. This remote stretch flows through alternating canyons and valleys incised into a mosaic of geologic formations dominated by limestone but interspersed with basalt, granite, Supai and Tapeats sandstones and conglomerates. Biotic communities that cover the hillsides and rims include great basin/plains grassland, pinyon juniper woodland, interior chaparral, desert grassland and upper Sonoran scrub, these all bisected by the riparian woodlands, meadows and floodplains of the Verde River. These various substrates and habitats host a diverse flora of species with affinities for disparate regions that in places form atypical plant associations. On the limestone, Arizona endemics occur including Mearns sage (*Salvia dorrii* ssp. *mearnsii*) and Apache buckwheat (*Eriogonum heermannii* var. *apachense*). The ribbon of green flowing through the desert hills was home to various flourishing prehistoric cultures, provides habitat for abundant wildlife, and is one of the state's richest river ecosystems. A few plant species, including Mearns sage, were likely transported from other regions and cultivated or encouraged near settlements. Since the first communities and ranches showed up in the 1800s, locals have pumped and diverted the river's waters. In 2009, due to growing water demands and depleting water sources in Prescott, large-scale pumps were installed that tap into the Big Chino aquifer, the primary source of Verde River flows. This has caused public debate among communities receiving the pumped water, downstream stakeholders, and those concerned about the potential lasting impacts to the Verde River's ecosystems, thus prompting an abundance of research and active management. Despite the abundance of resources along the Verde and concern over its future, no section has had a complete floristic inventory. The goal of this project, a complete floristic inventory of the Upper Verde River, will be an invaluable resource to researchers, land managers and members of the public and will fill gaps in our knowledge of the flora of the region.

This section of the Verde is located almost entirely within the Prescott National Forest with a small portion in the Coconino National Forest and in numerous private land holdings. The majority is remote backcountry but many areas are easily accessible, offering opportunities from moderate day hikes to multi-day backpacking trips. With few maintained hiking trails, travel is done via unmaintained hiking trails and route finding along the river and rims. From Prescott/Chino Valley access is via Highway 89a to Verde Ranch Road and FR318 Perkinsville Road which runs from Chino Valley to Jerome. Access points from Clarkdale/Cottonwood are off of FR131, Sycamore Canyon

continued



from top *Palmer's penstemon* (*Penstemon palmeri*) and *dwarf sand verbena* (*Abronia nana*).

Central Arizona Fossil Creek

by Wendy Hodgson and Joni Ward, *Desert Botanical Gardens*. Map courtesy the authors.

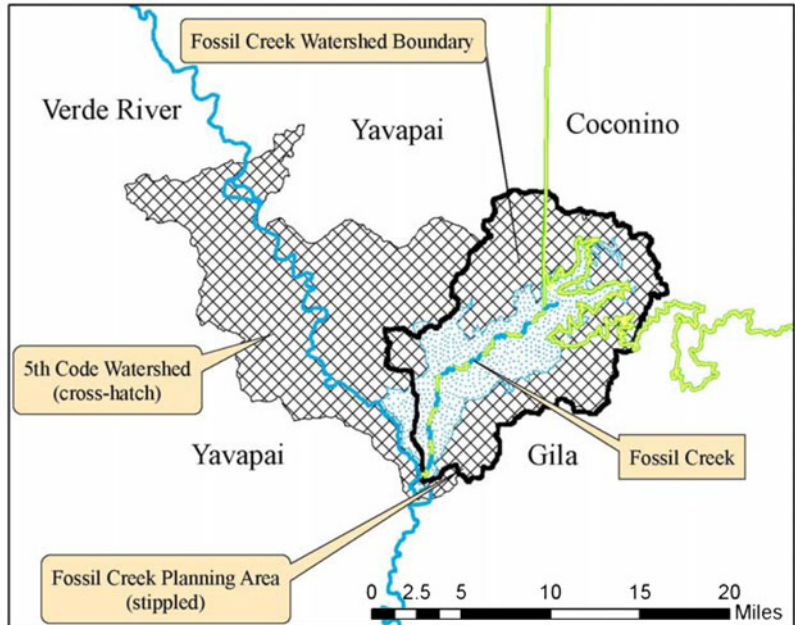
The Fossil Creek Planning Area shown in the map at right (stippled area) from the *Fossil Creek State of the Watershed*¹ includes the Fossil Creek Wilderness on the Coconino National Forest (with over 10,000 acres), the Fossil Springs Botanical Area (about 50 acres) and numerous hiking trails along the Creek and surrounding areas and covers over 36,000 acres. The plant communities range from desert scrub to ponderosa pine/Gambel oak and include riparian communities¹. The Smith and Bender report recommended that the boundaries of the proposed natural area of Fossil Creek follow the 4600 foot contour line on the east and west sides of the springs, with the north and south boundaries to fall about one-half mile above and below the springs. Three hundred fourteen species of flowering plants and ferns from 77 families have been documented from the Fossil Creek Planning Area². A search of SEINet yields a list of 65 species in a two mile radius of the area. While a formal inventory has been conducted for this area, there are gaps in the actual

documentation of the plants with vouchered collections. We hope to support management efforts through a complete vouchered flora survey of the Planning Area. Initially we will focus on a part of the area recommended in the Smith and Bender report with plans to expand into the Fossil Creek Watershed Area as shown in the map with collections in both Tonto and Coconino National Forests.

Our initial trip in March 2012 included 11 collectors and focused on the area around the former Irving Power Station, along the creek and into the surrounding hillsides. A second trip in early May included a smaller number of collectors as we continued along from the Irving Power Station. To date we have vouchered about 100 species.



Fossil Creek Watershed Boundary and Related Boundaries



References

- ¹ Fossil Creek State of the Watershed Report 2005 Northern Arizona University
- ² USDA, Forest Service. 2004. Fossil Creek database (unpublished). Coconino National Forest, Flagstaff, AZ.

Flora of the Upper Verde River *continued*

Road. These roads are maintained but many trails that split off require a high-clearance/4-wheel drive vehicle.

Organized collecting began during spring 2011 and will last until spring 2013. The study includes plants of the riparian zone, canyons, hills and rims to the extent of approximately one km. laterally from the river. Voucher specimens will be deposited at the ASU Herbarium with duplicates being sent to Deaver and Desert Botanical Garden Herbaria. Many collections have been made as a part of this study and past

studies, yet many opportunities to expand the species list exist in under-collected areas and during under-collected times of year. It will take many years to complete the flora, and likely species will be added well into the future.

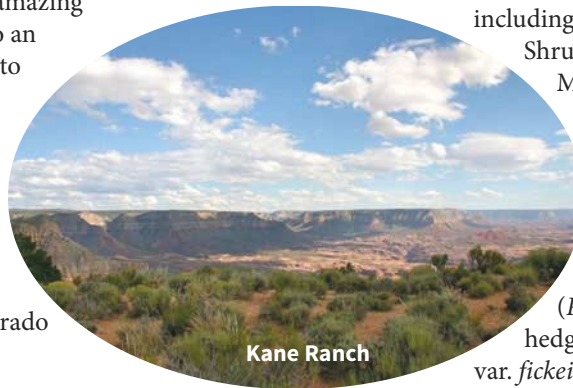
Coordinating botanist and contact for trip schedules and plant list: Frankie Coburn, coburn.frankie@gmail.com



The Kane and Two Mile Ranches

by Kate Watters, Grand Canyon Trust. Photo courtesy the author.

Spanning the lofty heights of the Kaibab Plateau, the sweeping vistas of the Marble Platform and the Vermilion Cliffs, and delving into lush river oases found deep in the canyons of Kanab Creek and the Paria River, the Kane and Two Mile Ranches encompass an area of tremendous ecological importance, significant social value, and spectacular beauty. The Grand Canyon Trust (GCT) and The Conservation Fund jointly purchased the Kane and Two Mile ranches in 2005, with the goal of working with land management agencies to maintain and restore the ecological, cultural, and scenic values of this amazing landscape. The GCT committed to an inclusive, science-based approach to conservation of the Kane and Two Mile Ranches' landscape that brings together citizens, scientists, and government agencies in restoring public lands and catalyzes broader discussions about sustainable public lands management throughout the Colorado Plateau region.



The Bureau of Land Management and National Forest Service are interested in maintaining and protecting the ecological and cultural resources across the Kane and Two Mile Ranches, and we are assisting them by practicing ecologically sustainable livestock management and by adding capacity for research, assessment, and monitoring through our restoration and volunteer programs, and the Kaibab Vermilion Cliffs Heritage Alliance. Our ecological assessment work in 2005 and 2011 is providing a foundation for establishing baseline ecological conditions across the plateau and we are continuing research related to cheat grass spread and modeling conditions in pinyon-juniper woodlands.

With the creation in 2008 of the Plant Atlas Project of Arizona (PAPAZ), the GCT began botanical inventory and survey work associated with establishing baseline conditions at the springs in Kanab Creek, House Rock Valley, on the Kaibab Plateau, and recently initiated a floristic study of Vermilion Cliffs National Monument.

Kanab Creek originates in the Utah Plateau region of southern Utah, carving its way through the Kanab Plateau creating Kanab Canyon, a rugged riparian area, with intermittent to perennial water. Several springs and seeps emerge from the bedrock walls of Kanab Creek Canyon. These rare habitats host diverse species assemblages that are regionally rare. Despite its prominence, geographical location, elevation range and diverse microhabitats, Kanab

Canyon and its rugged east rim country has received little attention from botanists. For example, desert columbine, (*Aquilegia cf. desertorum*), which has been documented throughout Grand Canyon springs, could be a new taxon. Kanab Canyon surveys revealed new populations which will provide material for further analysis.

The House Rock Valley is seated between the Paria Plateau to the north, the Kaibab Plateau to the west, and drops into Marble Canyon at its eastern and southern boundaries. The area consists of two dominant vegetation types, including Southern Colorado Plateau Sand Shrubland and Inter-Mountain Basis Mixed Salt Desert Scrub. The House Rock Valley is home to a large number of key species ranging from pronghorn antelope to the endangered chisel-toothed kangaroo rat. Rare plants include the Brady pincushion cactus (*Pediocactus bradyi*), Fickeisen hedgehog cactus (*Pediocactus peeblesianus* var. *fickeiseniae*), and Mojave indigobush (*Psorothamnus arborescens* var. *pubescens*).

The Kaibab Plateau rises above a sea of windswept grassland, desert scrub, and pinyon-juniper woodlands, and towers over the Grand Canyon's north rim, reaching elevations of over 9,000 feet in some areas. It hosts a number of threatened, endangered, sensitive and endemic species—limited in distribution only to the Plateau itself. Additionally springs comprise some of the most rare and ecologically diverse habitats in the Southwest.

The Paria Plateau falls within the Vermilion Cliffs National Monument, which was designated in the year 2000 for the protection of its spectacular geology, rich cultural history, abundant wildlife, and its unique combination of cold desert flora and warm desert grassland. The monument is very remote, extending across a 4,000-foot elevation gradient, and contains habitats ranging from riparian desert oases in Paria Canyon to slickrock badlands to pinyon-juniper woodlands scattered with ponderosa pine. The area supports a large diversity of plant species, many of which are poorly documented. A working checklist by Larry Higgins and Duane Atwood in 2005 contains approximately 475 species of vascular plants. Initial baseline surveys by GCT in 2008 in Paria Canyon added 27 new taxa to the Vermilion Cliffs National Monument list and 37 to the Paria Canyon specifically. It is also home to four documented special status

continued

The Southwest Plant Conservation Alliance is Born!

by Wendy Hodgson, Desert Botanical Gardens

On December 10-11, 2011, a group of botanists met at the Desert Botanical Garden to discuss rare plant conservation in the American Southwest. The regional focus includes seven states (AZ, CA, CO, NM, NV, TX, UT) and six biological provinces: the Chihuahuan Desert, Colorado Plateau, Great Basin, Madrean Sky-Islands, Mohave Desert, and Sonoran Desert. This area is floristically diverse and includes many rare species, including ca. 700 G1-G2 plant species which represent about ten percent of the region's flora. G1-G2 species are considered rare by NatureServe and its network of state natural heritage programs but 88 percent of these require more information on their status and trends. Botanists are few, new species are continually being described, and plants and their habitats continue to be impacted. For those reasons, it became apparent that a coordinated response to the conservation of the region's rare plants was sorely needed.

After much discussion at the December meeting, the group decided to organize as the Southwest Plant Conservation Alliance whose mission will be to help foster communication among those working with rare plants and provide a new cohesiveness of effort for plant conservation. The new Alliance initially established several organizational and planning steps. They include, but are not limited to, finalizing and posting an updated species list on the

Southwest Environmental Information Network (SEINet), ranking species using a novel but proven method, organizing the next rare plant conference in spring 2013 at the Desert Botanical Gardens (which will be held in conjunction with the Arizona Native Plant Society's Botany 2013 Conference), adding information about the Alliance and its work, including high profile species, on the Desert Botanical Gardens website (www.dbg.org), developing ideas for a Conservation Action Plan, investigating funding sources, initiating outreach to potential partners and stakeholders, and developing educational and outreach tools to reach the public. There are undoubtedly numerous people, organizations, and institutions that would be pleased to help in our endeavors. We therefore need to get the word out about the Alliance which will be a great way to accomplish these important rare plant conservation goals. Connecting not only with other botanists but with people in general — all people — is critical to the success of rare plant and habitat work. Having the Southwest Plant Conservation Alliance, which is closely connected with SEINet, will help us make those connections. Many thanks to the National Park Service who funded the December workshop. Thanks also to John Spence who not only planned and coordinated the meeting but also continues to lead us in the development of our Alliance.



The Kane and Two Mile Ranches *continued*

plant species Welsh's milkweed (*Asclepias welshii*), Brady pincushion cactus (*Pediocactus bradyi*), Paradine Plains cactus (*Pediocactus paradenei*), the Paria Plateau fishhook cactus (*Sclerocactus sileri*) and other near endemics.

In order to fulfill the monument's mission of preserving native plant communities, it is critical to gain a solid understanding of plant diversity, habitat, and distribution across the landscape. Between 2000 (when the monument was designated) and 2007, visitation to the monument more than doubled as recreation opportunities such as backpacking, wildlife watching, and off-road vehicle use have increased in popularity. Increased recreation, continued livestock grazing, the spread of invasive species, and the ever-present threat of a changing climate have the potential to affect native plant communities. Yet, little baseline information is available to describe the current status, diversity, and distribution of native and introduced plant species and what information currently exists is not currently in a format that is usable. Moreover, ever-declining agency budgets preclude the ability of BLM staff to compile

or make available this important information for use in management decision-making.

The Grand Canyon Trust, Desert Botanical Garden and Brigham Young University received funding to develop a knowledge base for conservation-oriented management of native plant communities by compiling a comprehensive plant species list and distribution map for Vermilion Cliffs National Monument. The goal is to make this information available to scientists, managers, and the public by entering new and existing plant collections into the SEINet database. This baseline information will provide opportunities for an improved understanding of the status, diversity, and occurrence of the monument's plant communities, will provide foundational information for future research, and most importantly, will provide valuable information to the BLM that will allow them to make informed decisions on how to maximize protection of the flora the monument was designated to protect through management of recreation, livestock grazing, restoration, and rehabilitation activities.





from left *MacDougal's nipple cactus* (*Mammillaria macdougalii*), *Graham's nipple cactus* (*M. grahamii*), *bloody barberry* (*Berberis haematocarpa*), and *desert mariposa lily* (*Calochortus kennedyi*).

The Flora of Ruby, Arizona

A New Plant Atlas Project of Arizona

by Ries Lindley. Photos courtesy the author.

With almost 114,000 square miles of land area, Arizona still has a lot of frontiers. Understanding our native plants is, of course, one of those frontiers. PAPAZ projects were first started in Northern Arizona and now include areas like Tent Rocks, Hart Prairie Preserve, and the Kaibab Plateau. Ruby, Arizona, is a future project in the southern part of the state.

Ruby is an old mining camp born around a little mining boom in the late 19th century. The town seems to be best remembered today for the brutal murder of Jack Fraser and his brother Al in February of 1920 at their general store. The two brothers had only bought the store eleven days before they were murdered. The killings likely signaled the last gasp of mining as well. Silver and gold mining had given way to lead and zinc mining, and eventually, those metals played out too.

With the mines gone, the town remains. There are weathered buildings, abandoned and broken mining equipment, and various sizes of crushed-rock waste spilled over the landscape. But the heart of the landscape remains. It consists of those gorgeous, rocky hills, generously salted with yellow grasses, deep green oaks, and the changing colors of seasonal plants. There are artificial lakes and a number of little microhabitats created by the accidents and fates of exposure, soil, slope, rocks, and man-made microgeological features.

Today the half section or so of property is privately owned by a family consortium and managed by family member/owners Howard and Pat Frederick. The land is about seven miles north of the Mexican border and about 23 miles west of 1-19 on Ruby Road. The elevation ranges from a low of about 4,100 feet to elevations several hundred feet

higher. The Fredericks consider the flora and fauna there a treasure and the land a key to their preservation.

Arizona Native Plant Society's Nancy Zierenberg, along with a number of plant-loving friends, developed a plant list for Ruby that exhibits a striking diversity of plants for such a small property. Plants found there range from the commonplace, like spidergrass (*Aristida ternipes*) and Mexican blue oak (*Quercus oblongifolia*), to the exotic, like Santa Cruz beehive cactus (*Coryphantha recurvata*). The desert and the oak grasslands meet here, so a casual walk through the land might reveal the desert's Santa Rita pricklypear (*Opuntia santa-rita*) or oak grassland species like MacDougal's nipple cactus (*Mammillaria macdougalii*). To plant lovers, Ruby holds out the promise of tantalizing possibilities. Schott's century plant (*Agave schottii*) is there and common at this elevation, but Ruby is only miles from the rarer smallflower century plant (*A. parviflora*).

Ruby deserves to be well-documented. PAPAZ training instructors assure their students that "if you don't know what you have, you don't know what you're losing." If you would like to be involved with The Flora of Ruby project, please contact Ries Lindley at Ries.Lindley@gmail.com. The first outing will be in late fall or early winter of this year. If you would like to see Ruby without participating in the project, call 520.744.4471. The property is open to the public Thursday through Sunday, and the cost is \$12 per person.



BOOK REVIEW by Douglas Ripley, President, Cochise Chapter, Arizona Native Plant Society

Baboquivari Mountain Plants: Identification, Ecology, and Ethnobotany

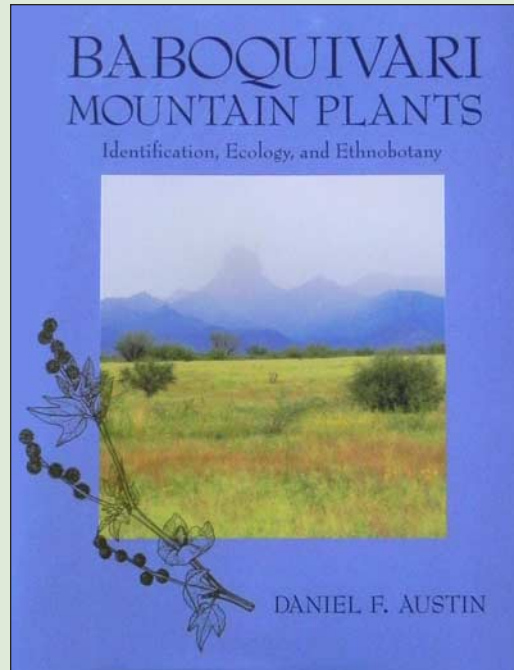
by Daniel F. Austin, University of Arizona Press. 2010. \$79.95, 352 pp.

Baboquivari Mountain, one of the so-called “Lesser Sky Islands,” is considered the most sacred place to the Tohono O’odham people and is located on the western border of the Altar Valley in Pima County, approximately fifty miles southwest of Tucson, Arizona. The highest peak is 7,730 feet high and is a popular site for many climbers and tourists. The region displays an exceptional biological diversity owing to its location at the boundary between the Chihuahuan and Sonoran Deserts Floristic Provinces, while at the higher elevations, representative species of the Petran Montane Coniferous Forest Province and the Madrean Montane Coniferous Forest Province occur.

Dr. Daniel Austin, adjunct professor of plant sciences at the University of Arizona, a research associate at both the Arizona-Sonora Desert Museum and the Desert Botanical Garden, and a professor emeritus of botany at Florida Atlantic University, has resided in Southern Arizona since 2001. Since settling in Southern Arizona he has undertaken various botanical investigations starting with a plant survey of the Buenos Aires National Wildlife Refuge, including the Baboquivari Mountains, and especially the Brown Canyon area leading to the mountain itself.

Baboquivari Mountain Plants: Identification, Ecology, and Ethnobotany, represents Dr. Austin’s commendable effort to provide an extremely interesting account of what he has learned of the plants of the Baboquivari Mountains, including the human influences upon them, and a detailed description of their nomenclature in the three dominant languages of the area: English, Spanish, and Tohono O’odham.

This book does not discuss the entire known flora of the Baboquivari Mountains consisting of 785 taxa. Rather, Dr. Austin presents detailed descriptions of 187 of the most common and obvious species. For each of those he provides the following summary information:



Scientific name
Common name(s)
Botanical description (Including a line drawing)
Habitat
Range
Seasonality
Status (native or introduced)
Ecological significance
Human uses
Derivation of the name
Miscellaneous information

The descriptions presented for each species are of sufficient detail to provide a wealth of useful and often entertaining information without being overly technical. For example, the botanical descriptions provide a

very clear account of each taxon without resorting to highly abstruse terminology. I found the discussions of the ecological significance and human uses to be especially well done and they provided me with numerous useful facts about many plants commonly encountered in Southern Arizona.

Useful tables provide information on the comparison of size and species richness of local floras in the vicinity of the Baboquivari Mountains, linguistic relationships of the indigenous people mentioned in the text, and a pronunciation guide for indigenous languages. An appendix, arranged in alphabetical order by families, provides a complete listing of all known vascular plants of the Baboquivari Mountain chain. Finally a comprehensive index for all scientific and common names makes finding individual plants in the text easy.

Baboquivari Mountain Plants: Identification, Ecology, and Ethnobotany is an important contribution to our understanding of the Arizona flora and the people who have encountered and been influenced by it for centuries. It is written and presented with such clarity and insight that it should appeal equally to professional botanists, serious amateurs, and the casual naturalist.

Kanab Canyon and its Tributaries

by Wendy Hodgson, Desert Botanical Gardens

Volunteers have assisted the Desert Botanical Garden in documenting plants in and along Kanab Canyon as part of an on-going floristic analysis of areas deemed high priority on the Kaibab National Forest, funded by the Forest Service. Kanab Creek Wilderness alone encompasses over 68,000 acres; Kanab Creek, a perennial stream for much of its lower length, originates 50 miles north of the Wilderness boundary in southern Utah. There are several secondary drainages that flow into Kanab Creek from both its east and west side. Not only is the scenery unmatched, but the plant life is also diverse — what more can a botanist ask? Yet, only a handful of botanists have documented the plants from this area. With the help of PAPAZ volunteers and others, including those involved with monitoring the area's springs, we are continuing to understand and document its plants.

Budding Botanists Vera Markgraf and Winnie Taney assisted Barb Phillips and me in collecting 270 collections representing 107 taxa (including many cacti) 17-21 June 2010, from Sowats Point, Jump Up Point, Horse Spring Point, and neighboring rim areas — some of the most visually stunning areas in the state. Included in these collections was the rare and easily overlooked Darrow's buckwheat (*Eriogonum darrovi*), a species of concern in Nevada and Arizona. Duplicate collections with photos and labels were distributed to the herbaria at Northern Arizona University, the Northern Arizona Museum, and the U.S. Forest Service when adequate material was available. The flora will be downloaded to the Southwest Environmental Information Network (SEINet) and will continue to be maintained, added to, and edited for accurate nomenclature and information so as to provide the only known working floristic list of Kanab Canyon and its tributaries.

Although collections made in June 2010 have added significantly to those previously collected in other parts of the Wilderness Area, there remain extensive areas both along and below the rims that are in need of further plant exploration and documentation (Hodgson 2010). The threat of expanded uranium ore mining at known breccia sites warrants botanical inventories for rare plants such as *Rosa stellata* ssp. *abyssa*.

The continued collaboration and efforts to assess, monitor, and document springs habitats and the plants they support must continue through the combined efforts of the U. S. Geological Survey, Kaibab National

Forest, Bureau of Land Management, Grand Canyon National Park, Grand Canyon Trust, and Desert Botanical Garden (US Forest Service 2009). Very little is known regarding species of concern in or near federal lands available for mineral (uranium resources) development, including 1) what exactly grows at these sites, including sensitive species and their abundance; 2) sensitivity and potential chemical toxicity of the plants (rare or not) to uranium; and 3) present uranium concentrations in plants and potential effects (Bills *et al.* 2011). PAPAZ provides important baseline data by having ably trained volunteers help botanists document plants within these and other areas of the state with high quality, data-based (SEINet) herbarium specimens, thereby effectively determining what exactly grows at particular sites.



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Kanab Creek Wilderness. Courtesy U.S. Forest Service, Southwestern Region, Kaibab National Forest

Honoring Phil Jenkins

by Douglas Ripley

Earlier this year Phil Jenkins, the longtime Senior Curatorial Specialist at the University of Arizona Herbarium, retired. During his 17 years working at the UA Herbarium, Phil provided invaluable assistance to many members of the Arizona Native Plant Society and others needing help in identifying their plant collections.

Phil's interest in biology dates from his preschool years on his family's farm in Eastern Washington. His mother believed early on that he would become an ornithologist, but when it came time to go to college he found himself switching his major from music to biology to art and finally back to biology and plants.

He began concentrating his interests in botany in the 1970s and began his career working for the U.S. Forest Service where he was able to take biology classes in his spare time. He began his formal training in plant systematics with Ronald Taylor at Western Washington University, which he enjoyed immensely. In 1978-1979 he worked in research projects at the University on Lycopodium diversity and the importance of the lichen *Usnea oregana* as a nitrogen fixer. Both studies took place on a recent lava flow from Mt. Baker, Washington.

In 1979, he was offered a position with the Forest Service in Springerville, Arizona. Recognizing his growing knowledge of plants the Forest Service assigned him tasks that involved doing vegetative surveys, writing environmental impact statements, and designing prescribed burning projects.

Two years later, he accepted a job with the research branch of the Forest Service, specifically the Rocky Mountain Forest and Range Experiment Station Fire Project in Tempe, Arizona. That project studied fire history, fire behavior, the affects of fire on wildlife and vegetation, and then made management recommendations to the National Forests. Again, he was assigned those jobs that involved vegetation surveys and plant identification, and was also given the responsibility of care and management of the Station's herbarium.

In 1986 he came to Tucson to continue his education while working as a biological consultant with a Tucson firm. As part of that employment he was the senior author of three reports for the U.S. National Park Service. Other



work as a consultant included surveying locations, population changes, and ecology of rare, threatened, endangered or candidate plant species for the U.S. Fish and Wildlife Service and the Forest Service. During this time he began volunteering with Paul Martin's project to update Howard Scott Gentry's Rio Mayo Plants (Carnegie Institution No. 527, 1942). His main function in that project was the identification of collected specimens that required many very enjoyable trips to the mountains and coast of western Mexico.

Phil eventually completed the bachelor's and master's degrees in biology from the Department of Ecology and Evolutionary Biology at the University of Arizona. His master's degree research involved the systematics of the genus *Browallia* (Solanaceae) under the direction of Professor L. McDade. Along with Tom Van Devender, Phil discovered and described a new species of *Browallia* (*Browallia eludens*), a rare plant known in Arizona only from Santa Cruz County and several populations subsequently discovered in Chihuahua and Sonora, Mexico.

Phil began his career at the UA Herbarium in January 1992, where he worked for Charles Mason until his retirement in July 1992. In addition to his tireless efforts to help identify plants for members of the general public, students, government agencies, and scientists, Phil was responsible for overseeing the curation of the UA Herbarium's approximately 400,000 vascular plants, approximately 15,000 seed collections, approximately 5,000 mosses and lichens, and a mycological herbarium.

We offer all best wishes to Phil in his retirement and extend to him the gratitude of the Arizona Native Plant Society for his years of support and assistance to our members.

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