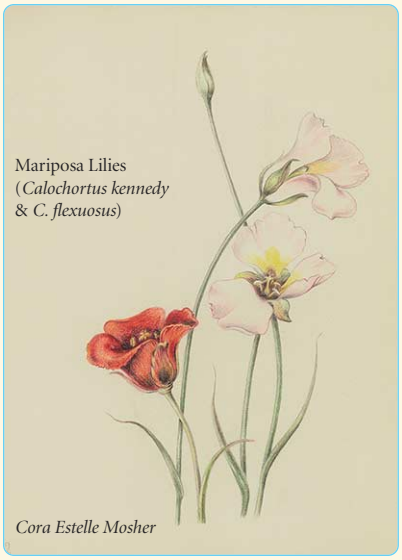

Plant Press Arizona

THE ARIZONA NATIVE PLANT SOCIETY

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A Plant Press Arizona Potpourri

Plus

With Regular Features

Even as the popularity of native plant gardening continues to grow, there are still nurseries who cling to a handful of introduced species as if they are the only plants on earth. BUT nurseries can also be made to change, as growers will always want to produce what sells. Above: The glorious vervain (*Glandularia gooddingii*, photo: Jack Dash) vs. the introduced West Indian lantana (*Lantana camara*, inset photo: Sue Carnahan). See page 3 for the article.

A *Plant Press Arizona* Potpourri

by Doug Ripley, Arizona Native Plant Society, Cochise Chapter

We hope you enjoy this issue of *Plant Press Arizona* which presents articles on a variety of native plant issues rather than focusing on a central theme as we have done in recent years. In this issue we provide two papers by Jack Dash. The first provides useful suggestions for the specific types of native plants one can use in their gardens rather than relying on non-native species. In the second, Jack presents suggestions for using crop wild relatives (CWR) in vegetable gardening. Glenn Rink provides an interesting discussion concerning the distribution of two native plants that have arrived in the Flagstaff area from the East in recent years. Frank Reichenberger and Ries Lindley discuss the preliminary results of a little study they described in the previous issue of *Plant Press Arizona*. In their study they endeavored to determine the flowering and leafing sequence (i.e. which comes first in the spring: flowers or leaves?) of the major deciduous Arizona riparian trees. Finally, we take a colorful visit to our neighbors to the south where Tom Van Devender presents a highly informative bilingual paper on the Cacti of the Río Moctezuma Subbasin, Sonora, Mexico.

President's Note

by Douglas Ripley jdougripley@gmail.com

We extend end of year greetings to everyone and all best wishes for the New Year. The "native plant business" for the Arizona Native Plant Society chugged along in good form in 2023. However, unlike the previous year, the extreme drought and practically nonexistent monsoon season in 2023 certainly diminished our enjoyment of the native flora in most parts of the state. The rain gauge in my garden in Cochise County recorded a little over seven inches of rain for the year as compared to over twenty-two inches in 2022. Fortunately, there are typically native plant botanical displays to enjoy even when the flowering season is diminished due to lack of moisture. One of my favorite species in this category is the quite common riparian Fremont Cottonwood (*Populus fremontii*) which my wife and I had the pleasure of seeing this autumn in its full golden foliage along the Gila River in Graham County.

Membership and Budget

We were pleased with the continued growth in our membership in 2023 with over 175 new members joining, coupled with the formation of three new chapters in the past two years as explained in this issue of *Plant Press Arizona*. Fortunately, our financial situation is solid thanks to the skillful and conscientious oversight of our budgets during the past ten years by our recently retired treasurer, Diane Kelly.

Thankfully, Diane was replaced earlier in the year by our new treasurer Andrew Gourevitch who enthusiastically started his new job recently and whom I am sure will keep the Society on track financially. Finally, many members have made generous contributions to the Society during the year either as separate donations of cash or, in one case, as a used car, or in conjunction with their membership renewals. For all this we are profoundly grateful as such generosity will significantly strengthen our organization and expand the services we can offer.

Agenda for 2024

A big agenda item for the new year is our annual Botany Conference. Unfortunately, we are having to reschedule the conference from the previously announced April 2024 date due to several unforeseen conflicts. We should be able to announce the new date and other details for the rescheduled conference shortly. A feature of the 2024 conference will be the voting by the membership (either in person at the conference or remotely for those who cannot attend) for individual Society offices and for the individual members of the Board of Directors. I ask all Society members to consider taking a more active role in the society by volunteering to run for one of the several vacancies we currently have. You can find out more details about any Society position by contacting me or any current Board of Directors member.

Summary of Events for 2024

We anticipate in the new year that we will continue the many activities and products that the Society has developed and offered over the years. Those include individual chapter monthly meetings, chapter field trips, the annual late summer three-day field trip to the Chiricahua Mountains, training classes such as plant identification classes offered in cooperation with the University of Arizona Herbarium, and the publication of our semi-annual journal *Plant Press Arizona* and our quarterly *Happenings* newsletter.

2024 National Native Plant Month

Starting in 2022, the U.S. Congress has annually passed a resolution declaring April as National Native Plant Month. The Arizona Native Plant Society formally expressed its support for the resolution in 2023 and Governor Katie Hobbs declared via an official proclamation April 2023 as Native Plant Month in the State of Arizona (see p. 14). A similar resolution is planned for 2024 by Senator Mazie Hirono (D-Hawaii) and Senator Mike Braun (R-IN). Details about the resolution and responses to it by individual states can be found here: **https://www.nationalnativeplantmonth.org/**. It seems to me that our Society should think of ways we can use this designation to support the conservation of native plants in Arizona. I welcome any ideas members may have to support this effort.

I will close with all best wishes for the new year and thanks for your continued support of the conservation and enjoyment of Arizona's magnificent native flora.

Fremont's Cottonwoods (*Populus fremontii*) along the Gila River flowing through the Gila Box Riparian National Conservation Area, Graham County. First View: Looking to the northeast. Second View: Looking to the southwest. *Photo Credit: Doug Ripley*


Figure 1. Crimson Fountain Grass (*Pennisetum setaceum*). Figure 2. Bull Grass (*Muhlenbergia emersleyi*). Credits: Max Licher.

Native Alternatives to Common Non-Native Landscaping Plants

by Jack Dash[1]

Readers of the *Arizona Plant Press* aren't likely to need much convincing, but when advocating for native landscaping plants it's not uncommon to be faced with the question of, does it actually matter? Does it really make a difference in the backyard biodiversity of my yard? Will the birds and bugs actually notice? The answer is unequivocally, yes. Native plants have evolved within their respective ecosystems over the course of millenia, becoming ideally suited to withstand particular selection pressures and conditions of temperature, rainfall, and soil. But they have not evolved alone. Alongside the plants, a variety of organisms ranging from fungi and bacteria to reptiles, birds, and mammals have evolved to utilize the food and shelter created by the plants that grow near them. Gila woodpeckers (*Melanerpes uropygialis*) are well-adapted to carving out nests in the trunks of saguaros (*Carnegia gigantea*), rufous hummingbirds (*Selasphorus rufous*) perfectly time their long migrations to the availability of certain nectar plants like ocotillo (*Fouquieria splendens*), and Yucca moths (*Tageticula* spp.), each specializing on its own species of yucca, mature into adults just as the flowers, into which they will insert their eggs, begin to appear.

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These are just a few of the multitudinous, impossibly complex, and poorly understood relationships between living beings in the Southwest, and our poor understanding or outright ignorance about these types of relationships is all the more reason not to disturb them anymore than they already have been. Planting the correct native species in the right location will grant wildlife value and ease of cultivation to your yard that is not possible with poorly adapted non-native plants.

Now the good news is that the Southwest provides no shortage of species to choose from. With thousands of native plants, many hundreds of which can be found as seed or starts from local growers, every shape, size, texture, and color of plant that any gardener could ever need can be found right here amongst the diverse and distinctive flora of the Southwest. As you begin your journey into the world of native plant gardening you are more likely to be overwhelmed by the wealth of options than frustrated by the lack of choices for your landscape.

A yard full of non-native plants can be visually beautiful, it's true. But this beauty only serves to obscure what is ultimately, a lovely wasteland. With that said, a garden populated by native plants can also play host to a few species from

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Figure 3. Oleander (*Nerium oleander*). Credit: Jack Dash.
Figure 4. Arizona Rosewood (*Vauquelinia californica*). Credit: Leslie Landrum


Figure 5. African Sumac (*Searsia lancea*). Credit: Heather Elke
Figure 6. Desert Willow (*Chilopsis linearis*). Credit: Sue Carnahan


Figure 7. Yellow Bird of Paradise (*Erythrostemon gilliesii*). Credit: Liz Makings Figure 8. Prairie Acacia (*Acaciella angustissima*). Credit: Jack Dash

Native Alternatives to Common Non-Native Landscaping Plants

continued

elsewhere. Perhaps, like many gardeners, you want to grow fruits and vegetables to provide nutritious and tasty food to your loved ones. The water saved by utilizing native species will ensure that needier fruit and vegetable cultivars can be grown without breaking the bank, while the pollinators attracted by native plants will likely find their way to your squash and tomatoes, particularly if you cultivate heirloom varieties with a long history in your area. Many native plants also produce edible fruit and foliage, and in coordination with fruit trees and vegetables will ensure an abundant backyard bounty. You may also have an affinity for potted tropical plants, showy annual bedding flowers, or a species from back home that you feel you simply can't live without... and that's ok. There's no need to be dogmatic.

However, it is essential that you do your homework and avoid plants that may become invasive. Some of the most pernicious weeds in the Southwest, from fountain grass (*Pennisetum setaceum*) to tamarisk (*Tamarix* spp.) were intentionally introduced as landscaping species, and have since "hopped the fence" and displaced or eliminated native plants, pollinators, and wildlife from their former homes. And who knows, with time you may find that you lose interest in those non-native species you thought you needed as you see the myriad benefits native plants will lend to your landscape.

Native Alternatives to Invasive species

Even as the popularity of native plant gardening continues to grow, there are still nurseries and landscapers who cling to a handful of introduced species as if they are the only

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Figure 9. Bermuda Grass (*Cynodon dactylon*). Credit: Max Licher. Figure 10a: Trailing Grama (*Bouteloua diversispicula*). Credit: Sue Carnahan. Figure 10b: Curly Mesquite Grass (*Hilaria belangeri*). Credit: Sue Carnahan. Figure 10c: Vine Mesquite Grass (*Hopia obtusa*). Credit: Max Licher.

Figure 11. Italian Cypress (*Cupressus sempervirens*). Credit: Sue Carnahan. Figure 12. Arizona Cypress (*Hesperocyparis arizonica*). Credit: Max Licher.

Figure 13. Chinese Elm (*Ulmus parvifolia*). Credit: R. Grundy. Figure 14. Canyon Hackberry (*Celtis reticulata*). Credit: Max Licher

Figure 15. Wax-leaf Privet (*Ligustrum japonicum*). Credit: Sue Carnahan. Figure 16. Sugar Sumac (*Rhus ovata*). Credit: Max Licher.

Figure 17. Heavenly Bamboo (*Nandina domestica*). Credit: Paul Rothrock. Figure 18. Red Barberry (*Mahonia haematocarpa*). Credit: Max Licher.

Figure 19. Oriental Arborvitae (*Thuja* spp.). Credit: Kansas Forest Service. Figure 20. Rocky Mountain Juniper (*Juniperus scopulorum*). Credit: Max Licher.

Figure 21a. Southern Live Oak (*Quercus virginiana*). Credit: Anne Barber. Figure 21b. Texas Live Oak (*Quercus fusiformis*). Credit: Anthony Mendosa. Figure 22. Emory Oak (*Quercus emoryi*). Credit: Max Licher

Figure 23. West Indian Lantana (*Lantana camara*). Credit: Sue Carnahan. Figure 24. Vervain (*Glandularia gooddingii*). Credit: Jack Dash.

Figure 25. Red Push Pistache (*Pistacia* x Red Push). Credit: Sue Carnahan. Figure 26. Velvet Ash (*Fraxinus velutina*). Credit: Max Licher.

Clockwise from top left: Figure 27a. Afghan Pine (*Pinus brutia* var. *eldarica*). Credit: Max Licher. Figure 27b. Aleppo Pine (*Pinus halepensis*). Credit: Edward Gilbert, Wikipedia. Figure 28a. Ponderosa Pine (*Pinus ponderosa*). Credit: Kirstin Phillips. Figure 28b. Pinyon Pine (*Pinus edulis*). Credit: Max Licher.

Native Alternatives to Common Non-Native Landscaping Plants

continued

plants on earth. A perusal of your local garden center or a drive through any suburban neighborhood will turn up a plethora of introduced species that ought to have disappeared from our landscapes long ago. As much as the dedicated native plant gardener might be tempted to sneak out at night and fell their neighbors African sumac (*Searsia lancea*) or yank their heavenly bamboo (*Nandina domestica*) out by the roots, it is much better, for mental health and domestic bliss, to simply lead by example. Even the most stubborn snowbird or intransigent HOA board may be won over to the cause of native plants through a quick fence-side conversation or an invitation to tour a yard populated with thriving native specimens.

Nurseries can also be made to change, as growers will always want to produce what sells. If customer after customer comes in looking for native landscaping plants,

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Figure 29. Pink Muhly (*Muhlenbergia capillaris*). Credit: Stickpen, Wikipedia. Figure 30. Plains lovegrass (*Eragrostis intermedia*). Credit: Patrick Alexander

Figure 31. Moroccan Mound (*Euphorbia resinifera*). Credit: Liz Makings. Figure 32. Claret Cup Hedgehog Cactus (*Echinocereus triglochidiatus*). Credit: Patrick Alexander.

Figure 33. Argentine Saguaro (*Leucostele terscheckii*). Credit: Stan Shebs, Wilipedia. Figure 34. Saguaro (*Carnegia gigantea*). Credit: Sue Carnahan.

Figure 35. Vinca (*Vinca major*). Credit: Max Liche. Figure 36. Dayflower (*Commelina erecta*). Credit: Sue Carnahan.

Figure 37. Snapdragons (*Antirrhinum* spp.). Credit: Haplocromis, Wikipedia. Figure 38. Penstemons (*Penstemon parryi*). Credit: Max Licher.

Figure 39. Mediterranean Fan Palm (*Chamaerops humilis*). Credit: Ann Barber. Figure 40. Arizona Fan Palm (*Washingtonia filifera*). Credit: Max Licher.

Native Alternatives to Common Non-Native Landscaping Plants *continued*

and if consumers refuse to buy the same old introduced plants these nurseries have been churning out for decades, then they will get the message and alter their practices or risk going out of business with a greenhouse packed to the rafters with poorly adapted plants that nobody wants anymore.

Below is a list of some native alternatives to commonly planted introduced species that can serve as a jumping off point as you scour local nurseries and rummage seed catalogs to design your landscape.

Introduced species	**Native alternative**
fountain grass (*Pennisetum setaceum*)	bull grass (*Muhlenbergia emersleyi*)
oleander (*Nerium oleander*)	Arizona rosewood (*Vauquelinia californica*)
African sumac (*Searcia lancea*)	desert willow (*Chilopsis linearis*)
Yellow bird of paradise (*Erythrostemon gilliesii*)	prairie acacia (*Acaciella angustissima*)
Bermuda grass (*Cynodon dactylon*)	trailing grama (*Bouteloua diversispicula*), curly mesquite grass (*Hilaria belangeri*), vine mesquite grass (*Hopia obtusa*)
Italian cypress (*Cupressus sempervirens*)	Arizona cypress (*Hesperocyparis arizonica*)
Chinese elm (*Ulmus parvifolia*)	canyon hackberry (*Celtis reticulata*)
wax-leaf privet (*Ligustrum japonicum*)	sugar sumac (*Rhus ovata*)
heavenly bamboo (*Nandina domestica*)	red barberry (*Mahonia haematocarpa*)
oriental arborvitae (*Thuja* spp.)	Rocky Mountain juniper (*Juniperus scopulorum*)
southern and Texas live oak (*Quercus virginiana*, *Q. fusiformis*)	Emory oak (*Quercus emoryi*)
West Indian lantana (*Lantana camara*)	vervain (*Glandularia gooddingii*, *G. bipinnatifida*)
red push pistache (*Pistacia* x red push)	velvet ash (*Fraxinus velutina*)
Afghan and Aleppo pine (*Pinus brutia* var. *eldarica*, *P. halepensis*)	pinyon or ponderosa pine (*Pinus edulis*, *P. ponderosa*)
pink muhly (*Muhlenbergia capillaris*)	Plains lovegrass (*Eragrostis intermedia*)
Moroccan mound (*Euphorbia resinifera*)	claret cup hedgehog cactus (*Echinocereus triglochidiatus*)
Argentine saguaro (*Leucostele terscheckii*)	saguaro (*Carnegia gigantea*)
vinca (*Vinca major*)	dayflower (*Commelina erecta*)
snapdragons (*Antirrhina* spp.)	penstemons (*Penstemon* spp.)
Mediterranean fan palm (*Chamaerops humilis)*	Arizona fan palm (*Washingtonia filifera*)

Crop Wild Relatives for Arizona Gardens *by Jack Dash*[1]

Figures courtesy the author

Throughout our history, humans have thrived on a vast diversity of plant foods ranging from the ambrosia-like to the hardly palatable. A diverse dietary base can promote health and food security as options for sustenance will be available even when adverse climate conditions, natural disasters, or human deviousness remove one or more species from our plates. Ironically, as globalization has brought people into contact with an assortment of edible plants completely unknown to their ancestors, the diversity of plant species we ingest has, in many instances, narrowed rather than expanded.

Around the world, diets are becoming more similar and increasingly dependent on a handful of plant and animal species. Of the more than 6,000 plant species cultivated for food around the world, fewer than 200 make major contributions to food production globally, regionally, or nationally. Just 9 species (sugar cane, maize, rice, wheat, potatoes, soybeans, oil-palm fruit, sugar beet, and cassava) account for two-thirds of the total crop production. Researchers have determined that around 30 plants account for 90% of calories consumed, with three plants (rice, corn, wheat) accounting for 60% of caloric intake globally. Scientists have also suggested that a significant percentage of historic cultivars have disappeared from the agricultural landscape. There are around 1,000 different cultivars of bananas, yet how many of us have ever eaten anything other than the standard "Cavendish" cultivar that dominates nearly 50% of the global market?

The advent of large-scale industrial agriculture has made it efficacious for farmers to narrow in on a handful of cultivars of any given species for reasons such as ease of mechanized harvest, maximization of yield, and ability to withstand storage and transport. This comes with a cost of lost genetic diversity in our crops, including traits related to nutrient density, quality of flavor, hardiness, and pest resistance.

Our reliance on a narrowing genetic base of plants for food leaves humanity vulnerable to the vagaries of nature, including diseases like the potato blight, which wreaked havoc in Ireland in the mid-19th century, insects such as the Asian citrus psyllid that's threatening millions of acres of citrus orchards, as well as climate change and drought which have already forced farmers right here in Arizona to abandon cultivation and sell their land to developers. So how might we find our way out of this catastrophe waiting to happen and into a future filled with diverse, resilient, and tasty foods?

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One option is to look back at where our food plants came from in the first place — crop wild relatives (CWR). Crop wild relatives are the ancestors and distant relatives of domesticated agricultural and horticultural crops that still live in nature. These wild plants are often hardier than their cultivated progeny, more disease and pest-resistant than our coddled cultivars, and, in some instances, tastier. Within CWR are alternative gene forms (alleles) that humans can utilize in traditional crop breeding and perhaps transgenic work to help fortify our common crops and to introduce the vigor of wildness to plants that have lost the joie de vivre they once had. This article will highlight just a handful of CWR found right here in Arizona. I will completely ignore Arizona's incredible diversity of wild foods, such as pinyon pine and mesquite, which have potential as crop plants but have never been domesticated appreciably. The following species, chiltepin, tepary beans, and wild almonds, are species with great potential for agriculture and horticulture in Arizona and would be well worth cultivating in any native plant garden.

Chiltepin

Chiltepin (*Capsicum annuum* var. *glabriusculum*) is the wild ancestor of approximately 95% of all chile cultivars, from the sweet and mild bell to the viciously spicy Thai chile and many more. The natural range of chiltepin extends from South America up to southern Arizona, where these wild chiles are most often found in mountainous areas with rugged topography and plenty of vegetative cover. Chiltepins are quite spicy, but the heat dissipates quickly, and they have become a fairly profitable commodity, especially in northern Mexico. Some adaptations this species exhibits to survive in semi-arid environments are

continued next page

Figure 1. Chiltepin (*Capsicum annuum* var. *glabriusculum*).

Tepary beans (*Phaseolus acutifolius*). Figure 2a. Tepary flower. Figure 2b. Tepary fruit and seeds.

Crop Wild Relatives for Arizona Gardens *continued*

their relatively small leaves, a robust root system, and small fruits held upright on the plant so birds can easily locate and eat them. These avian horticulturists will perch on a tree or shrub and deposit the seeds in a neat manure pile. The upshot is that chiltepins are almost always associated with mesquites or various shrubs that provide shade, protection from critters, and insulation from extremes of heat and cold. Because our Arizona chiltepins are at the northernmost limit of the species' range in fairly arid mountain ranges, they are likely to be more cold and heat-tolerant than wild plants from further south. They may also be more resistant to diseases or pests than cultivated chilis; anecdotally, I have seen tomato hornworms preferentially eat cultivated chiles and ignore chiltepins growing in the same garden bed. Aside from these other advantages, chiltepins are unarguably more drought tolerant than cultivated chiles. At the same time, their more robust root system and perennial growth habit mean they can help preserve soil by sending out larger masses of roots and not requiring annual plowing to install new plants.

Chiltepins can be cultivated in a traditional veggie and herb bed or integrated into a mixed-species polyculture with edible plants like mesquite, hackberry, and wolfberry to mimic their natural habitat more closely and support wildlife habitat in your yard. Perhaps best of all, from a gardener's point of view, chiltepin plants are lovely with a neat shrubby form, pendulous white or purple flowers, and upright Christmas ornament-like fruits that mature from green to a vibrant red, sometimes with purple streaks. It is possible that chiltepins hold the key to the continued success of the global chile industry in the face of a changing climate, and they are also lovely landscaping plants that no Arizona gardener should be without. In warmer parts of the state, these perennial shrubs can live many years, and in the northern reaches of Arizona, they can be grown as annuals or cultivated in a pot that you can protect from frost.

Tepary Beans

Tepary beans (*Phaseolus acutifolius*) are wild annual vines that appear in grasslands and oak woodlands following the onset of monsoon rains. These fast-growing vines twine up shrubs, trees, and even grasses, doing their best to find the sun and nutrients necessary to produce a crop of the small, dark beans that will drop and rest in the soil until the next monsoon entices them to germinate and repeat the cycle. Indigenous people have cultivated tepary beans in the Southwest for centuries and developed numerous varieties with larger beans than the wild ancestor and with various colors from white to brown to red and even spotted. Whereas most beans will turn their leaves to minimize sun exposure, teparies do the opposite and track the sun through the long, hot days of summer. Because teparies are keyed to the rhythms of the monsoon cycle, they will grow until moisture begins to slacken off, at which point they will begin to set fruit; in fact, too much water will prevent flowering and fruiting. The beans have a higher protein content than pinto beans, and their drought adaptation makes them ideal for large-scale cultivation in the Southwest. Teparies make a great addition to a "Three Sisters" garden featuring corn, beans, and squash because, like many other legumes, they host nitrogen-fixing bacteria that will add nutrients to the soil, keeping your garden fertile and improving soil quality.

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Figure 3a-Fruit on wild almond (*Prunus fasciculata*). Figure 3b. Black Cherry Fruit (*Prunus serotina*).

Crop Wild Relatives for Arizona Gardens *continued*

The inherent xeric qualities of teparies would suggest that they are ideally suited for crop breeding programs intended to increase the drought and heat tolerance of other cultivated beans such as pintos (*Phaseolus vulgaris*) and lima beans (*P. lunatus*) and, more importantly, teparies can be cultivated on a much larger scale, reducing the water use of Arizona farmers and helping improve soil degraded by nutrient and water greedy crops like alfalfa and cotton. Cultivated or wild tepary beans are commonly available through seed catalogs, and Native Seeds/SEARCH (https://www.nativeseeds.org/), an Arizona-based nonprofit, offers them for sale. These seeds can be sown into the garden in spring among trees and shrubs, where they will quickly grow into a lovely vine. The flowers are small but decorative, and the seeds are a favorite for quail and other backyard birds, making them an excellent choice for a wildlife garden.

Wild Almonds

It is a little-known fact that stone fruits like peaches, apricots, plums, and cherries are all part of the genus *Prunus*, as are almonds. These are all fairly high water-use crops, with one almond taking 1-3 gallons of water to produce, and these trees are subject to various insect issues, including borers, leaf rollers, leafhoppers, and weevils. What is perhaps even less widely known is the fact that Arizona is home to at least four species of native *Prunus*, ranging from the water-loving Black Cherry (*Prunus serotina*) found in moist montane canyons to the xeric desert almond (*P. fasciculata*) found in sandy washes in the western portion of the state. Given the water needs of our cultivated *Prunus* species, the existence of a heat-tolerant, drought-hardy CWR, like desert almond, could hold important implications for orchardists concerned about the future of their trees in a changing climate. In addition, though water is needed, the black cherry is less impacted by insects and diseases than other cherry species. Therefore, it may hold genetic keys to unlocking greater resistance in our cultivated plants.

These two plants are also quite lovely in a backyard landscape, though it is worth noting that the fruit of these species are toxic to humans and domesticated animals in large quantities. The black cherry makes a small tree with elegant sprays of white 5-petaled blossoms and bunches of deep red cherries that persist on the plant for weeks until birds carry them all off. Desert almond is a dense shrub with tiny leaves and hairy fruits resembling miniature peaches. This plant makes an excellent background shrub for a low-water desert garden where it can tolerate reflected heat from walls and nutrient-poor sandy soils.

This article aims to encourage readers to consider the origins of the food they eat and to consider cultivating the native plants discussed in their yards, uniting the disciplines of native plant horticulture and food gardening that are sometimes considered mutually exclusive by native plant enthusiasts. On the contrary, CWR are as valuable to Arizona's ecosystems as any other native plant and just as threatened by habitat loss. As with our other native plants, gardeners can play an important role in conserving these lovely and valuable species that are central to Arizona's ecological and agricultural future.

Acknowledgment

Special thank you to Erin Riordan at the Arizona-Sonora Desert Museum for her extensive knowledge and considerable editorial abilities. This article has been greatly enhanced by her input and expertise.

From left: Sorosporium fungus growing from a tanglehead inflorescence. A field of tanglehead. *All photos by author.*

SPOTLIGHT ON A NATIVE PLANT

by Jack Dash, President, Tucson Chapter, Arizona Native Plant Society. nativeplantstucson@gmail.com

Tanglehead (*Heteropogon contortus*)

Tanglehead is a common grass species that thrives in disturbed areas such as roadsides and trail margins. This plant is easily distinguished from other grasses by its dark inflorescence with long awns that twist together and detach in a cluster, often sticking to pant legs or forming tangled masses in the ground. In the fall, the green foliage turns to a rusty red, and it is a lovely sight when the wind blows through a field of tanglehead. This species is quite drought tolerant and can grow in various soil types from clay to sand, rocky to loamy; its ability to spread by seed can be a blessing and a curse as it can be challenging to control in a mixed grass planting, especially in smaller gardens. These same traits of abundant seedling recruitment and tolerance for disturbed sites make tanglehead an ideal species for restoration projects or filling more extensive areas. Tanglehead is found from about 1,000 to 5,500 feet in the southern and central portions of the state, with a disjunct population around the Grand Canyon.

It is not uncommon to find tanglehead swarming with butterflies, bees, beetles, wasps, and ants when in flower, which is unusual for a grass. This odd trait derives from the fact that inflorescences of tanglehead can become infected by a smut fungus and a resulting sticky liquid that appears irresistible to insects, making this a valuable addition to a pollinator-friendly landscape. Aside from pollinators visiting this viscous exudate, some skipper butterfly species will utilize tanglehead foliage as a caterpillar food source. If you have the space for it, tanglehead is one of our hardiest and most decorative grasses for xeriscaping and has the potential to be as good a pollinator attractor as any wildflower in your garden.

From left: Fly on tanglehead inflorescence. Empress leilia butterfly on a tanglehead inflorescence. Bee mimic fly on tanglehead.

Figure 1a. *Scorzonera laciniata*. Credit: Tony Frates. Figure 1b. *Scorzonera laciniata* Fruit. Credit: Tony Frates.

Two Plants, Two Places: The case of *Scorzonella laciniata* (cutleaf vipergrass) and *Carex duriuscula* (needleleaf sedge)

by Glenn Rink[1]

At a very young age, most of us readily observe that plants and animals are different. Animals move around and plants do not. However, this is a gross misperception. Individual animals move around, while individual plants don't tend to move around much. Instead, plants move around generationally. We don't tend to see this movement, nor do we always see how it happens. But if we pay attention, we see the results. Dandelions (*Taraxacum officinalis*) are nearly ubiquitous the world over, but they haven't always been that way. Humans moved them both around purposefully, so that they could continue using them for food and medicine, and inadvertently, by chance. Many plants don't depend on humans for dispersal. Birds pick up and eat plant propagules that then get deposited in far flung places. Some plants have seeds that readily blow for miles in the wind. Despite that, we almost never know how individual species have gotten around, but every once in a while, we get a clue as to how this may have happened.

Here, I want to point out two plants that have found their way to Flagstaff from points to the east, and surmise how and when this happened. But first a little background.

First a bit of Flagstaff history. For fifty years. from 1929 to 1979, Flagstaff attracted thousands of participants and spectators to the All-Indian Pow Wow. Natives came from all over the country and brought their horses and families to participate in parades, rodeos, and dances over the course of three days. In the early days, they arrived in horse-drawn wagons. They also brought their weavings, jewelry, and other things to trade. Much of the activity was centered around Thorpe Park in west Flagstaff. One of the parades started at the National Guard Armory next to Thorpe Park, proceeded east on Birch Street to San Francisco, south to Aspen Street, then returned west to the Armory. Community food preparation was common. As many as 100,000 people

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Two Plants, Two Places *continued*

attended these events, which is a lot for a town of much less than half that size at that time. Local businesses prospered, but there were some downsides. Due to overcrowding, unsanitary conditions, alcohol, fighting, public intoxication, and law enforcement issues, the pow wow moved from Thorpe Park to Fort Tuthill, south of town, in 1977, then came to a close in 1979. (**https://library.nau.edu/speccoll/exhibits/powwow/early.html**)

Back to plants. When I was doing my master's thesis work at Canyon de Chelly in 2002, I found the two plants that are the subject of this article; a sedge (*Carex duriuscula*) and a dandelion-like plant that took me years to identify. Not surprising that I couldn't identify the dandelion plant for so long. It was not included in any plant treatments for the region. This plant differs from our common dandelions in having stem leaves and branched inflorescences. Eventually, I learned that this plant was *Scorzonera laciniata*, a European native that is exotic to North America.

Ken Heil of San Juan College in Farmington had collected several specimens in Chinle in 2001. Ken may have known what it was right away since it had been present in New Mexico since the late 1980s. We know that *Scorzonera laciniata* arrived in the Colorado front range by 1954. It is now widespread in Colorado.

We can trace the introduction of *Scorzonera laciniata* in the Southwest from herbarium records, databased in SEINet. *Scorzonera laciniata* may have arrived in New Mexico in 1987, where we know it from two collections, one in Santa Fe and another about 30 miles south of Santa Fe (SEINet). By the 1990s it had become more widespread. By 2010, the distribution of *Scorzonera laciniata* in Arizona was limited to the northern and eastern portions of the Navajo Nation at Kayenta, Chinle, and southeast of Ganado. In 2011, Jan Busco found it at South Rim Village, Grand Canyon. By 2023, it was also known from Flagstaff, Sedona, and the White Mountains. The following SEINet distribution maps document this spread.

Carex duriuscula

Carex duriuscula is a small, inconspicuous dryland sedge that primarily occurs to the north and east of Flagstaff (Figure 6). I did not expect to find it in Flagstaff, so was surprised to find it along the road south of the Francis Short Pond in Thorpe Park in 2011. A couple of years later, a west Flagstaff neighbor asked me to identify a sedge that had volunteered in her garden. I was intrigued when this turned out to be *C. duriuscula*. Then in 2018, I was telling Mimi Murov, my botanist neighbor about these finds. She invited me to her yard to look at some plants. Not only did she have *C. duriuscula* volunteering in her yard,

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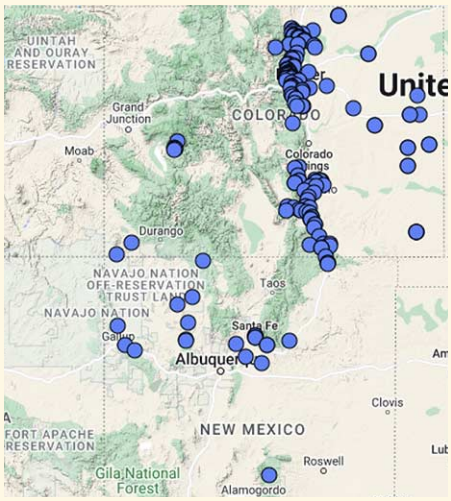
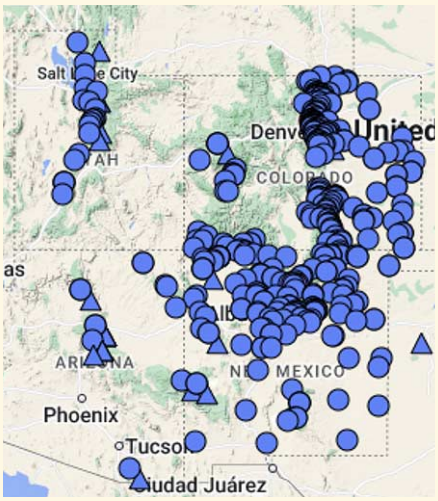
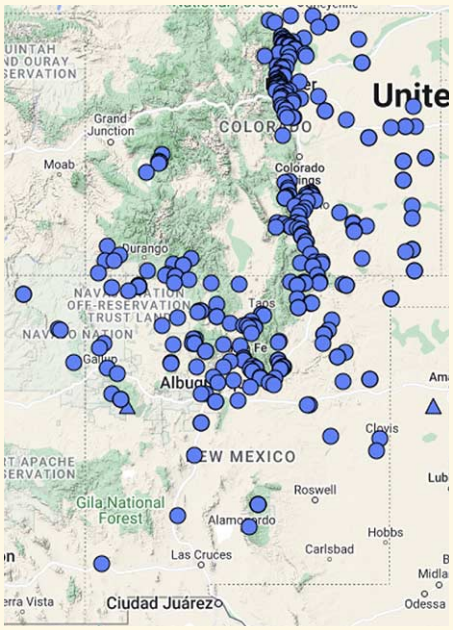






From left, *credit SEINet*: Figure 2. *Scorzonera laciniata* distribution in the Four Corners states by the year 2000. According to herbarium records, it had not arrived in Arizona or Utah yet.

Figure 3. *Scorzonera laciniata* distribution in the Four Corners States by the year 2010. In Arizona, the distribution of *Scorzonera laciniata* was limited to the northern and eastern portions of the Navajo Nation at Kayenta, Chinle, and southeast of Ganado. It still had not arrived in Utah, according to herbarium records.

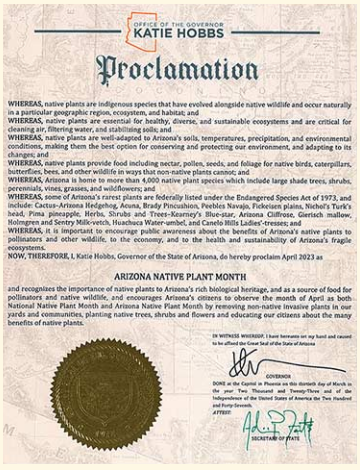
Figure 4. *Scorzonera laciniata* distribution in the Four Corners States in 2023. It is now widespread in eastern Arizona and along the Wasatch Front in Utah.

Two Plants, Two Places *continued*

but she also had *Scorzonera laciniata*. Since then, I have noticed *Scorzonera* in three other locations in west Flagstaff, all in or adjacent to Thorpe Park.

Given Thorpe Park's history with the All-Indian Pow Wow, and that many to most of the participants came from the Navajo Nation, it seems reasonable to surmise that both of these plants made the trip to Flagstaff with natives in the middle part of the 1900s. That they are both inconspicuous plants, *Scorzonera laciniata* because it looks more or less like the common dandelion and *Carex duriuscula* because it is small and grasslike, could explain why they were not documented in Flagstaff for so many years after the Pow Wow ended. It is pure speculation on my part that they came to Flagstaff hitching a ride with Native Americans who lived in northeastern Arizona or New Mexico. But it seems reasonable. Plants do move around a lot, sometimes with the help of humans, sometimes in ways we can't explain.

Figure 5. *Carex duriuscula*. Credit: Max Licher.



OFFICE OF THE GOVERNOR
KATIE HOBBS

Proclamation

WHEREAS, native plants are indigenous species that have evolved alongside native wildlife and occur naturally in a particular geographic region, ecosystem, and habitat; and
WHEREAS, native plants are essential for healthy, diverse, and sustainable ecosystems and are critical for cleaning air, filtering water, and stabilizing soils; and
WHEREAS, native plants are well-adapted to Arizona's soils, temperatures, precipitation, and environmental conditions, making them the best option for conserving and protecting our environment, and adapting to its changes; and
WHEREAS, native plants provide food including nectar, pollen, seeds, and foliage for native birds, caterpillars, butterflies, bees, and other wildlife in ways that non-native plants cannot; and
WHEREAS, Arizona is home to more than 4,000 native plant species which include large shade trees, shrubs, perennials, vines, grasses, and wildflowers; and
WHEREAS, some of Arizona's rarest plants are federally listed under the Endangered Species Act of 1973, and include: Cactus-Arizona Hedgehog, Acuna, Brady Pincushion, Peebles Navajo, Fickeisen plains, Nichol's Turk's head, Pima pineapple, Herbs, Shrubs and Trees-Kearney's Blue-star, Arizona Cliffrose, Gierisch mallow, Holmgren and Sentry Milk-vetch, Huachuca Water-umbel, and Canelo Hills Ladies'-tresses; and
WHEREAS, it is important to encourage public awareness about the benefits of Arizona's native plants to pollinators and other wildlife, to the economy, and to the health and sustainability of Arizona's fragile ecosystems.
NOW, THEREFORE, I, Katie Hobbs, Governor of the State of Arizona, do hereby proclaim April 2023 as

ARIZONA NATIVE PLANT MONTH

and recognizes the importance of native plants to Arizona's rich biological heritage, and as a source of food for pollinators and native wildlife, and encourages Arizona's citizens to observe the month of April as both National Native Plant Month and Arizona Native Plant Month by removing non-native invasive plants in our yards and communities, planting native trees, shrubs and flowers and educating our citizens about the many benefits of native plants.

IN WITNESS WHEREOF, I have hereunto set my hand and caused to be affixed the Great Seal of the State of Arizona

GOVERNOR

DONE at the Capitol in Phoenix on this thirtieth day of March in the year Two Thousand and Twenty-Three and of the Independence of the United States of America the Two Hundred and Forty-Seventh.

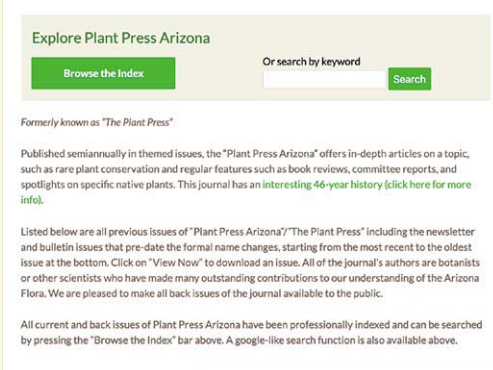
ATTEST:

SECRETARY OF STATE

Arizona Native Plant Month's official Proclamation by Governor Katie Hobbs encourages Arizonans to celebrate each April by removing non-native invasive plants and planting native trees, shrubs, and flowers.

New Index for *Plant Press Arizona*

We are pleased to announce that the editors of *Plant Press Arizona* recently employed a professional indexer to prepare a comprehensive index of all past issues of the journal. Consisting of a four-page typewritten newsletter, the Society's first monthly publication (Vol. 1, No.1) appeared shortly after the Society's founding in March 1977. Since its outset, the Society's journal has offered in-depth articles on specific topics and regular features, such as book reviews and spotlights on individual native plants. The journal is now published twice annually in a full color format.



Explore Plant Press Arizona

Browse the Index

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Formerly known as "The Plant Press"

Published semiannually in themed issues, the "Plant Press Arizona" offers in-depth articles on a topic, such as rare plant conservation and regular features such as book reviews, committee reports, and spotlights on specific native plants. This journal has an interesting 46-year history (click here for more info).

Listed below are all previous issues of "Plant Press Arizona"/"The Plant Press" including the newsletter and bulletin issues that pre-date the formal name changes, starting from the most recent to the oldest issue at the bottom. Click on "View Now" to download an issue. All of the journal's authors are botanists or other scientists who have made many outstanding contributions to our understanding of the Arizona Flora. We are pleased to make all back issues of the journal available to the public.

All current and back issues of Plant Press Arizona have been professionally indexed and can be searched by pressing the "Browse the Index" bar above. A google-like search function is also available above.

Interested in a particular plant, subject, or author? You can now easily locate the specific journal reference to it thanks to the new index as well as with a new Google-like search feature. All past issues of the Society's newsletters and journals are available for downloading at the AZNPS website (aznps.com) along with access to the new index and the current quarterly newsletter *Happenings*.

Published since 1977, the journal of the Arizona Native Plant Society has offered in-depth articles on specific topics and regular features, such as book reviews, committee reports, and spotlights on specific native plants.

Interested in a particular plant, subject, or author? *Plant Press Arizona* is organized so that you can browse the interactive index or search by keyword.

Flower First or Leaf First? A Report on a Special Project *by Frank Reichenbacher[1] and Ries Lindley[2]*

Last year the AZNPS kindly allowed me to submit an article to *Plant Press Arizona* which was published in the Fall 2022 issue. In it, I brought up a challenge made to me by my professor long ago: "…why is it that some trees (referring to broadleaf deciduous riparian trees) flower before they leaf, while other trees leaf before they flower?"? I never forgot that challenge, although I had not made a serious attempt to address it. Last fall, I decided to have a go at it.

With all due respect to my professor, it has never been clear to me that some trees really do flower before they leaf while others leaf before they flower. I thought perhaps some do and some don't, even within a species or even on different branches of the same tree, or perhaps the sequence changes from year to year based on environmental conditions, or as the tree ages. I decided that the first thing to do is go out and get some leafing and flowering data.

These are the dominant broadleaf deciduous trees of streams and rivers in the Southwest:

Common Name	Scientific Name
Fremont Cottonwood	*Populus fremontii*
Narrowleaf Cottonwood	*Populus angustifolia*
Goodding Willow	*Salix Gooddingii*
Bonpland Willow	*Salix bonplandiana*
Arizona Sycamore	*Platanus wrightii*
Velvet Ash	*Fraxinus velutina*
Arizona Black Walnut	*Juglans major*
Arizona Alder	*Alnus oblongifolia*
Box Elder	*Acer negundo*

We were not able to find Narrowleaf cottonwood, Bonpland willow, or Box elder for our phenology project, but we found and tracked at least one specimen of the other six species.

I knew we would need a lot of data, so I invited AZNPS members to help. Ries Lindley of Tucson and a member in Portal, Cochise County, both volunteered and have submitted their observations. In the chart of results (see below), Ries' observations are those from the Santa Cruz River in Tucson, and we have two observations from Portal in Cochise County. I collected the remainder. Choosing our trees was the first challenge. We started our visits before the trees had begun to leaf and flower; therefore, we could not always be certain what species we might have chosen and what sex. Arizona Alder is monoecious (male and female flowers on the same tree), but all the rest of our species are dioecious, i.e., trees are either male or female.

This has been really very interesting, with surprises and quirks in the data. My observations of Goodding willow and Fremont cottonwood on the Verde River and velvet ash at Seven Springs happen to come from immature trees that either did not flower fully or began to flower and were then hit by late frost. One of my cottonwoods was clearly unhealthy, though that was not clear until the project was nearly over. Ries had the same issue with one of his trees as well.

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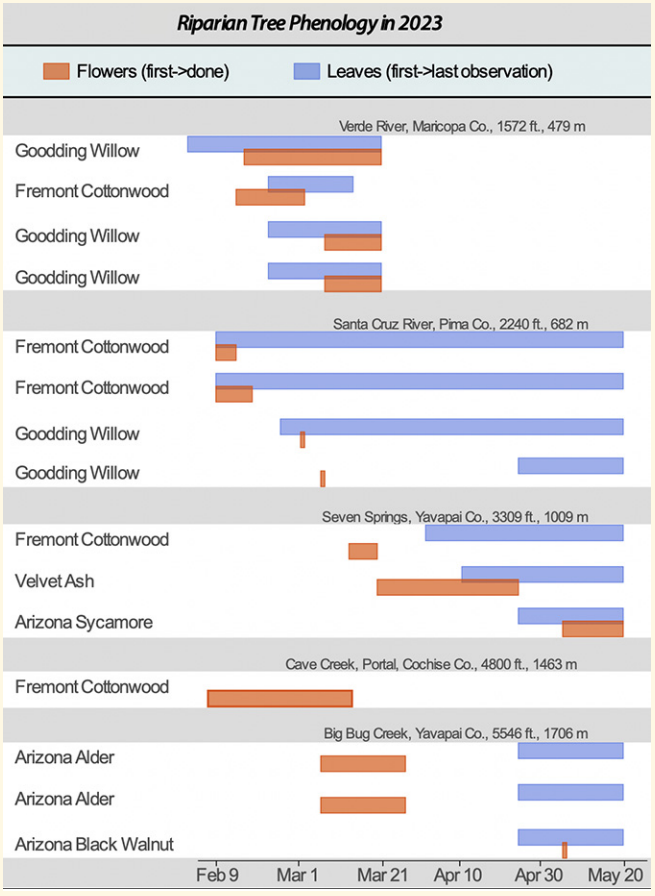

[1]Director, Alamocito Foundation, Inc., Arizona Native Plant Society, Phoenix Chapter. **frank@alamocito.org**. [2]Ries Lindley, Arizona Native Plant Society, Tucson Chapter.

Flower First or Leaf First? *continued*

And there was a very interesting issue with my Fremont cottonwood at Seven Springs: it may be a mutant Fremont cottonwood or a hybrid of unknown origin. I randomly chose it when it was leafless, and it looked just like all the others. It put out male flowers for a brief period and then shutdown reproductive activity. I searched for others in the vicinity and have found none so far. It might be the only specimen.

I organized the sites in the chart from lowest to highest elevation because spring comes earlier in the low desert than it does in the high mountains.

Looking at this chart one feature stands out. The two lower elevations, Sonoran Desert locations (Verde River and Santa Cruz River), group together while the two higher elevation sites, which are separated by more than 2,000 ft. elevation, group together. Fremont cottonwood at the Portal site, which has just the two observations — Feb. 7 and March 13 — flowered much earlier than expected at an elevation of 4,800 ft.

The one Velvet ash also flowered significantly before it leafed , but that individual tree seemed unhealthy and after producing a few flowers that was it. Four out of the five Goodding willows flowered after leafing, but the one did not appear unhealthy as well. My Fremont cottonwood from the Verde River flowered and began to leaf simultaneously, but the possible hybrid from Seven Springs flowered first, then began to leaf. The Arizona sycamore from Seven Springs began to leaf and then flowered shortly after, but it waited until very late in the spring to do so.

From my Winter 2022 article (*Plant Press Arizona*, Vol. 45, No. 2), recall that I presented two questions: (1) Is it true that some trees flower before they leaf, while other trees leaf before they flower, and (2) if question 1 is true, why is it that some trees flower before they leaf, while other trees leaf before they flower? As you can see from the chart we have very mixed results, although, at the most basic level it is obviously true that some trees flower first, some leaf first, and some do both at the same time. But we need more data. A lot of the inconsistency among species and between sites is likely due to our small sample size. If we can get more data next year, we will probably see some real patterns emerge from the noise.

Ries observed honeybees and other insects around Fremont cottonwood trees in flower and wondered why that would be since cottonwoods are wind pollinated. Turns out that the bees are harvesting pollen, but they are not pollinating. Since male and female flowers are on different trees a pollinator would have to want to visit a female flower, which has no visible petals and produces no nectar. Insects take a lot of pollen from male cottonwood flowers, but don't do any significant pollinating. Willow twigs with flowers have tiny little structures called *nectaries* that produce a nectar-like insect-attractant on both male and female flower catkins. This does attract insect pollinators to flowers of both sexes contributing a substantial amount of pollination services.

But what about the first question: *Why don't they all just leaf and flower at the same time in the spring when it starts to warm up?*

There are three answers which likely explain why they don't seem to all leaf and flower at the same time at a given location:

Resource and Energy Trade-offs

When leaves are dropped in the fall, the tree then has no way to acquire and store more energy until the following spring when new leaves are produced. Moreover, the first leaves consume more energy than they produce, at least initially. The plant must optimize resource distribution in the plant, so the survival is not imperiled by over-allocation to either leaf emergence or flower production. Four choices are possible: (a) leaf before flowering so the first leaves can fuel some portion of flower production,

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From left:

Fremont cottonwood. Fruit capsule beginning to mature, Verde River.

Arizona Sycamore. Female flower balls, Seven Springs.

Credit: Frank Reichenbacher, 2023.

Flower First or Leaf First? *continued*

(b) flower before leafing, (c) go for broke and do both at the same time, or (d) put it all into the leaves and don't flower at all.

Insect Pollination

The second answer comes from choice b, above. Plants, like all living organisms, live in an environment of competition for resources, and one of the most important resources for flowering plants is pollinators. Flowering before other species has the advantage of exclusive use of the most efficient local pollinators, at least for a while. But Goodding willow, our only insect pollinated species, didn't flower before it leafed, nor did they flower before Fremont cottonwoods. So perhaps the energy resource tradeoff didn't work out or perhaps insect pollination isn't that vital for them.

Wind Pollination

A tree that relies on wind pollination and produces leaves before or while flowering might have a problem with the leaves interfering with female flowers ready to receive pollen grains floating by. This might be what the Arizona alder is up to. Those trees were flowering when there was still a good deal of snow on the ground, long before any other deciduous plant of any species had begun to leaf. That might be why Arizona alder develops flower buds before the winter even sets in. Just as leaves are starting to turn in October alders develop small stout flower catkins (a type of flower cluster) both male and female separately. These partly develop and then overwinter, exposed to the cold, on a naked tree. When spring arrives, they are poised to go, and the female flowers will have unimpeded access to wind-borne pollen.

Goodding Willow. Female flower catkin, Santa Cruz River. Credit: Ries Lindley, 2023.

Arizona Alder. Male flower catkins (top) releasing pollen, female flower catkins (below) ready to receive, Big Bug Creek. Credit: Frank Reichenbacher, 2023.

What is it that triggers leaf and flower emergence in our riparian trees? How do they know when it's time to do one or the other? Scientists have worked out that photoperiod (the length of the day and night), temperature, air, soil, interact in complex ways to provide separate but related cues that plants track with photoreceptors and chemical pathways that respond incrementally to environmental signals. Whether and when to leaf and flower are hugely important decisions, the solutions of which are baked into the genetically and environmentally determined makeup of tree species — indeed, every flowering plant species. Sometimes they get it wrong. Ries and I both think that we saw significant flowering episodes in some trees cut short by late frosts and these trees did not recover in time to flower again before it was too late. And note that each plant in its own unique spot in the ground is individually tracking those environmental cues through internal physiological mechanisms. That is partly why you see so much individual variation in our results chart.

It's a great project! So please contact me if you would like to participate in this ongoing study beginning in early 2024. We'll have descriptions of the species to track, guidelines, and suggestions, as well as data forms. We may set up an email list so participants can collaborate and share their solutions to challenges in the field. Every observation, even just one, is useful!

New Arizona Native Plant Society Chapters

As the membership of our Society continues to grow, three new chapters have been added to our ranks in the past two years. The three new chapters, which are described below, represent a significant contribution to our Society and serve as a wonderful testament to the dedication and hard work of the new members who made them a reality.

The Hakdaqwi:va Peach Springs Chapter

Carrie Cannon, Chapter President
Carrie.Cannon@hualapai-nsn.gov

The ancestral lands of the Hualapai Indian Tribe include seven million acres of Northwestern Arizona, a region that is botanically distinctive and rare. Located within the eastern extent of the Mojave, and northern extent of the Sonoran Desert , present and ancestral lands are situated within a unique bioregion. This includes the Grand Canyon at the northern extent, and the northern Sonoran Desert at the southern extent. This region ranges in elevations from 500 feet along portions of the Colorado river and up to nearly 13,000 feet at the summit of the San Francisco peaks. The Hualapai people traditionally organized themselves among 14 different tribal bands so that each subsisted within their own territory, encompassing a seven-million-acre region of Northwestern AZ from the south rim of the Grand Canyon and Colorado River, east to the Little Colorado River, and southward to the Bill Williams and Santa Maria Rivers.

The Hakdaqwi:va Peach Spring's Chapter began in January 2023, and has been active for nearly one year with 20 members. Our chapter meetings are located in Peach Springs, AZ, the capital of the Hualapai Indian Reservation. Our meetings take place on the second Wednesday of each month where we feature a 45-minute guest presentation, and chapter members each take turns sharing five-minute presentations about a plant family, a botanist, or a plant species. Although this AZNPS chapter is the first of its kind in Arizona, being the first on an Indian Reservation, the tribal community is no stranger to safeguarding botanical knowledge.

Hualapai plant knowledge over the last 100 plus years has had as many twists and turns as the course of the Colorado River itself, the middle of which comprises 108 miles of the reservation's northern boundary.

During this era, the federal government's approach to education was to strip Indian children of their culture and heritage in an attempt to acculturate them into white society.

continued next page

Clockwise from top left: Figure 1: Hualapai Ethnobotany Youth Project Members. Figure 2: Hakdagwi:va Peach Springs Chapter of the AZ Native Plant Society March Meeting. Figure 3 Jess Yazzie and Tiny Cesspooch looking at plant samples. Figure 4: Loveena Watahomigie and Sterling Selena viewing chapter meeting raffle prizes. Figure 5: Valentine Indian Boarding School. Credit, Figures 1 and 5: Hualapai Department of Cultural Resources. Figures 2–4: Carrie Cannon.

New Arizona Native Plant Society Chapters *continued*

English was therefore mandatory, and speaking the Hualapai language was forbidden. Yet, some half a century later, in the fall of 1975, Hualapai Indian children were subject to a second round of assimilation, only this time it took place in the reverse order! Children who attended the Peach Springs Bilingual/Bicultural School from 1975-2000 were taught Hualapai language, culture, ethnobotany, zoology, and ethnogeography.

The curriculum and instructional content of the Bilingual Program was presented in both English and Hualapai, thereby instituting the Hualapai language in the school setting. This nationally acclaimed program developed bilingual-curriculum books to be culturally relevant and taught about the local flora, fauna, geography, land sites, and the meanings of petroglyphs and pictographs within ancestral tribal lands. When the Bilingual School was founded, the Hualapai team of teachers that developed the curriculum had the forethought to teach what was relevant from the Hualapai perspective. In large part, this involved teaching ethnobotanical knowledge.

The Hualapai Bilingual Program in the Peach Springs Elementary School dissolved in the 1990's after a gradual decline, due to the lack of support as the school went through significant leadership and directional changes. It should be noted that the new leadership at the school was non-Hualapai and lacked Hualapai tribal support. This also coincided with proposition 203, English only legislation that passed in the State of Arizona in 2000. When the Bilingual School was discontinued in Peach Springs, there was no longer formal programming to transmit the language, ethnobotany, and land- based knowledge to youth.

In 2006 The "Hualapai Ethnobotany Youth Project" arose as elders of the community expressed concern that many youths were not learning about their heritage and landscape. Hualapai elders began to acknowledge and discuss the fact that ethnobotanical knowledge was in grave danger of fading away if not passed on to the next generation. The purpose of the Hualapai Ethnobotany Youth Project, which has been active in the community for the last 17 years, is to share in the transmission of ethnobotanical knowledge from elders to tribal youth, while promoting knowledge of traditional harvesting practices and the Hualapai language. Elder instructors of the project are fluent Hualapai speakers. They teach the youth the tribal names of the plants, which often describe something about the plant.

Today, most Tribal members live on the reservation in the capital town of Peach Springs and have little time in the modern world to travel to harvest or learn about the traditional foods and plants, and there has been a need to provide opportunities for adult populations interested in the local plant knowledge. We hope that our new chapter will fill that important need.

continued next page

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New Arizona Native Plant Society Chapters *continued*

White Mountain Chapter

Jess Rollar, Chapter President
aznpswhitemountain@gmail.com

The White Mountain chapter was created in mid-2021 and focuses on sharing the appreciation of our native plants here in the White Mountains. Our area is diverse, and you can often find Prickly Pear and Cliff Rose in our high deserts and Ponderosa Pine and Bog Violets in the higher elevations, just to name a few.

Along with native plants, we have a vast assortment of lichen, fungi, and mosses. The chapter focuses mainly on sharing knowledge and information with others regarding our native plants. We also enjoy hosting in person plant walks where folks can learn all about our native species within their own backyard and learn how to identify them. Our chapter remains committed to sharing this knowledge with local and visiting folks in hopes that others will share both our enthusiasm about plants and the desire to help keep our mountains beautiful.

Our meetings are often held on trails for native plant identification walks and education. We aim to meet once a month, take winters off due to our colder climate, and limit plant walks mainly to the summer and fall when temperatures are warmer.

Tonto Basin Chapter

Becky Settje, Chapter President
tontobasinnativeplants@gmail.com

The Tonto Basin Chapter started in the Fall of 2022. When current Chapter President, Becky Settje, arrived in Arizona four years ago from New England, she immediately joined the AZ Native Plant Society. She was hoping to find a chapter active in her area that would have a similar elevation, plant diversity and climate. Tucson was that place, but attending events three hours away was not feasible, and thoughts of starting a new chapter began stirring her mind.

Soon after, Becky met her neighbors, who also had an interest in native plants. They frequently discussed the idea of starting a native plant chapter, and after a couple years of tossing the idea around and taking several hikes to explore and identify desert plants and ecosystems, they decided it was time to do so. Teri Balaska, current chapter Vice President and her husband, Eric Sjoden, our lead botanist, studied biology and botany respectively and had field experience and knowledge to share.

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Clockwise from top left: Figure 1: Fungi growing on a fallen branch in Lakeside, AZ. Figure 2: Longleaf Cologania (*Cologania angustifolia*). Figure 3. Mount Baldy Wilderness, Apache-Sitgreaves National Forest, White Mountains. Figure 4: Our spring native plant sale at White Mountain Nature Center in Lakeside, Arizona. Figure 5: Spring plant walk at Mortenson Wash, Taylor, Arizona where we examined the impact that the Chediski-Rodeo fire had on the native plants in this area. Credit, Figures 1, 2, 4, and 5: Jess Rollar. Figure 3: Doug Ripley.

New Arizona Native Plant Society Chapters *continued*

The Tonto Basin Chapter is active from October through May with First Friday Field Trips and monthly chapter meetings. Many of our members are from Pine and Payson, so some of our field trips and meetings are held in the Payson area. We encourage you to join our email at tontobasinnativeplants@gmail.com to receive up-to-date meeting information.

Last year, our activities included a botany walk at the Tonto Natural Bridge State Park led by one of our members who has recorded plants at the park for several years. We visited the Tonto National Monument and the Boyce Thompson Arboretum, and explored the foothills of the Mazatzal Mountains and Four Peaks Wilderness. We also volunteered at the Tonto National Monument assisting the plant resource staff in removing invasive brome grasses and planting native species.

One of our chapter goals is to educate the local communities about non-native invasive species and how they displace native species and add fuel to desert fires. Unfortunately, our roadsides and landscapes are being invaded by several non-native invasive species including brome grasses, starthistle, and mustards. Stinknet is relatively new to our area, and we are striving to eradicate it before it becomes a problem. Through social media, library displays, community billboards, and our annual non-native invasive species meeting, presented by our County Extension Agent, we hope residents will recognize, report and properly remove this fast-spreading noxious weed. Members of our chapter will continue to monitor the sites where Stinknet has been reported and ensure it has been properly removed. Our chapter will be organizing a plant pull in Tonto Basin in the spring as well as volunteering at the Tonto National Monument removing invasive species.

This year, our meetings will include a book discussion, "Botany 101: Beginner's Lingo," "Fireside Plant Discoveries," "Liverworts, Mosses & Ferns," "Plant Families," and "Nonnative Invasive Plants." Our botany walks will explore plants and ecosystems at an elevation range from 2,300' to 5,000'. Please join us as we continue to learn and share the immense plant diversity of Gila County.

Clockwise from top left: Figure 1: Field Trip to Tonto National Forest. Figure 2: Watering Plants. Figure 3: Plant Identification Meeting. Figure 4: Field Trip to Tonto National Forest. Figure 5: Field Trip to Tonto National Forest. All figures credit: Becky Settje.

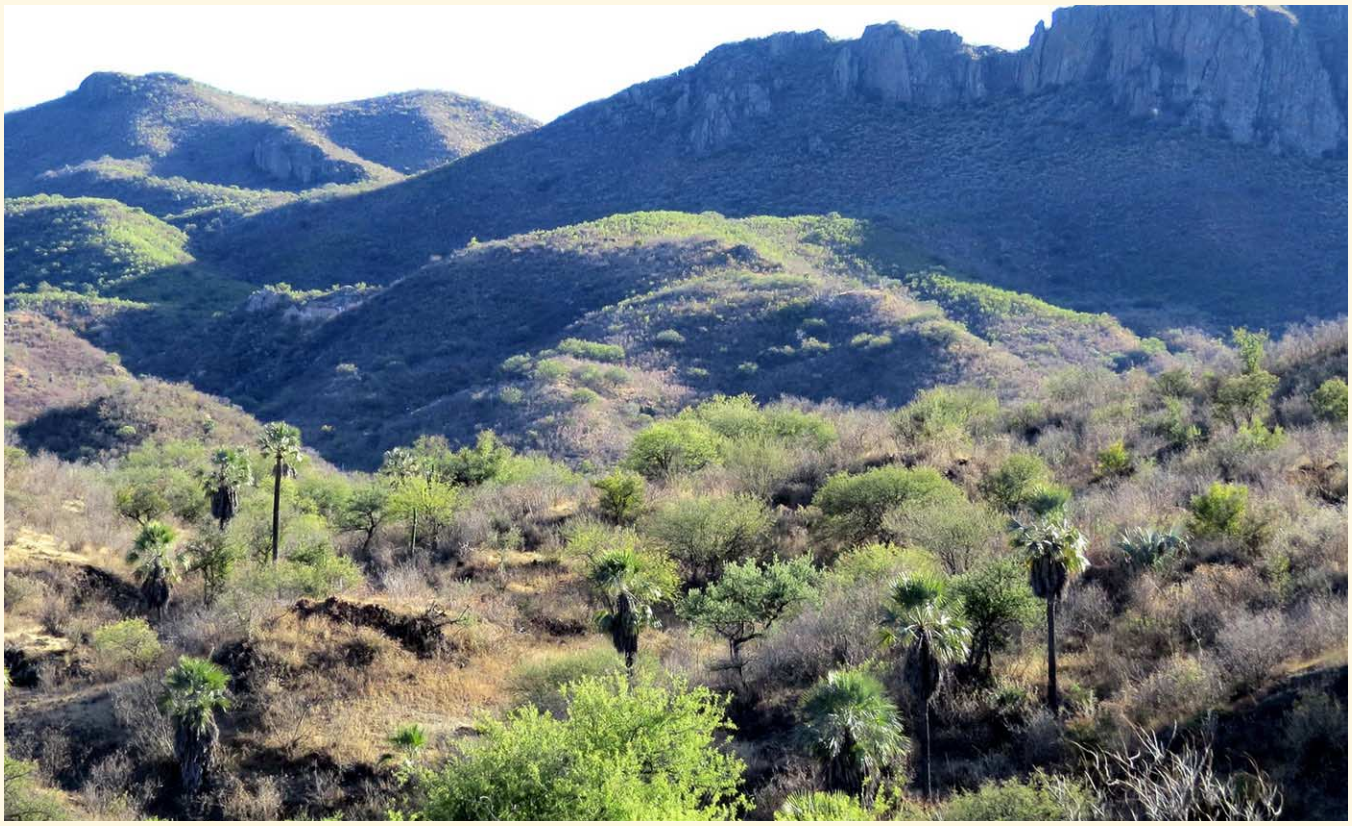

Figura 1. Matorral espinoso con palmas (*Sabal uresana*), Rancho el Babiso, municipio de Moctezuma. Fotografía por G. Yanes-Arvayo. || Figure 1. Foothills thornscrub with palms (*Sabal uresana*), Rancho el Babiso, municipality of Moctezuma. Photo by Yanes-Arvayo.

Cactáceas de la Subcuenca del Río Moctezuma, Sonora || Cacti of the Río Moctezuma Subbasin, Sonora

by Gabriel Peralta-Franco[1], Thomas R. Van Devender[2], Gertrudis Yanes-Arvayo[1], María de la Paz Montañez-Armenta[1], and Hugo Silva-Kurumiya[1]

Resumen

Los cactus de la familia Cactaceae son plantas dicotiledóneas con distribución en el continente americano. México es el país más importante para las cactáceas. La subcuenca del Río Moctezuma, Sonora, México, tiene una gran diversidad altitudinal y de vegetación. Se registraron cactáceas en 14 sitios en la subcuenca en este estudio y se utilizaron registros de las bases de datos de Madrean Discovery Expeditions y Universidad de la Sierra. Se obtuvieron 361 registros de cactus y se identificaron 21 especies (19 nativas), incluyendo tres especies enlistadas en la NOM-059-SEMARNAT 2010 bajo la categoría de Protección.

Abstract

Cacti are dicotyledonous plants in the Cactaceae with distribution in the American continent. Mexico is the most important country for cacti. The Río Moctezuma sub-basin, Sonora, Mexico, has a great altitudinal diversity and therefore of vegetation. Cacti observed at 14 sites in the sub-basin in this study were combined with records in the Madrean Discovery Expeditions and Universidad de la Sierra databases. A total of 361 individual records in 21 species (19 native) of cacti were identified, including three species listed with Special Protection status in the NOM-059-SEMARNAT 2010 Mexican endangered species law.

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Introducción

México se encuentra como el país más importante a nivel mundial por su alta concentración de cactáceas (Sierra 2011). La Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO) de México también ha reportado una alta diversidad de cactáceas en el país. Según la CONABIO, México alberga alrededor del 40% al 50% de las especies de cactáceas del mundo, con más de 120 géneros y

continued next page

Cactáceas || Cacti *continued*

aproximadamente 1000 especies registradas en su territorio (CONABIO, 2021). Las cactáceas mexicanas radican principalmente en las zonas áridas y semiáridas de Baja California y Baja California Sur, Guanajuato, los Desiertos Chihuahuense y Sonorense, la depresión de Balsas y los valles de Hidalgo y Querétaro y la región de Tehuacán-Cuicatlán en los estados de Puebla y Oaxaca (CONABIO 2020, Urquiza et al. 2011).

Las cactáceas tienen un importante rol en el ecosistema, brindan protección a gran cantidad de especies, aves, mamíferos e incluso reptiles; las flores y frutos de éstas plantas sirven de alimento a una gran variedad de insectos, aves y murciélagos (CONANP 2018).

Esta familia de plantas enfrenta diversas amenazas de origen antropogénico como el comercio ilegal, lo que ha originado que se tomen medidas de protección a nivel internacional como la lista roja de la IUCN, y Apéndice II por parte de CITES, de igual manera a nivel nacional algunas especies de cactáceas se encuentran en listadas en las NOM-059-SEMARNAT-2010 (DOF 2019, Sierra 2011, Paredes et al. 2000)

Figura 2. Matorral espinoso con *Pachycereus pecten-aboriginum* y *Stenocereus thurberi*. Rancho El Aguaje, municipio de San Pedro de la Cueva. Fotografía por Ana Lilia Reina-Guerrero. || Figure 2. Foothills thornscrub with *Pachycereus pecten-aboriginum* and *Stenocereus thurberi*, Rancho El Aguaje, municipality of San Pedro de la Cueva. Photo by Ana Lilia Reina-Guerrero.

Introduction

Mexico has the greatest concentration of cacti of any country in the world (Sierra 2011). The Mexican Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO) also reported the high diversity of cacti (120 genera, ca. 1000 species) with ca. 40% to 50% of the species in the world found in the country (CONABIO, 2021).

Mexican cacti are most common in the arid and semiarid zones in central Mexico in Guanajuato, Hidalgo, Puebla, Oaxaca, and Querétaro (CONABIO 2020, Urquiza et al. 2011). Cacti are also common in the Chihuahuan Desert on the Mexican Plateau from Coahuila and Chihuahua north to Texas, New Mexico, Arizona, and northeastern Sonora and in the Sonoran Desert from Arizona and California south into Baja California, Baja California Sur, and Sonora.

Cacti have an important role in the ecosystem, providing protection for birds, mammals, and even reptiles. The flowers and fruits are eaten by a great variety of insects, birds, and bats (CONANP 2018).

This plant family is threatened by diverse anthropogenic activities. Illegal commercial trade has resulted in international protection on the IUCN red list, CITES Appendix II and in the NOM-059-SEMARNAT-2010 (DOF 2019, Sierra 2011, Paredes et al. 2000), the Mexican endangered species law.

Área de Estudio

De acuerdo a García et al. (2015), La subcuenca del Río Moctezuma, Sonora tiene una superficie de 6712.088 km² y varía en altitud desde 350 a 2450 metros sobre el nivel del mar. El clima es una mezcla de semiárido templado y árido cálido.

INEGI (2021) clasifica de una forma más compleja los tipos de vegetación que se encuentran presentes en la subcuenca del Río Moctezuma en especial en la zona sur, de acuerdo a INEGI la subcuenca del Río Moctezuma, cuenta con selva baja caducifolia (Figura 2), sin embargo Van Devender et al. (2022) y Van Devender y Reina-Guerrero (2021) clasifican la vegetación en matorral espinoso de pie de monte (Figuras 1 y 2), un tipo de vegetación de transición entre la selva baja caducifolia al sur y otros tipos de vegetación como encinales y pastizales más al norte.

Study Area

According to García et al. (2015), the Río Moctezuma sub-basin in Sonora, Mexico has an área of 6712.088 km² and ranges in elevation from 350 to 2450 meters above sealevel. The climate is a mixture of temperate semiarid and hot arid.

INEGI (2021) provided a complicated classification of the vegetación of the Río Moctezuma area, including tropical deciduous forest in the southern areas (Figure 3). However, Van Devender et al. (2022) and Van Devender and Reina-Guerrero (2021) consider it foothills thornsrub (Figures 1 and 2), a tropical vegetation transitional between Sonoran desertscrub

continued next page

and tropical deciduous forest in southern Sonora and between Sonoran desertscrub and oak woodland to the north.

Metodología

Para determinar que especies de cactáceas se distribuyen en la subcuenca del Río Moctezuma, Sonora, hicimos avistamientos en 14 sitios dentro de la subcuenca de agosto a diciembre de 2022. También se utilizaron registros de las bases de datos de Madrean Discovery Expeditions (MDE, madreandiscovery.org) y la Registro de Datos de Avistamiento Universidad de la Sierra (UNISIERRA). Todas los registros y fotos de cactáceas están disponibles en estas bases de datos.

Methods

Cacti were observed in 14 areas in the Río Moctezuma subbasin from August to December 2022. Additional records were from from the Madrean Discovery Expeditions (MDE, madreandiscovery.org) and Registro de Datos de Avistamiento Universidad de la Sierra (UNISIERRA) databases. All records and images in this study are publicly available in these databases.

Table 1. Species of cacti in the Río Moctezuma sub-basin. *Non-native/cultivated.

Coryphantha recurvata (Engelm.) Britton & Rose
Cylindropuntia fulgida (Engelm.) F.M. Knuth
Cylindropuntia leptocaulis (DC.) F.M. Knuth
Cylindropuntia imbricata (Haw.) F.M. Knuth subsp. *spinosior* (Engelm.) M.A.Baker, Cloud-H. & Majure
Cylindropuntia thurberi (Engelm.) F.M. Knuth
Echinocereus rigidissimus (Engelm.) Hort.
Echinocereus scopulorum Britton & Rose subsp. *pseudopectinatus* (N.P. Taylor) W. Blum & Mich. Lange
Echinocereus stolonifer W.T. Marshall subsp. *tayopensis* (W.T. Marshall) G. Pichler
**Lophocereus schottii* (Engelm.) Britton & Rose
Mammillaria grahamii Engelm. subsp. *grahamii*
Mammillaria mainiae K. Brandegee
Mammillaria standleyi (Britton & Rose) Orcutt
Opuntia chlorotica Engelm. & Bigel.
Opuntia aff. *duranguensis* Britton & Rose
Opuntia engelmannii Salm-Dyck ex Engelm
Opuntia gosseliniana F.A.C. Weber
Opuntia pubescens H.L. Wendl. ex Pfeiff.
Opuntia santa-rita (Griffiths & Hare) Rose
Opuntia aff. *wilcoxii* Britton & Rose
Pachycereus pecten-aboriginum (Engelm.) Britton & Rose
**Peniocereus serpentinus* (Lag. & Rodr.) N.P. Taylor
Stenocereus thurberi (Engelm.) F. Buxb.

Resultados

Se obtuvo un total de 361 registros de individuos pertenecientes a la familia Cactaceae (126 contribuidos y 235 registros por parte de MDE y UNISIERRA), representados por 21 especies (Tabla 1), en 7 géneros; *Coryphantha* (1 especie), *Echinocereus* (3 especies, Figura 4B), *Cylindropuntia* (5 especies. Figura 4A), *Mammillaria* (3 especies, Figuras 5), *Opuntia* (7 especies, Figura 6), *Pachycereus* (1 especie, Figuras 6B y 7A) y *Stenocereus* (1 especies, Figura 7B). *Peniocereus serpentinus*, nativa del sur de México, esta cultivada en Jécori y ha escapado a los alrededores. *Lophocereus schottii*, cual es nativa en el Desierto Sonorense al oeste, es plantada como cerco vivo cerca Huépari y Suaquito.

Results

A total of 361 records of individual cacti (126 in this study and 235 from the databases) were found in Río Moctezuma sub-basin. These included 21 species (Table 1) in seven genera: *Coryphantha* (1 species), *Echinocereus* (3 species, Figure 4B), *Cylindropuntia* (5 species, Figure 4A), *Mammillaria* (3 species,

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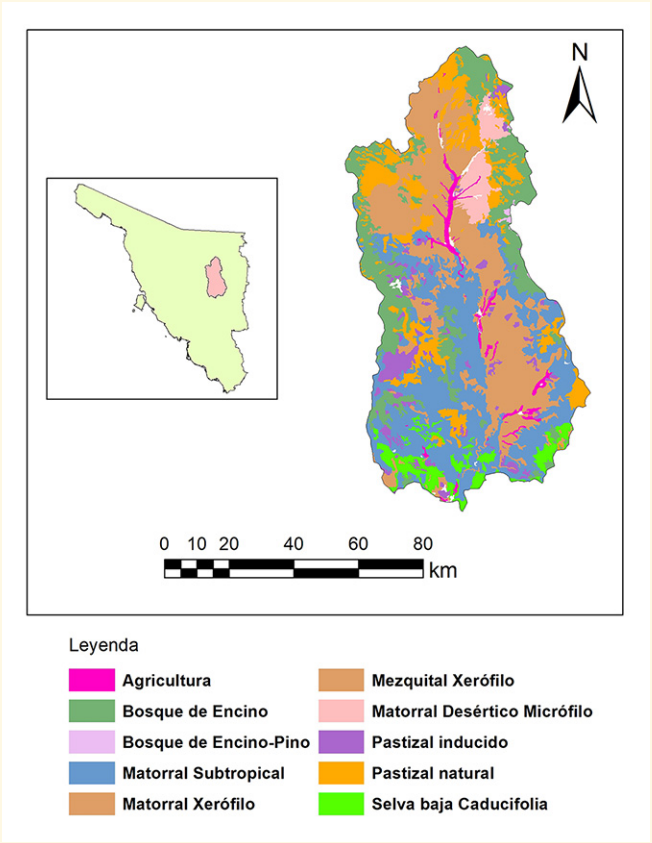

Figura 3. Tipos Figura 3. Tipos de vegetación en la subcuenca del Río Moctezuma (INEGI 2021). || Figure 3. Vegetation types in the Río Moctezuma sub-basin (INEGI 2021).

Cactáceas || Cacti *continued*

Figure 5), *Opuntia* (7 species, Figure 6), *Pachycereus* (1 species, Figures 6B and 7A), and *Stenocereus* (1 species, Figure 7B). *Peniocereus serpentinus*, native to southern Mexico, is cultivated en Jécori and has escaped locally. *Lophocereus schottii*, which is native in the Sonoran Desert to the west, has been planted as a living fence near Huépari and Suaquito.

Discusión

En este estudio se registraron 126 individuos de cactáceas en la subcuenca del Río Moctezuma, Sonora. *Coryphantha recurvata* y *Mammillaria mainiae* no estaban conocido de este parte de Sonora. En las bases de datos de MDE y UNISIERRA, 236 más registros representando un total de 21 especies.

La subcuenca del Río Moctezuma en Sonora tiene diferentes tipos de vegetación debido a factores físicos como las diferencias de altitud. La vegetación dominante en la mayoria del área es matorral espinoso con hay bosques de encino y pino-encino en las Sierras Juriquipa y la Madera arriba (Van Devender y Reina-Guerrero 2021). Estos diferentes tipos de vegetación permiten la distribución de los cactus, aunado a los climas semiáridos templados y árido cálido.

Las especies de cactus más comunes en la subcuenca son *Cylindropuntia thurberi* y *Stenocereus thurberi*, mientras que algunas especies sólo tienen un registro, como *Cylindropuntia leptocaulis*, *Echinocereus scopulorum* subsp. *pseudopectinatus* y *E. stolonifer* subsp. *tayopensis*. El género *Opuntia* presenta mayor diversidad de especies, con siete especies registradas en la subcuenca.

Discussion

In this study, 126 individual records with 236 additional records from the MDE and UNISIERRA databases document 21 species of cacti in the Río Moctezuma sub-basin. *Coryphantha recurvata* and *Mammillaria mainiae* were not previously known from this part of Sonora.

continued next page

Figura 4. A. Flor de *Cylindropuntia thurberi*, Moctezuma. B. *Echinocereus rigidissimus*, Presa El Tápiro, municipio de Cumpas. Fotografias por G. Peralta-Franco. || Figure 4. A. Flower of *Cylindropuntia thurberi,* Moctezuma. B. *Echinocereus rigidissimus*, Presa El Tápiro, municipality of Cumpas. Photos by G. Peralta-Franco.

Figura 5. A. *Mammillaria mainiae*, Jécori. Fotografía por G. Peralta-Franco. B. *M. standleyi*, Rancho Arroyo Seco, municipio de Moctezuma. Fotografía por G. Yanes-Arvayo. C. *M. standleyi*, Rancho El Aguaje, municipio de San Pedro de la Cueva. Fotografía por Ana Lilia Reina-Guerrero. || Figure 5. A. *Mammillaria mainiae*, Jécori. Photo by G. Peralta-Franco. B. *M. standleyi*, Rancho Arroyo Seco, municipality of Moctezuma. Photo by G. Yanes-Arvayo. C. *M. standleyi*, Rancho El Aguaje, municipality of San Pedro de la Cueva. Photo by Ana Lilia Reina-Guerrero.

Figura 6. *Opuntia pubescens*, Jécori. B. Flor de *Pachycereus pecten-aboriginum*. Rancho El Aguaje, municipio de San Pedro de la Cueva. Fotografía por G. Peralta-Franco y Ana Lilia Reina-Guerrero. || Figure 6. *Opuntia pubescens*, Jécori. B. Flower of *Pachycereus pecten-aboriginum*, Rancho El Aguaje, municipality of San Pedro de la Cueva. Photos by G. Peralta-Franco and Ana Lilia Reina-Guerrero.

The Río Moctezuma sub-basin has different types of vegetation depending on physical factors, especially elevation. The dominant vegetation is foothills thornscrub with oak woodland and pine-oak forest at higher elevations in the Sierras Juriquipa and La Madera (Van Devender and Reina-Guerrero 2021). The distributions of the cacti reflect the different vegetation types.

The cactus species most common in the sub-basin are *Cylindropuntia thurberi* and *Stenocereus thurberi*, while other species such as *Cylindropuntia leptocaulis, Echinocereus scopulorum* subsp. *pseudopectinatus*, and *E. stolonifer* subsp. *tayopensis* are only known from single records. *Opuntia* with seven species is the most diverse genus.

Agradecimientos

A todas las personas que han apoyado este proyecto, especialmente los padres de Gabriel Peralta. A Ana Lilia Reina-Guerrero para el uso de sus imágenes. A Wulfgang Blum y Marc Baker para actualizando lo nombre científicos. Greater Good Charities ha apoyado las Expediciones de Madrean Discovery y la base de MDE.

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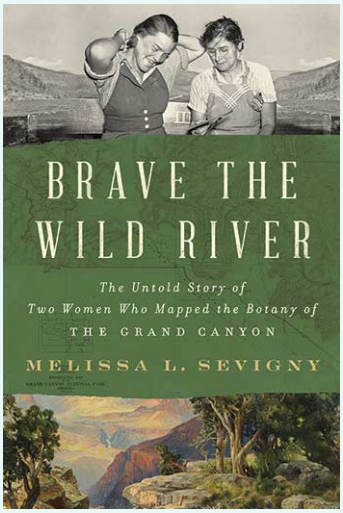
Figura 7. A. *Pachycereus pecten-aboriginum*. B. *Stenocereus thurberi*. Rancho El Aguaje, municipio de San Pedro de la Cueva. Fotografía por Ana Lilia Reina-Guerrero. || Figure 7. A. *Pachycereus pecten-aboriginum*. B. *Stenocereus thurberi*. Rancho El Aguaje, municipality of San Pedro de la Cueva. Photos by Ana Lilia Reina-Guerrero.

BOOK REVIEW *Ries Lindley, Arizona Native Plant Society, Tucson Chapter*

Brave the Wild River: The Untold Story of Two Women Who Mapped the Botany of the Grand Canyon by Melissa L. Sevigny

2023. 304 pages. W. W. Norton. Available in hardcover, eBook, and audiobook. For a list of places to purchase this book, go to: https://melissasevigny.com/buy/



"Over, under, through it all, ran the Colorado River." This sort of spare, powerful, and evocative prose makes you forget you are reading a history and sweeps you along the river with this story and the women who lived it. In 1938, there had been few boating expeditions down the Grand Canyon, and of those who had attempted the trip, the only woman to have tried died in the attempt. And certainly no one had truly studied the botany of the canyon. Elzada Clover and Lois Jotter stormed through both those barriers, and *Brave the Wild River* is their story.

A photo of Clover from that period of her life presents a deceptively prim and proper lady, who might well have been a schoolteacher from a time when the attributes of prim and proper would have been prized for such a job. In fact, Clover had been a schoolteacher, but by 1938, she had a PhD in botany, and she had some appetite for exploration. While working on her graduate studies, Clover, who was 41 at the time, roomed with other women working on graduate degrees. One was a mid-twenties graduate student working in cytogenetics of the primroses (*Oenothera*). That was Lois Jotter, who became the other woman of the expedition, perhaps in part, so the two could "chaperone" each other while they traveled with men into the wilderness.

It is hard to appreciate how difficult it must be to do all the eye-blurring research for a story like this and then boil the tale down to its essence and make it riveting to boot. If this were filmmaking, a lot of celluloid would have to be left on the cutting room floor to keep from cluttering up the end result. With all the drama, the publicity, the firsts, and the emotions of this story, Sevigny tells it without ever playing favorites with the characters. She makes truth the star of the story, and she treats everyone with fairness and dignity.

This is, of course, also a history, and the story is laced with historical context to help the reader understand the culture, politics, laws, beliefs, and prejudices of the time. Sevigny offers some explanation and understanding of anything relevant to the theme, such as public attitudes toward women and adventure, "The Law of the River," the hyperbolic journalism of 1938, history of national parks, etc. And, somehow, all this just makes the book more interesting without distracting you from the story.

The essence of the story is that one woman becomes interested in the idea of studying the plant life of an unstudied region, and she recruits a second woman to participate. They succeed, but oh, what a journey it is. And the downstream consequences continue to reverberate through our present day. About sixty of the vascular plants collected by Clover and Jotter can be found by searching the databases at swbiodiversity.org, and an additional 30 mosses may be found at bryophyteportal.org. About half the specimens are in the University of Arizona Herbarium.

The river of 1938 was not the highly managed river of today, and it is hard to know just how much has changed, but it is possible to understand how harrowing the rapids might have been by watching a film of Norman Nevills's (the leader of the Cover/Jotter expedition) 1947 expedition. (**https://archive.org/details/60794DangerRiverVwr**) Even ignoring the melodramatic voice-over of the 1940s footages and the grainy black-and-white format, the enormous power of the river is heart-stopping. Elzada Clover died in 1980, but Lois Jotter lived until 2013, long enough to be interviewed extensively about the 1938 expedition. One happy result of Jotter's longevity is a series of interviews she did with Lew Steiger, a Colorado River guide. The interview is available at the Cline Library of Northern Arizona University. (**https://archive.library.nau.edu/digital/collection/cpa/id/63375/**) The interview is a delightful animation of the already delightful portrait of Lois Jotter that Sevigny has painted.

This book is a richly complicated and wonderfully told story that will be interesting to anyone, not just those folks who love plants. It is a slice of history from the prewar era of the United States, and it says so much about the social milieu of the time. Greatness comes in different shapes, sizes, and colors, and *Brave the Wild River* makes it clear just how important it is to understand our history from those different perspectives.

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❍ $15 Student
❍ $30 Individual
❍ $35 Family
❍ $50 Organization
❍ $75 Commercial
❍ $100 Plant Lover
❍ $500 Patron
❍ $1,000 Lifetime

Mail to: Arizona Native Plant Society
PO Box 41206, Tucson AZ 85717

Or join online at **https://aznps.com/membership/**