Arctostaphylos patula,
Green-Leaf Manzanita

Cora Estelle Mosher

Plant Press Arizona

THE ARIZONA NATIVE PLANT SOCIETY

Volume 47, Number 1 **Summer 2024**

Gymnosperms

With Regular Features

©2024 Arizona Native Plant Society.
All rights reserved.

Strange that so few ever
come to the woods to

see how the pine lives and
grows and spires,

lifting its evergreen arms to
the light, — to see

its perfect success.

— Henry David Thoreau,
The Maine Woods

Figure 1. General Sherman giant redwood (*Sequoiadendron giganteum*), found in California's Sequoia National Park, is believed to be the largest individual organism on earth. *Photo: Doug Ripley*

Gymnosperms

by J. Douglas Ripley, Cochise Chapter, Arizona Native Plant Society

The Spermatophytes (Seed Producing Plants)

Most native plant lovers, even without formal training in botany, know that the seed-producing plants (S*permatophytes)*, are divided into five divisions, four within the gymnosperms (cycads, ginkgo, conifers, and gnetophytes), and the fifth division Angiosperms, or flowering plants, which are the most highly evolved and dominant members of the Plant Kingdom. In addition to the production of seeds, another major characteristic shared by all these groups is the presence of specialized vascular tissue (xylem and phloem) in their roots, stems, and leaves for conducting water and nutrients. Understanding the differences between the gymnosperms and angiosperms provides a fascinating insight into the evolutionary history of most of the plants that we enjoy and appreciate.

As the most highly evolved of these divisions, the angiosperms far outnumber the gymnosperms in terms of total numbers of extant species They also display significantly more efficient reproductive strategies and structures, and can inhabit much broader ranges of habitats. Nevertheless, the gymnosperms contain many species of major environmental significance, aesthetic value,

continued page 3

Above: Desert Ironwood Tree (*Olneya tesota*). Early and heavy flowering this spring in Southern Arizona. Inset: Saguaro Cactus (*Carnegiea gigantea*). Exceptional flowering in Tucson in March 2024. *Photo Credits: Doug Ripley*

President's Note

by Douglas Ripley jdougripley@gmail.com

Greetings to all Arizona Native Plant lovers, old and new! I hope you have been able to enjoy Arizona's remarkable native flora this summer. As usual we have been following closely the development of this season's monsoon activity. From just a casual observation of the season at my home in Cochise County it appears to be close to the norm since we moved here 17 years ago. Also, I believe that the winter rains, at least in Southern Arizona, were heavier and more frequent than in recent years. And apparently the inscrutable El Niño contributed to significant increases in rain and snow in northern Arizona. For me, just casual observations of the winter rains impact on the flora of the Sonoran Desert included a spectacular Saguaro cactus bloom along with a very surprising and extensive early blooming of the beautiful Ironwood Tree. I observed the early ironwood tree floral display even along city streets in Tucson where I had not previously noticed them as street trees.

Botany 2024 Annual Conference

The Society's most notable accomplishment to date this summer was the sponsorship of our Botany 2024 Conference, the first in-person conference meeting held since the start of the COVID pandemic in 2020. Held August 17–18 at the Pima Community College in Tucson, a good representation of members and non-members attended the conference. On the first day seventeen individual presentations were made by individuals with a wide range of interests and experience with native plants. On the second day three individual field trips were offered by members Lyn Loveless, Jack Dash, and John Scheuring.

Botanical Training Classes

Thanks to the generous support of Shelley McMahon, professor of plant sciences and Director of the University of Arizona's Herbarium, the Society has been able to continue offering plant identification class (11–15 November) led by.the UA Herbarium. This summer we offered an extremely popular two-day class led by Tucson Chapter members Mike Bauer with assistance from Sue Rutman and Linda Kennedy. We hope to continue such classes and expand the subject matter presented in the near future.

This Issue of *Plant Press Arizona*

For this issue of *Plant Press Arizona,* we decided to return to a single subject as we have done occasionally in the past. In some previous issues we explored a distinct group of native plants (e.g. orchids, grasses, and nonvascular lower plants) with the hope that such a treatment would enhance the reader's understanding and appreciation of those important groups. We continued that practice with this issue which deals entirely with the gymnosperms and discusses their occurrences in both Arizona and Sonora, Mexico.

Society Administration

Thanks to the conscientious efforts of the Society's Board of Directors and other volunteers such as individual chapter officers, the Society continues to operate on an even keel and is financially secure.

I want to thank all members for their participation in our Society and wish you happy botanizing for the remainder of the year.

Figure 2. Bristlecone Pine. *Photo: Doug Ripley*

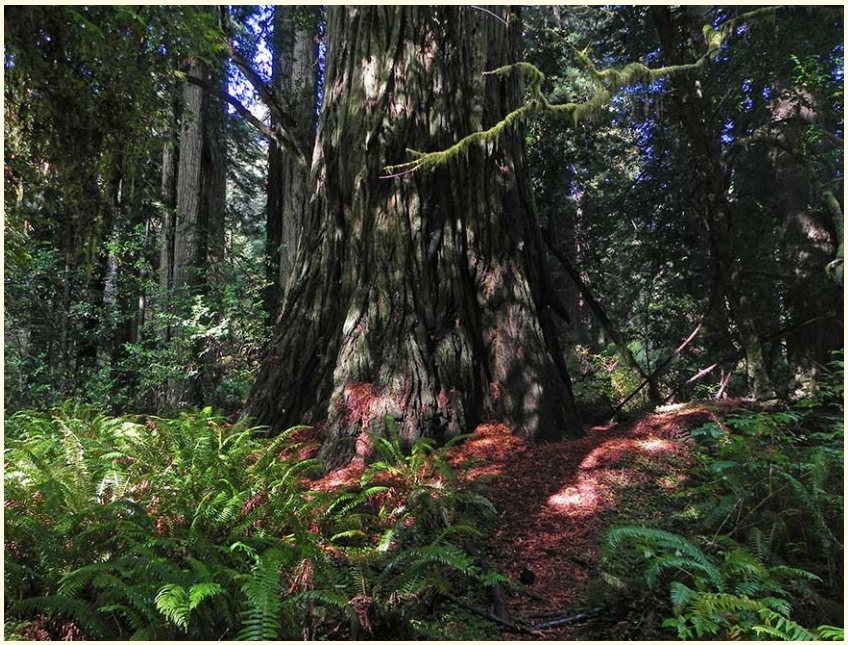


Figure 3. Coast Redwood. *Photo: Doug Ripley*

Gymnosperms *continued from page 1*

economic importance and sheer wonder. For example, the General Sherman giant redwood (*Sequoiadendron giganteum,* Figure 1) found in California's Sequoia National Park is believed to be the largest individual organism on earth. Also occurring in the Inyo National Forest of California's White Mountains are stands of the Bristlecone Pine (*Pinus arista* var. *longaeva*, Figure 2), one of which is possibly the oldest non-clonal living thing on earth with an estimated age of 4,789 years! An individual of the other California redwood (*Sequoia sempervirens,* Figure 3), which occurs on the northwest California coast, is believed to be the tallest living organism with a height of 379.6 feet (115.7 meters).

The cycads (Cycadophyta) are palmlike plants that live mainly in tropical and subtropical areas. The only cycad native to the United States is the *Zamia pumila* (Figure 4) found in south Florida, even though some cycads such as the Sego Palm (*Cycas revoluta,* Figure 5) are extremely popular ornamental

continued next page

Figure 4. *Zamia pumila*. *Photo: Wikipedia*

Figure 5. Sego Palm. *Photo: Doug Ripley*

Figure 6. *Ginkgo biloba tree and fruit. Photos: Wikipedia*

Figure 7. *Gnetum neglectum. Image: Wikipedia*

Gymnosperms *continued*

plants found throughout warmer climates in the country (Figure 5). The well-known ornamental Ginkgo Tree (*Ginkgo biloba,* Figure 6) is an ancient species and the only living representative of the Ginkgophyta.

The final gymnosperm division, Gnetophyta, contains three genera. *Gnetum* (Figure 7) is a broad-leaved vine-like plant found throughout the moist tropics. *Ephedra* is an unusual shrub that occurs commonly in Western North America and which will be discussed in more detail below (Figure 8). The third, *Welwitschia mirabilis,* has been described as "the most bizarre plant in the world" and it displays some modest angiosperm traits yet is definitely a gymnosperm. Found only in the Namib Desert of Namibia and adjacent regions of southwestern Africa, the plant produces a deep taproot and only two strap-like leaves which split into narrower segments with time (Figure 9).

The Environmental and Economic Significance of Gymnosperms

Gymnosperms occur on all continents except Antarctica and are found primarily in the temperate latitudes. Those widely found in the Northern Hemisphere are the conifers, including junipers, firs, larches, spruces, and pines. In the Southern Hemisphere gymnosperms are represented primarily by trees of the genus *Podocarpus.* (Figure 10). From Christmas trees and garden landscaping plants to the principal species of the boreal conifer forests where they often grow over huge landmasses, conifers are the major source of soft lumber, of paper, resins, and drugs, and are an invaluable

continued next page

Figure 8. *Ephedra asper. Photos, from left: Patrick Alexander, Liz Makings*

Figure 9. *Welwitschia mirabilis. Photo: Thomas Schoch*

Figure 10. *Podocarpus milanjianus. Photo: Wikipedia*

Figure 11. *Pinus aristata* var. *longaeva. Photo: Doug Ripley*

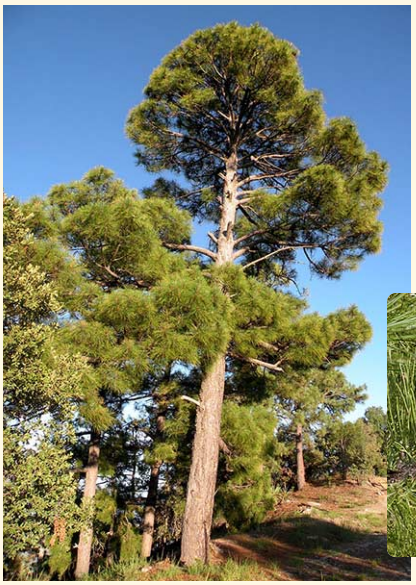


Figure 12. *Pinus arizonica. Photos from left: S. Gonzalez, Tom Van Devender*

Gymnosperms *continued*

component of our natural world. They are also a source of food for wildlife and the principal component of one of the earth's major carbon sinks.

For those reasons, we thought a discussion of the gymnosperms, with an emphasis on the native Arizona species, where they occur, and the contributions they have made to the diversity of the Arizona flora, would be a valuable and interesting topic to present in this issue of *Plant Press Arizona.*

Gymnosperms vs. Angiosperms: Numbers in the Arizona Flora

GYMNOSPERMS

Gymnosperms in the Arizona flora are represented by the following three families, containing 7 genera and 27 species:

The Pine Family (Pinaceae)

Pinus (Pine): 10 species

Pinus aristata var. *longaeva* (Bristlecone Pine, Figure 11). Subalpine and alpine; 6,800–8,000 ft.; Arizona, California, Utah

Pinus arizonica (Arizona Pine, Figure 12). Slopes, canyons and rims, and tablelands; 6,900–8,200 ft.; Arizona, New Mexico

Pinus discolor (Border Pine, Figure 13). Pinyon-juniper woodland, foothills, mesas, tablelands; 2,300–7,545 ft.; Arizona, New Mexico, Texas

Pinus edulis (Two Needle Pinyon, Figure 14). Dry mountain slopes, mesas, plateaus, and pinyon-juniper woodland; 5,900–8,800 ft.; Arizona, California, Colorado, New Mexico, Oklahoma, Texas, Utah, Wyoming

Pinus engelmannii (Apache Pine, Figure 15). High and dry mountain ranges, valleys, and plateaus; 4,900–8,100 ft.; Arizona, New Mexico; Mexico

continued next page

Figure 13. *Pinus discolor. Photos: Sue Carnahan*

Figure 14. *Pinus edulis. Photos: Max Licher*

Figure 15. *Pinus engelmannii. Photo: Douglas Koppinger*


Figure 16. *Pinus flexilis*. *Photos: Patrick Alexander*


Figure 17. *Pinus leiophylla* var. *chihuahuana*. *Photos: Sue Carnahan*


Figure 18. *Pinus monophylla. Photos, from left: Sky Jacobs, Sky Davis*

Gymnosperms *continued*

Pinus flexilis (Limber Pine, Figure 16). High montane forests, often at timberline; 5,000–11,800 ft.; Alberta, British Columbia; Arizona, California, Colorado, Idaho, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Wyoming

Pinus leiophylla var. *chihuahuana* (Chihuahua Pine, Figure 17). Dry slopes and plateaus; 4,900–8,000 ft.; Arizona, New Mexico; Mexico

continued next page

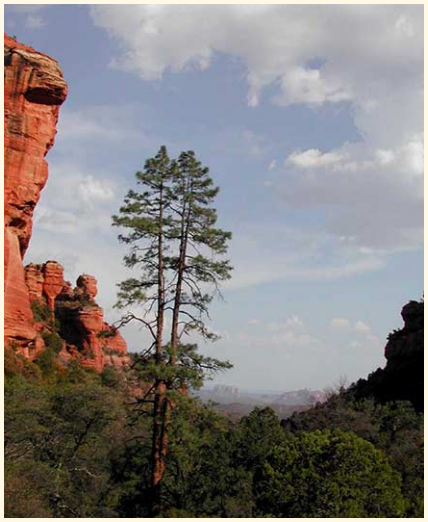




Figure 19. *Pinus ponderosa. Photos (clockwise from left): Max Licher, Max Licher, Les Landrum, Liz Makings, Patrick Alexander*



Figure 20. *Pinus strobiformis*. *Photos, from left: Max Licher, Max Licher, Doug Ripley*

Figure 21. *Picea engelmannii. Photos, clockwise from top left: Patrick Alexander, Sky Jacobs, Max Licher*

Figure 22. *Picea pungens. Photos: Max Licher*

Gymnosperms *continued*

Pinus monophylla (Single Leaf Pine, Figure 18). Dry low-montane or foothill pinyon-juniper woodland; 3,500–7,500 ft.; Arizona, California, Idaho, Nevada, Utah; Baja California

Pinus ponderosa (Ponderosa Pine, Figure 19). 5,000–9,000 ft.; British Columbia to New Mexico.

Pinus strobiformis (Southwestern White Pine, Figure 20). Arid to moist summit elevations, montane forests; 6,200–9,800 ft.; Arizona, New Mexico, Texas; northern Mexico

Picea (Spruce): 2 species

Picea engelmannii (Engelmann Spruce, Figure 21). Moist montane areas; 8,000–9,800 ft.; through much of the U.S southwest, northern Mexico, and western Canada

Picea pungens (Blue Spruce, Figure 22). Midmontane forests; 8,000–9,800 ft.; Arizona, Colorado, Idaho, New Mexico, Utah, Wyoming

Pseudotsuga (Douglas-fir): 1 species

Pseudotsuga menziesii (Douglas-fir, Figure 23). Mountain slopes in the U.S., Canada, and Mexico, 6,500–10,000 ft.; common in the central parts of the state, southward to the Chiricahua, Huachuca, Santa Catalina, and Santa Rita Mountains

Abies (True Firs): 2 species

Abies concolor (White Fir, Figure 24). Coniferous forests; 5,500–11,000 ft.; Arizona, California, Colorado, Idaho, Nevada, New Mexico, Oregon, Utah; Baja California and Sonora

continued next page

Figure 23. *Pseudotsuga menziesii. Photos, from left: Tom Van Devender, Paul Rothrock, Max Licher*

Figure 24. *Abies concolor. Photos, from left: Max Licher, Les Landrum*



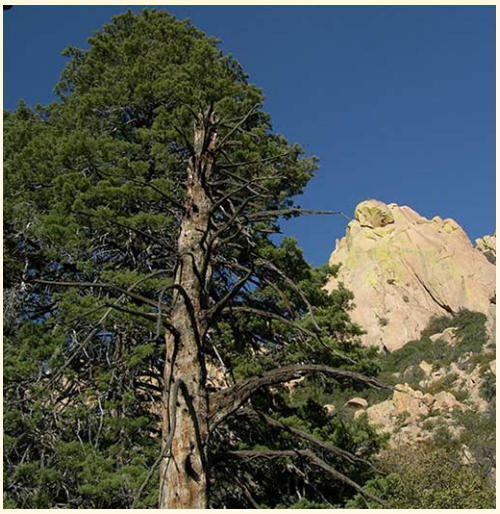


Figure 25. *Abies lasiocarpa* var. *arizonica*. *Photos, from left: Tanya Hardy, Wikipedia*


Figure 27. *Juniperus arizonica*. *Photos: Max Licher*

Figure 26. *Hesperocyparis (Cupressus) arizonica*. *Photos, from top: Doug Ripley, Cricket Raspet*


Figure 28. *Juniperus californica*. *Photos, from left: Wikipedia, Walter Siegmund*

Gymnosperms *continued*

Abies lasiocarpa var. *arizonica* (Whitebark Fir, Figure 25). Rocky slopes in mixed conifer communities; 5,500–11,000 ft.; Arizona, Colorado, New Mexico

The Cypress Family (Cupressaceae)

Cupressus (Cypress): 2 species

Hesperocyparis (*Cupressus) arizonica* (Arizona Cypress, Figure 26). Canyon bottoms and on mountain slopes; 3,200–5,000 ft.; Sky Islands north to Greenlee County; New Mexico, Arizona, California; northern Mexico

Hesperocyparis (*Cupressus*) *glabra* (Smooth Cypress). Similar habitats to *H. arizonica* but further to the northwest

Juniperus (Juniper): 7 species

Juniperus arizonica (Arizona Juniper, Figure 27). Found on dry, well-drained soils in full sun; 4,000–6,500 ft.; cone production October–November; Arizona, southwest New Mexico; northern Mexico

Juniperus californica (California Juniper, Figure 28). Dry, rocky slopes and flats; 2,500–5,250 ft.; Arizona, California, Nevada; Baja California

continued next page


Figure 29. *Juniperus communis*. *Photos, from left: Max Licher, Paul Rothrock*


Figure 30. *Juniperus deppeanna*. *Photos: Max Licher*

Gymnosperms *continued*

Juniperus communis (Common Juniper, Figure 29). Above 8,000 ft.; cooler parts of North America and Eurasia

Juniperus deppeanna (Alligator Juniper, Figure 30). 4,500–8,000 ft.; Arizona, New Mexico, Texas; Mexico. Common in the southeastern and central parts of Arizona, extending at least as far north as Flagstaff and west to the Baboquivari Mountains

Juniperus monosperma (One-Seed Juniper, Figure 31). Dry, rocky soils and slopes; 3,200–7,500 ft.; Arizona, Colorado, New Mexico, Oklahoma, Texas

Juniperus osteosperma (Utah Juniper, Figure 32). Dry, rocky soils and slopes; 4,200–8,500 ft.; Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming

Juniperus scopulorum (Rocky Mountain Juniper, Figure 33). Rocky soils, slopes, and eroded hillsides; 4,000–8,800 ft. (0 ft. at Vancouver Island and Puget Sound); Alberta, British Columbia.; Arizona, Colorado, Idaho, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oregon, South Dakota., Utah, Washington, Wyoming; Mexico

continued next page


Figure 31. *Juniperus monosperma*. *Photos: Max Licher*


Figure 32. *Juniperus osteosperma*. *Photos, from left: Kirstin Phillips, Max Licher*


Figure 33. *Juniperus scopulorum*. *Photos, from left: Les Landrum, Max Licher*

Figure 34. *Ephedra aspera*. *Photos: Ries Lindley*

Figure 35. *Ephedra californica*. *Photo: BJ Stacey, iNaturalist*

Figure 36. *Ephedra cutleri*. *Photo: Max Licher*

Figure 37. *Ephedra fasciulata*. *Photo: Patrick Alexander*

Gymnosperms *continued*

The Joint-Fir Family (Ephedraceae)

Ephedra (Joint-Fir): 9 species

Ephedra aspera (Rough Joint-fir, Figure 34). Coning March–April; fry rocky slopes, ravines, and fans; 1,600–1,800 ft.; Arizona, California, New Mexico, Texas; northern Mexico

Ephedra californica (California Joint-fir, Figure 35). Coning March–April; dry slopes and fans to valley grasslands; 160–3,280 ft.; California; Baja California

Ephedra cutleri (Cutler's Joint-fir, Figure 36). Coning late winter–midspring (March–May); dry, flat, sandy areas, occasionally on rocky slopes; 4,600–7,500 ft.; Arizona, Colorado, New Mexico, Utah

Ephedra fasciulata (Arizona Joint-fir, Figure 37). Coning March–April; dry rocky slopes, washes, and sandy areas; 1,000–4,000 ft.; Arizona, California, Nevada, Utah

Ephedra funerea (Death Valley Joint-fir, Figure 38). Coning March–April; sandy, dry soil and rocky scrub areas; of conservation concern; 1,640–5,000 ft.; California, Nevada, western Arizona

Ephedra nevadensis (Nevada Joint-fir, Figure 39). Coning late winter–midspring; dry, rocky slopes and hills, rarely in sandy flat areas; 2,300–6,200 ft.; Arizona, California, Nevada, Oregon, Utah

continued next page

Figure 38. *Ephedra funerea*. *Photos, from left: C.V. Morton and Dennis Stephenson*

Figure 39. *Ephedra nevadensis*. *Photo: Wikipedia*

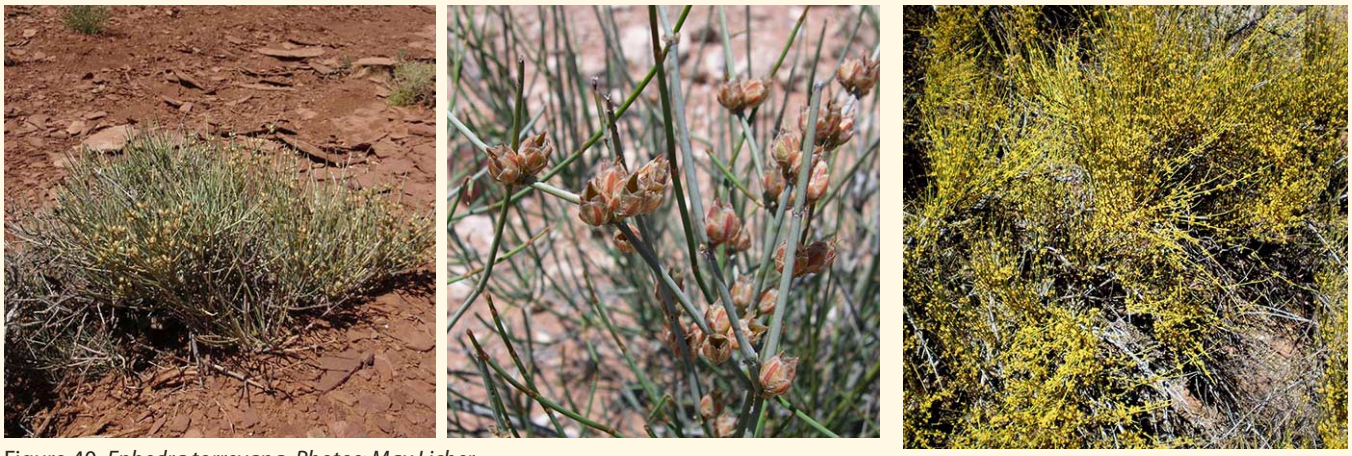


Figure 40. *Ephedra torreyana*. *Photos: Max Licher*

Gymnosperms *continued*

Ephedra torreyana (Torrey's Joint-fir, Figure 40). Coning spring; dry rocky to sandy areas; 1,600–6,500 ft.; Arizona, Colorado, Nevada, New Mexico, Texas, Utah; Chihuahua

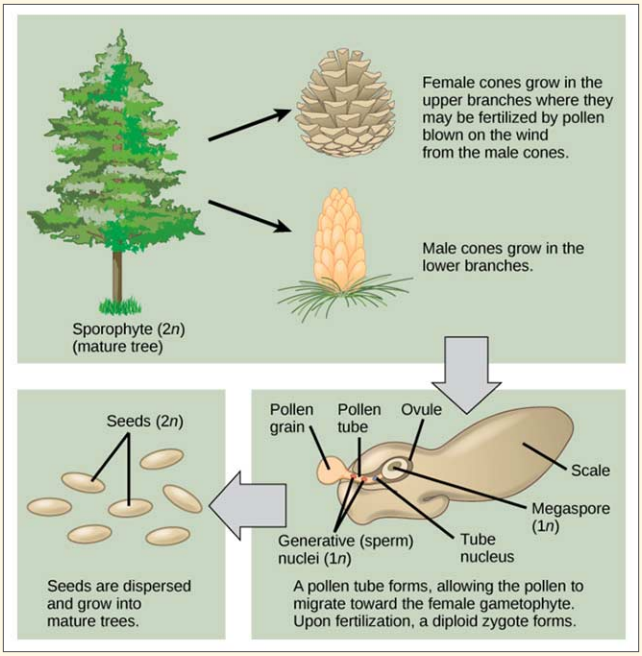
Ephedra trifurca (Long-Leaf Joint-Fir, Figure 41). Coning late winter–early spring; dry rocky slopes to flat sandy areas; 1,600–6,500 ft.; Arizona, California, New Mexico, Texas; Baja California, Chihuahua, Coahuila, Sonora

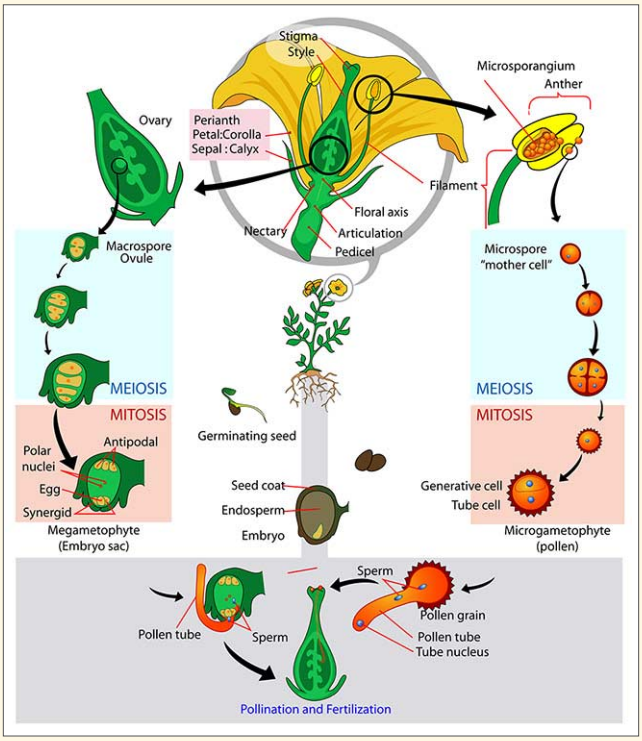
Ephedra viridis (Mormon Tea, Figure 42). Coning spring; dry rocky slopes and canyon walls; 2,600–8,200 ft.; Arizona, California, Colorado, Nevada, New Mexico, Oregon, Utah, Wyoming

continued next page

Figure 41. *Ephedra trifurca*. *Photos: Tom Van Devender*

Figure 42. *Ephedra viridis*. *Photos, from left: Max Licher, Kirstin Phillips*





Gymnosperms *continued*

ANGIOSPERMS

Angiosperms in the Arizona Flora are represented by approximately 4,000 species in hundreds of families.

Sexual Reproduction: Gymnosperms vs. Angiosperms

The gymnosperms have a sexual life cycle (Figure 43) considerably different from the much more highly advanced angiosperms (Figure 44). Perhaps the most significant characteristic that separates the gymnosperms from the angiosperms is that their seeds are born "naked" on a seed producing structure (e.g. the ever-popular pine cone). The name *gymnosperm* means "naked seed." Angiosperms on the other hand have evolved into a much more streamlined and efficient means of sexual reproduction allowing for almost limitless variations for attracting pollinators and producing and dispersing seeds. The angiosperm seed is formed contained in a closed ovule, the wall of which comprises the fruit and can be characterized by almost endless variations.

Distribution of Gymnosperms in Arizona

The gymnosperms occurring in Arizona, as well as most of North America, are represented mainly by cone-bearing trees (the Conifers) and an unusual plant called *Ephedra* which is classified in the Gnetophyta and which is described in the "Spotlight on a Native Plant" feature in this issue. Many of the Arizona conifers occur at elevations above approximately 5,000 feet but junipers generally grow at lower elevations. Consequently, the richest occurrences of Arizona conifers are found in the southern Sky Islands and the other mountain ranges of the central and northern sections of the state such as the Mogollon Rim, White Mountains, and San Francisco Peaks. The Kaibab Plateau, located almost entirely in Coconino County, Arizona, north of the Grand Canyon, is famous for its rich stands of spruce, fir, and ponderosa pine.

Notable Large Conifer Specimens in Arizona

Encountering a giant conifer during a botanical outing can be a thrilling event! (Figure 45) Fortunately, there is an excellent guidebook prepared and maintained by the Arizona Department of Forestry that documents Arizona's Magnificent

continued next page

From top:

Figure 43. The Gymnosperm Sexual Life Cycle.

Figure 44. The Angiosperm Sexual Life Cycle

Figure 45. Ken Morrow and Bob Zahner (L–R), then co-coordinators of the Arizona Register of Big Trees, and the Arizona Cypress (*Cupressus arizonica*) Champion Tree. *Photo: Glenda Zahner*

Gymnosperms *continued*

Trees (https://dffm.az.gov/arizonas-magnificent-trees) that can guide you to Arizona's size record holders (both gymnosperms and angiosperms). This topic was the subject of the Summer 2019, Volume 42(1) of *Plant Press Arizona* (https://aznps.com/wp-content/uploads/Plant-Press-42-1-Final.pdf).

Where Can One Observe Some Really Old Arizona Conifers?

Fortunately for Arizonans, the Petrified Forest National Park, located in Navajo and Apache counties in northeastern Arizona is a truly wonderful place to observe the petrified remains of ancient gymnosperms. The fossilized trees found in the park date to the Late Triassic Epoch, about 225 million years ago, and are part of the widespread and colorful Chinle Formation from which the Painted Desert gets its name. Fossils found in the park include Late Triassic ferns, cycads, ginkgoes, and many other plants along with large amphibians and early dinosaurs.

The most conspicuous fossilized conifer seen as one drives through the park is *Araucarioxylon arizonicum* (alternatively *Agathoxylon arizonicum,* Figure 46), which has been designated the state fossil of Arizona. The species is known from massive tree trunks that weather out of the Chinle Formation in desert badlands of northern Arizona and adjacent New Mexico.

Conclusion

Gymnosperms represent a truly excellent complement to the flowering plants in the Arizona Flora. With their often-majestic beauty, range of habitat preferences, usefulness for many human purposes, and support of critical environmental processes, we should celebrate them whenever and wherever we can!

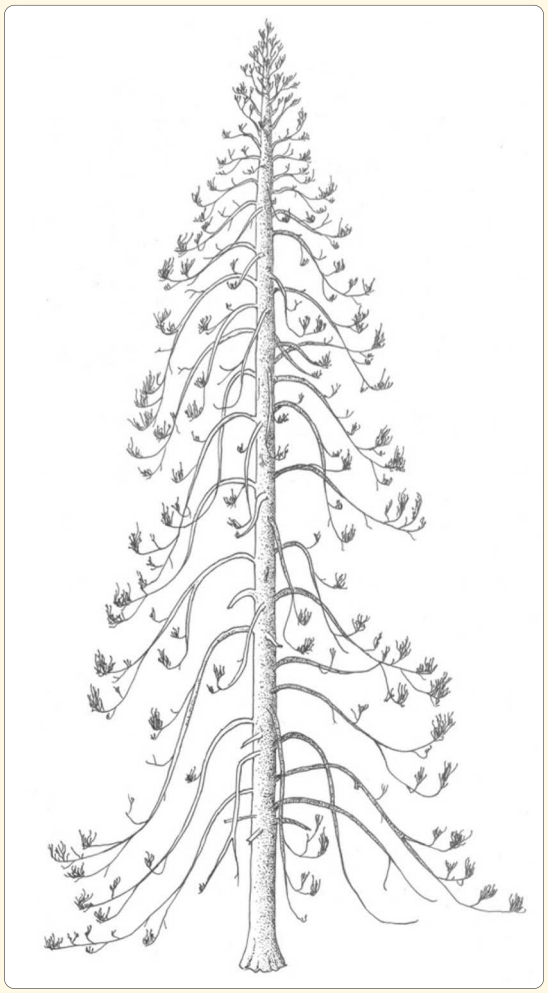


Figure 46. *Araucarioxylon arizonicum. Photos: Doug Ripley, Illustration: Falconaumanni - Own work, CC BY-SA 3.0*

SPOTLIGHT ON A NATIVE PLANT *by Jack Dash*[1]. *Photos courtesy the author*

Ephedra spp. (Mormon Tea, Joint-fir, Canutillo, Popotillo)

Ephedra is a genus of unusual xerophytic shrubs classified in the family Ephedraceae. These plants are gymnosperms, more closely related to pines and cypresses than to flowering plants like legumes and asters. This ancient genus shows up in the fossil record as far back as 125 million years ago during the early Cretaceous Period, when dinosaurs still roamed the Earth, and the first flowering plants were just beginning to make their appearance.

Though the Ephedraceae used to contain other genera, those have all gone extinct, leaving *Ephedra* as the only genus in this family. The closest living relatives to *Ephedras* are in the families Gnetaceae and Welwitschiaceae, the latter of which is represented by just one species, *Welwitschia mirabilis*, a botanical oddity found only in the Namib Desert of Namibia and adjacent regions of southwestern Africa.

The genus *Ephedra* is represented by nine species in the state of Arizona, all sharing the same basic form: untidy masses of reed-like stems growing from woody bases (see photos). A close inspection will reveal that there are leaves, though these have been reduced to papery sheaths, with photosynthesis occurring primarily in the green or gray-blue stems. Plants are typically dioecious, meaning that pollen and seed-bearing structures are borne on separate individuals. Instead of flowers, *Ephedras* have strobili, a fancy word for cones, like those found on other gymnosperms. All our native *Ephedras* are wind pollinated, though there are species of *Ephedra* found in Eurasia that are known to be pollinated by nocturnally active flies and moths. It has been consistently observed that pollen-producing (male) plants are generally found on drier sites, and seed-bearing plants (females) are typically associated with lower, more mesic areas. This habitat specialization may be partly explained by the higher water

[1P]President, Tucson Chapter, Arizona Native Plant Society.
nativeplantstucson@gmail.com

continued next page

SPOTLIGHT ON *Ephedra* spp.

cost associated with seed production and the greater spread of pollen when plants are located in more exposed, windier areas.

The common name of Mormon Tea is derived from the historic use of this plant by settlers as a stimulant, a practice that was most likely borrowed from indigenous groups in the region who also made tea with these plants to help cure kidney and stomach ailments and, allegedly, venereal diseases. Members of this genus have been a part of the pharmacopeia of southeast Asia for several thousand years because they contain the drug ephedrine, a substance used in the treatment of low blood pressure, asthma, and congestion. This substance has also been added to weight-loss supplements, and the overuse of these weight-loss pills has resulted in severe adverse effects up to and including death in rare cases. Because of this, weight-loss drugs containing ephedrine are banned in the United States. None of our native species are known to contain ephedrine, though the stimulation and increased heart rate associated with their use means they should be consumed with caution, if at all.

Ephedras can be found from around 1,000 to 6,500 feet elevation, and are often common components of Desertscrub, Grassland, and Pinyon-Juniper Woodland biotic communities. These relicts of a bygone era may seem like an odd choice for use in gardens due to their lack of showy foliage or flowers, and the difficulty of tracking them down in the nursery trade. With that said, creative native plant gardeners will enjoy placing *Ephedras* in succulent gardens as an accent or planting them in an informal hedge with saltbushes (*Atriplex* spp.), junipers (*Juniperus* spp.), and/or creosote (*Larrea tridentata*).

Who's Who at AZNPS

BOARD OF DIRECTORS

Kara Barron *Director* **kara@gwpaz.org**

Sue Carnahan *Director at Large* **carnahan.sue@gmail.com**

Carrie Cannon *Director, Peach Springs Chapter President* **Carrie.Cannon@hualapai-nsn.gov**

Nathan Cline *Upper Gila Chapter President* *nathan.cline@eac.edu*

Jack Dash *Director, Co-Editor,* Plant Press Arizona, *Tucson Chapter President,* **nativeplantstucson@gmail.com**

Andrew Gourevitch *State Treasurer* **gourevitch@yahoo.com**

Wendy Hodgson *Director, Education & Outreach Committee Chair* **whodgson@dbg.org**

Robin Kulibert *Director, Santa Cruz Chapter President* **santacruz.aznps@gmail.com**

Lyn Loveless *Director* **lyndloveless@gmail.com**

Valerie Morrill *Director, Yuma Chapter President* **aznpsyuma@yahoo.com**

Kirstin Olmon Phillips *Director, Flagstaff Chapter* **kphillips@musnaz.org**

Doug Ripley *State President, Co-Editor,* Plant Press Arizona, *Cochise Chapter President* **aznpscochise@gmail.com**

Lisa Rivera *Director, Phoenix Chapter President* **aznpsphoenix@gmail.com**

Jess Rollar *Director, White Mountain Chapter President* **aznpswhitemountain@gmail.com**

Andrew Salywon *Director at Large* **asalywon@dbg.org**

John Scheuring *Director at Large, Conservation Committee Chair* **aznpsconservation@yahoo.com**

Becky Settje *Director, Tonto Basin Chapter President* **beckysettje@hotmail.com**

Sue Smith *Director, Prescott Chapter President* **PrescottNativePlantSociety@gmail.com**

Anita Thompson *Director at Large, Plant Material Committee Chair* **anitathompson@arizona.edu**

COLLABORATORS

Ries Lindley *Co-Editor,* Plant Press Arizona **ries.lindley@gmail.com**

Patricia Sanchez *AZNPS Administrator* **arizonanativeplantsociety@gmail.com**

Shelley Silva Happenings *Editor* **shelley.a.silva@gmail.com**

Julie St. John Plant Press Arizona *Layout Editor* **JulieStDesign@gmail.com**

Roadside Gymnosperms of the Santa Catalina Mountains

by Jack Dash[1] *Images courtesy the author unless otherwise noted*

Gymnosperms (naked seeds) can be found across the state of Arizona, from sweltering desert flats to cool mountain heights. One of the benefits of Arizona's rugged topography, with steep mountains and precipitous canyons, is the ability to travel through many biotic communities in a day's drive or hike. There are few better examples of this than a drive-up the General Hancock Highway (also known as the Mount Lemmon Highway and the E. Catalina Highway) in the Santa Catalina Mountains north of Tucson, Arizona. Extending 24 miles from its base and rising around 6,000 feet, this spectacularly engineered paved highway, constructed between 1933 and 1950, compresses southern Arizona's diverse biotic communities into a pleasant drive, showcasing a large variety of gymnosperms in their preferred habitats.

These biotic communities aren't hard lines. They are intergrading associations of plants that mingle and blend depending on various biotic and abiotic factors, including slope, aspect, geology, and presence or absence of herbivores and seed dispersers. This article takes the reader on a tour up the highway, with stops to focus on particular species that are representative of some of the biotic communities a visitor might encounter while driving this zig-zagging road, replete with astounding views and stomach-turning drops. Along the way you will encounter squawking Steller's Jays, snow-covered hillsides, spectacular geological formations (Figure 2), and of course, iconic Arizona native plants.

The approach to the front range of the Catalina Mountains takes you through a desert sprouting with track homes and gated communities. The temperature here at about 2,500 feet is 81 degrees on a late March day. The desert here, where it hasn't been replaced by urban sprawl, consists of Arizona Upland Sonoran Desertscrub. Lime-colored foothill palo verde (*Parkinsonia microphylla*), stately saguaro (*Carnegiea gigantea*), and waxy jojoba (*Simmondsia chinensis*) adorn the roadsides. Well below the preferred habitat of coniferous trees, this may seem like an unlikely place to encounter a gymnosperm. Yet scattered here and there are the bundled,

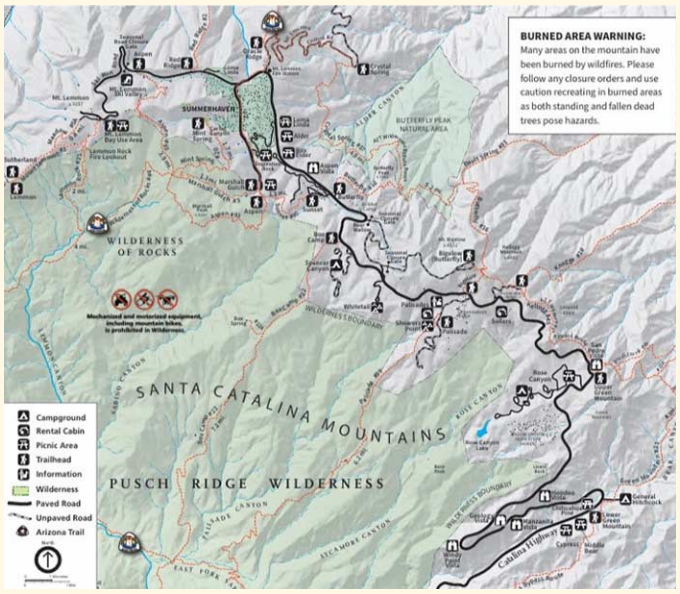


Figure 1. Map of the General Hancock Highway, Santa Catalina Mountains. *Image: Coronado National Forest, USFS*

leafless branches of long-leaf joint fir (*Ephedra trifurca*, Figure 3). Though lacking the needles and large cones typically associated with gymnosperms, this hardy desert shrub is more closely related to the stately firs found on top of Mt. Lemmon than to the desert plants surrounding it.

As you get closer to the mountains, what looks like a solid wall of rock reveals itself to be a three-dimensional front range split by canyons and cliffs and backed by the snow-covered peaks of Mt. Lemmon and Mt. Bigelow. Before long, you are enveloped in the mountains, the last few mega-mansions built into the foothills of the range give way to lush canyons fed by water from the winter's often abundant rainfall.

About five miles up the road, you pass the parking lot for the swimming holes at Molino Vista and a shift begins in the vegetation, more grassland and woodland species enter the mix. As you reach 4,000 feet above sea level, the mesquites (*Neltuma velutina*) become interspersed with alligator juniper (*Juniperus deppeana*). Although Arizona is home to five species of juniper, this one is relatively easy to differentiate with its blue scale-like foliage and bark furrowed and split into small plates resembling the skin of an alligator. Pull over at one of highways many pull-offs, and rub your fingers on the needles to take in the medicinal fragrance. This is the time of year when small pollen and seed-bearing cones (also known as megastrobili) appear on these plants. The wind blows the tiny grains of pollen onto the seed-bearing strobili which following fertilization will develop into fleshy "berries" beloved by birds.

[1]President, Tucson Chapter, Arizona Native Plant Society.
nativeplantstucson@gmail.com

continued next page

Figure 2. Upright rock formations against a backdrop of conifer in the Santa Catalina Mountains. *Photo: Doug Ripley*

Figure 3. Pollen-bearing cones on *Ephedra trifurca.*

Roadside Gymnosperms of the Santa Catalina Mountains *continued*

The hills and jagged cliffs are perspiring, dripping rivulets from springs that have come alive after abundant winter rain and snowfall. The turns are tighter, and a look in the rearview mirror may show quick views of the Tucson Basin stretching out towards the twin peaks of the Santa Rita Mountains to the south.

Around milepost 7.4 a small spur splits off from the highway leading towards Gordon Hirabayashi Campground. Along that road, a new gymnosperm makes its first appearance. This is Border Pinyon (*Pinus cembroides*, Figure 4), the sky island analog to the well-known pinyon pine of northern Arizona and the southern Rockies. Border Pinyon is a stout, conical tree that develops a spreading canopy as it ages. The needles of this pine are usually clustered in whorls of three, with dark green on top and white undersides. At the tips of many branches are small pinecones that hold tasty seeds beloved by wildlife.

Past the Bug Spring Trailhead and Windy Point Vista, at milepost 9.1 is an overlook granting views of Seven Cataracts. In years of sufficient rainfall these falls tumble into Willow Canyon, eventually feeding into Bear Canyon down the Mountain. Just beyond this point, the blue tips of Arizona cypress trees (*Hesperocyparis* [*Cupressus*] *arizonica*, Figure 5) peak out above the canyon's rim. With their distinctive blue-green scales, furrowed bark, and globe-shaped seed cones, these trees are readily distinguished from other native conifers.

On the hills above the road, skeletons of drought-killed cypresses are a stark reminder of recent cycles of drought and extreme heat. During the last glacial period, some 11,000-plus

continued next page

Figure 4. Border pinyon.

Figure 5. Arizona cypress.

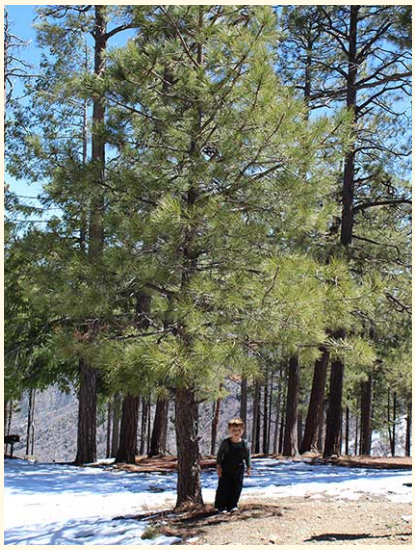


Figure 6. Young ponderosa pine with 3-year old Julian for reference.

Figure 7. Pineland dwarf mistletoe.

Roadside Gymnosperms of the Santa Catalina Mountains *continued*

years ago, the climate was cooler, with more winter rainfall. As a result, cypresses, pines, and other conifers were more widespread in modern southern Arizona. Over the last 10,000 years, a gradually warming climate has driven these majestic trees into moist canyons such as those found in the Santa Catalinas. Anthropogenic climate change may render even these refugia habitats unfavorable to cypress survival. Recent studies by Tucson-based botanist James Verrier have shown a significant decline in populations of Arizona Cypress in the Dragoon and Santa Catalina Mountains.

As one continues upward, the Desert and Grassland have fully given way to montane biomes, and the highway is enclosed on either side by tall gymnosperms. By the time you reach the Lower Green Mountain Trailhead 11.6 miles up the Highway at 7,340 feet, the air is imbued with the resiny fragrance of Chihuahuan (*Pinus leiophylla*) and ponderosa pines (*Pinus ponderosa*, Figure 6) instead of earthy desert petrichor.

Ponderosa pine is one of the iconic trees of the American West, covering more than four million acres in Arizona alone and spanning elevations from 5,000 to 9,000 feet. The long needles usually occur in bundles of two, though it can be more, while the bark is plated, and often weeps a golden sap. In the 2020 Bighorn Fire, large swaths of pine forest were swallowed in the 48-day inferno. Where the fire scar is visible from the road Fendler's buckbrush (*Ceanothus fendleri)* and male fern (*Dryopterus filix-mas*) poke out from between the charred hulks of pines. Ponderosa pine is also susceptible to attack by the Pineland Dwarf Mistletoe (*Arceuthobium vaginatum* ssp. *cryptopodium*) as well as several other species of mistletoe (Figure 7)

As you continue to rise in elevation maples (*Acer* spp.) show up in clearings and road edges. First, a smattering here and there and then dense clusters interspersed among the conifers. Rolling the windows down, a cold breeze passes through the car. Patches of snow appear in shady spots, glistening in the sun, slowly turning to liquid and running into the ditches lining the highway. Imperceptibly, grove by grove the Ponderosa Pine is infiltrated more with Douglas-fir (*Pseudotsuga menziesii*)—whorls of long needles give way to fanning branches covered in flattened, waxy foliage (Figure 8). The sight of Douglas-fir trees in this dry part of the country may surprise snowbirds and tourists from the wetter regions of the Pacific Northwest, where this tree is nearly ubiquitous. But the oblong cones with winged bracts and the flat needles

continued next page

Figure 8. Douglas-fir.

Figure 9. Steller's jay.

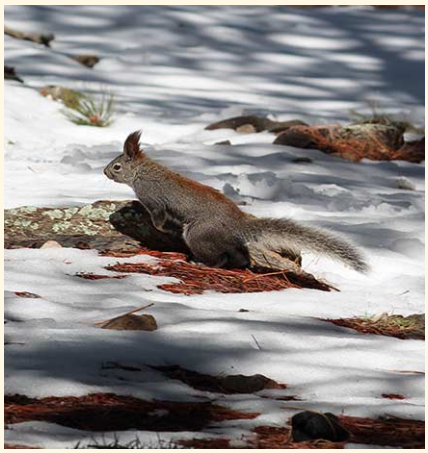


Figure 10. Abert's squirrel.

Figure 11. Hail-damaged Subaru.

Roadside Gymnosperms of the Santa Catalina Mountains *continued*

with blunt tips indicate that this species is indeed present, far away from the emerald woodlands and gray skies of the U.S. Pacific Northwest, and British Columbia.

Passing 8,000 feet in elevation, you come to a series of small pull-offs. Alder Picnic Area has a park-like stand of Douglas-Fir, open enough to provide sweeping views toward the Gila River valley. Steller's jays (*Cyanocitta stelleri*, Figure 9) squawk noisily and flit between trees, their outline regal with a black crest and iridescent blue feathers. Abert's squirrels (*Sciurus aberti*) forage in the duff-covered forest floor (Figure 10). They meticulously search out pine nuts, acorns, and other seeds to eat and cache away for the lean months. It is here, standing in a shady bower looking out at a broad arid valley separating the Santa Catalinas from the Galiuros, that the term "sky island" really makes sense. Plants and animals that could never survive in the arid Sonoran Desert thrive in this cool refuge.

Figure 12. White spruce.

After 26 sinuous miles of driving, you come to Mt. Lemmon Ski Valley. This is the southernmost ski destination in the United States, but warming winters make good years of good snowfall increasingly uncommon. Under the spring sun, much of the winter's snow is turning to slush, and patches of green are peaking through at the margins. The ski lift is silent, and the slopes are empty. Behind a gate across the road leading to Mt. Lemmon Observatory is a black Subaru riddled with hundreds of dents. A passer-by says it had been caught in a hailstorm and abandoned after taking a pummeling from what must have been massive drops of hail (Figure 11). The conifers on the road's edge are reflected in the hood of the beat-up car, warped into wavy colored lines where their reflections cross the dented hood. Mother Nature still packs a punch!

In wooden planters next to the road, small white spruce (*Picea glauca*) trees are intermixed with a dwarf juniper (*Juniperus horizontalis,* Figure12). Neither of these species is native to the Santa Catalinas, and they are a testament to the impact humans have had on the forests of these ancient mountains. Bringing in plants like woolly mullein (*Vercascum thapsus*) from other regions, and letting them loose into new habitats, free from the constraints of the places they evolved. These species alter the ecology of the mountain in obvious ways, such as changes in fire regimes and recovery, and in more subtle ways that we have yet to grasp. The conifers in these planters are unlikely to "hop the fence" and become invasive, but it speaks to people's relationship with the flora of Arizona. Surrounded by a veritable smorgasbord of lovely gymnosperms, somebody has decided to import two species not found in this mountain range. It is the embodiment of the phrase "can't see the forest for the trees."



From left: *Asclepias hypoleuca* with flies at Barfoot Park, Chiricahua Mts. *Asclepias macrotis*, Huachuca Mts. *Asclepias nummularia*, Hwy 92, Hereford. *Photos: Bob Behrstock*

BOOK REVIEW *Bob Behrstock, Arizona Native Plant Society, Cochise Chapter*

Milkweeds of the United States by Gene Thomas

2024. 226 pages. Pollinia Publishers, Vallejo, CA. Soft cover, 8.5" x 11". Available from Amazon.

Flowering plants are characterized by gaudy advertisements that alert pollinators-generally insects-to the presence of tasty nectar or nourishing pollen grains. Some blossoms literally prostitute their gametes, making them nearly impossible to avoid at the ends of long, dancing stamens; others may surround them with richly colored petals perfumed with intoxicating scents. By contrast, there are genera within, for example, the pipevines and orchids, whose hidden pollen is protected inside devilishly designed traps that lure (and may kill) visiting insects. You would be forgiven if you thought these evolutionary abnormalities were rare occurrences-buried in the annals of obscure botanical journals; but Arizonans are quite familiar with one of these genera. A quick perusal of the SEINet website suggests that milkweeds (*Asclepias*: Apocynaceae) comprise approximately the seventh largest genus of Arizona's dicots.

Our state's 31 milkweeds range from the desert floor to the heights of the mountains-an amazingly diverse collection of colorful species with representatives that may barely project above the ground, or proudly thrust their blossoms 12 feet into the sky. Some are rare (two Mexican species barely reach Arizona); others appear widely in dense stands. A few species have leaves the size of your thumb, others may be as large as dinner plates. Most have a single stem, but all three shrubby U.S. species occur only in Arizona. Their leaves and stems are toxic to most insects, yet they nourish Monarchs and several other caterpillars, and the flowers are pollinated by bees, wasps, flies, beetles, and various lepidopterans that they attract in immense numbers. Due to their range of forms and colors, copious nectar production, resistance to drought, grazing and fire, and value to threatened western Monarch

continued next page



Who visits milkweeds? From left: *Anastoechus*, Hereford. *Poecilognathus*, Hereford. *Hemipenthes celeris*, Ramsey Canyon. *Photos: Bob Behrstock*



From left: Juniper Hairstreak, Upper Garden Canyon, Ft. Huachuca. *Amblyscirtes exoteria* on *Asclepias lemmonii*, Garden Canyon, Sierra Vista. *Asclepias elata*, Sawmill Canyon, Ft. Huachuca *Photos: Bob Behrstock*

BOOK REVIEW **Milkweeds of the United States** *continued*

butterflies, milkweeds are especially valuable additions to our pollinator gardens and warrant increased use for habitat restoration.

Until now, there was no comprehensive guide to the 76 milkweeds known from the United States. Happily, Gene Thomas has solved that problem with the new *Milkweeds of the United States*. Some AZNPS members, including me, met Gene in July 2019 when he attended a Cochise chapter meeting during his 76,000 mile journey documenting and photographing all the U.S. milkweeds.

Suggesting this book is simply a guide to milkweeds does it a grave injustice. Rather, it is a synthesis of the universe of milkweeds, including their fossils, a zoogeographic record that springs from an African ancestor, their convoluted taxonomic history, the heroes of milkweed systematics, their relationship with migrating Monarch butterflies, curious flower anatomy, surprising pollination biology and diverse pollinators, their resistance to above ground disturbances, and profiles of the several endangered species. The chapter on physical and chemical defenses clarifies the remarkable physiological adaptation that permits Monarch caterpillars and several other insects to thrive on foliage that's toxic to most other animals. Appendices and sidebars provide a glossary of terms, sources for the scientific names, state species lists, information on propagation (Gene holds a PhD in Horticulture), harvesting and historical uses, and, for deep divers, an annotated chapter-by-chapter bibliography that expands on the book's meticulous research. The text is richly illustrated with five hundred plant photos (nearly all by Gene), many of which are focus-stacked macros illustrating the beauty and complexity of *Asclepias* blossoms, seeds, and leaves, as well as reproductions of 53 milkweed-related book plates and other works of art from the 16th through the 20th centuries that depict the history and science behind the genus. Each species account includes a range map derived from BONAP (The Biota of North America) data.


From left: *Asclepias quinquedentata*, Carr Canyon. *Chauliognathus lecontei* on milkweed, Hereford. *Photos: Bob Behrstock*

Although Gene states he writes for "general readers" you'll not feel he's talking down to you. The book is scholarly, reflecting Gene's deep and varied interests; reading it will help you be a better botanist, a better entomologist, and increase your understanding and appreciation for the history of scientific investigation. For all these reasons, the availability of this new volume is timely and valuable. Every plant family deserves a book like this.

Figure 1. Forest of conifers, Sierra El Tigre, Sonora. *Photo: George Ferguson*

Gymnosperms South of the Border: Sonora

by George Ferguson[1]

Gymnosperms comprise less than 1% of the total number of species of plants in Arizona and Sonora. Yet, forests of gymnosperms dominate the upper elevations of mountains while in the lower elevations they are abundant as small trees or shrubs—all gymnosperms are woody plants (Figure 1). In Sonora, one might expect to see more species as you travel south from Arizona, as biodiversity generally increases toward the New World Tropics from the northern Temperate zone. However, northern species drop out; the general rule is not always the case.

For example, in the Gnetophyte family Ephedraceae there are more joint-fir species of *Ephedra* in Arizona (9 species) than in Sonora; there are just two—boundary ephedra and longleaf joint-fir, which co-occur from Sonoran desertscrub of Pinacate/Gran Desierto east along the borderlands into desert grassland and Chihuahuan desertscub. Both are found on dry rocky slopes to flat sandy areas at the northern tier of Sonora, and reach further south into semiarid regions of the central Mexico plateau. Ephedraceae are absent in Central America into the tropics, yet other *Ephedra* shrubs occur in arid temperate South America and elsewhere in the world.

In the sky-island mountains and Sierra Madre Occidental of Sonora, one sees a similar pattern in the conifer trees. The Cypress family Cupressaceae is a large family, widespread in temperate regions of the northern and southern hemispheres, yet few reach the tropics. Arizona has two species of New World *Hesperocyparis*, smooth cypress and Arizona cypress. Two cypress species occur in Sonora, yet a different combination as smooth cypress drops out. Arizona cypress is in moist canyons of the easternmost sky-island chain into the Sierra Madre, and replaced by Mexican cypress in east central Sonora and southward.

Likewise, a replacement of species happens southward in woodland junipers (*Juniperus*) which are conifers in the

continued next page

[1]University of Arizonia Herbarium, Tucson Chapter, Arizona Native Plant Society

Figure 2. Durango Juniper (*Juniperus durangensis*).
Photo: Alejandro Gómez Nísino, iNaturalist

Figure 3. Chihuahua pine in Sonora, Sierra San Antonio.
Photo: George Ferguson

Gymnosperms South of the Border: Sonora *continued*

Cypress family. Of the seven juniper species in Arizona, five drop out. The one-seeded Arizona juniper in the semi-arid foothills barely occurs southward into northern Sonora, where it becomes replaced by Durango juniper in central Sonora (Figure 2). In the riparian oak woodland of east central Sonora and southward a relative of Arizona's Rocky Mountain juniper is the Blanco juniper (with which it hybridizes). Alligator juniper occurs across sky-islands well into the Sierra Madre with two distinct varieties. Thus, just four juniper species are found in Sonora, (with two overlapping into Arizona). There are no junipers naturally occurring south of northern Central America (Guatemala) in the New World.

The largest family of Gymnosperms and of conifers is the Pine family Pinaceae, a family of over 200 species including pines, firs, spruces, and Douglas-firs; all Northern hemisphere in world distribution. Some 15 species occur in Arizona, and 15 species in Sonora, but of those only eight overlap with Arizona, so again there is a replacement, not simply an increase in diversity southward. In the southernmost Arizona sky-islands along the border, Madrean species such as Apache pine are at their northern fringe in pine oak woodland while some of the upper elevation conifer species become limited. Northern species like blue spruce, corkbark fir, limber and bristlecone pine drop out, and ponderosa pine and white fir (*Abies*) are only found in Sonora's northernmost ranges near the border at summits in tiny areas of north facing slope.

Neither of Arizona's two spruces (*Picea*) occur in Sonora, though one, Engelmann spruce, is found in Mexico only at a very localized spot in the Sierra Madre, at the highest point in Chihuahua overlooking the barrancas of Sinaloa. The Sierra Madre otherwise is usually not over 8,000 ft. elevation, in fact the sky-island mountains of Arizona are the highest of the Madrean archipelago. The greatest diversity of conifers in the sky-islands of Sonora or Arizona is in the Pinaleño Mountain range and its highest peak (Mt. Graham), Graham County, and the Chiricahua Mountains (Cochise County) with their dramatic relief allowing for spruce-fir forests (Ferguson, G.M., et al. 2013).

The Arizona sky-island pines (*Pinus*) such as Chihuahua pine (Figure 3), Arizona pine, Apache pine, and Southwestern

continued next page

Figure 4. *Pino triste* (Sad pine, *Pinus lumholtzii*). *Photo: Jerry Oldenettel https://www.flickr.com/photos/jroldenettel/3234671020/*

Figure 5. Durango fir in Sonora at northern limit near Yecora. *Photo: George Ferguson*

Gymnosperms South of the Border: Sonora *continued*

white pine all occur as dominants in Sonoran sky-islands and far south into the Sierra Madre range, along with Douglas-fir (*Pseudotsuga*). Of Arizona's three pinyon pines, only the Border pinyon occurs into the sky-island mountains of Sonora with scattered populations southward. A replacement, the true Mexican pinyon occurs throughout the Sierra Madre, on the drier east side in Chihuahua into central Mexico. Other more southern Sierra Madre conifer replacements are found in east central Sonora southward, such as drooping *pino triste* (sad pine, Figure 4) and Herrera pine.

Also, there appear four species of Pinaceae on the moist Pacific slope at relatively low elevation of the Sierra Madre in pine oak woodland, from east central Sonora southward, into the highlands of Guatemala and Nicaragua or at least their close relatives—the Yecora pine (of the pseudostrobus pine complex), the egg-cone pine, and Maximino pine as well as the riparian Durango fir (Figure 5), related to *Abies guatamalensis*. No other Pinaceae occur naturally in Central America south of Nicaragua, or in South America. Given the diversity of 15 Pinaceae in Sonora, at any one local area in the Sierra Madre, no more than ten Pinaceae species co-occur together or nearby, often less especially in the sky-islands of Sonora, compared to nine on sky-islands such as Mt. Graham and ten in the Chiricahua Mts., in Arizona.

continued next page

Gymnosperms South of the Border: Sonora *continued*

There are indeed Gymnosperms in the tropics such as some Gnetaceae, Araucariaceae and the cycads. Increasing the diversity in Sonora is the cycad family Zamiaceae, represented by two species of the cycad *Dioon*, one occurring in central Sonora (Figure 6) and another in southern Sonora, both are rare in the landscape. Although Zamiaceae cycads reach the tropics in South America, Africa and Australia the *Dioon* occur no farther south than Honduras in Central America. Also appearing in Sonora is another in the Cypress family, *Taxodium* called ahuehuete, the Mexican bald-cypress related to bald-cypress of the Eastern U.S., the redwoods and giant sequoia. This magnificent tree grows in limited groves along streams in the foothills of southern Sonora and southward in Mexico, where it is protected, to Guatemala (Figure 7).

Certainly, biodiversity is higher in the tropics as a rule. Also, Mexico is a worldwide center for pine diversification when considered as a whole (e.g. 30 species of pines are endemic). Overall, Gymnosperm diversity, being mostly northern in distribution, with replacements southward, decreases in total number of species from some 33 in Arizona to 27 species in Sonora. Together, however, the region of southwestern U.S. and northwestern Mexico supports an amazing diversity of Gymnosperms, with about 47 species in just the two states.

Figure 6. *Dioon vovidesii*. *Photo: George Ferguson*

Figure 7. Bald Cypress (*Taxodium distichum* var. *Mexicana*). *Photo: A.L. Reina-G*

References

Ferguson. G.M., A.D. Flesch and T.R. Van Devender 2013. *Biogeography and Diversity of Pines in the Madrean Archipelago.* Pp. 197–203. Proceedings RMRS-P-67. U.S. Department of Agriculture, Forest Service. Rocky Mountain Research Station, Fort Collins, CO.

Ferguson, G.M., R.S. Felger and M.B. Johnson. *Conifers.* Pp. 35–58 *In* R.S. Felger, M.B. Johnson and M.F. Wilson. *The Trees of Sonora, Mexico.* Oxford University Press. 2001.

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

Journeys of a Pure Naturalist by Joe "JB" Billings. *Photos courtesy the author.*

2024. 253 pages with photos and maps. MonarchQuestAZ, Vail, Arizona. For additional information: https://journeysbyjb.com/.

Most of us must lead our lives confined by the external obligations of job, family, taxes, rent/mortgage, and the like. Some of this group, just a few, no doubt, somehow manage to live with all those pesky obligations and still weave their quest for knowledge, dreams, and adventure around the inescapable and prosaic facts of life. And some smaller number of this latter group even take the time to tell their story. Journeys of a Pure Naturalist is a book about one man's life searching for knowledge and enjoying every search as an adventure.

JB Billings and I first met 53 years ago at Northern Arizona University. He was an intense, and intensely curious, young man. The only thing that has changed about that is his age. Journeys is a journal of selected quests, projects, and stories that range from the self-taught knapping of stone tools to documenting a flora of plants important to pollinators. As to place, the journeys range from the remote heights of the Galiuro Mountains to the Sea of Cortez.

The book is a very satisfying mix of history, prehistory, adventure, science, and personal growth. The first three chapters are about the Galiuro Mountains. This mountain range, almost next door to Tucson, presents few options for approach by road and perhaps even fewer for exploring on maintained trails. Yet people lived and worked there and still do, albeit not many. The young version of the author was drawn to this range precisely because of its difficulty and accessibility issues. It was a place to be alone with nature. Decades later he introduces us to the wonder of these mountains and the ranchers who worked there, and he takes us to the history of earlier times.

Stories about trips to the Sea of Cortez are also very broad in scope but flow together because they are thematically similar. The book takes us along on the journey. We meet fishermen from Sonora, and we are introduced to sea life we didn't know existed. We get to know what it's like to build a reed boat with hand tools and lashing, camp on remote beaches, spearfish for food, and ache with the effort of a difficult rowing sortie. Even the trips to civilization for much-needed supplies are opportunities for interesting branches in the story, like a visit to Nuestra Señora de Loreto Conchó in Loreto, Baja California Sur (complete with a mention of the little sign that admonished visitors to wear proper clothing)

continued next page

The reed boat on the Jeepster Commando.

In the Galiuros, from left: The sky castle above Rattlesnake Basin. Angel Wings formation along the southern skyline ridge.

BOOK REVIEW **Journeys of a Pure Naturalist** *continued*

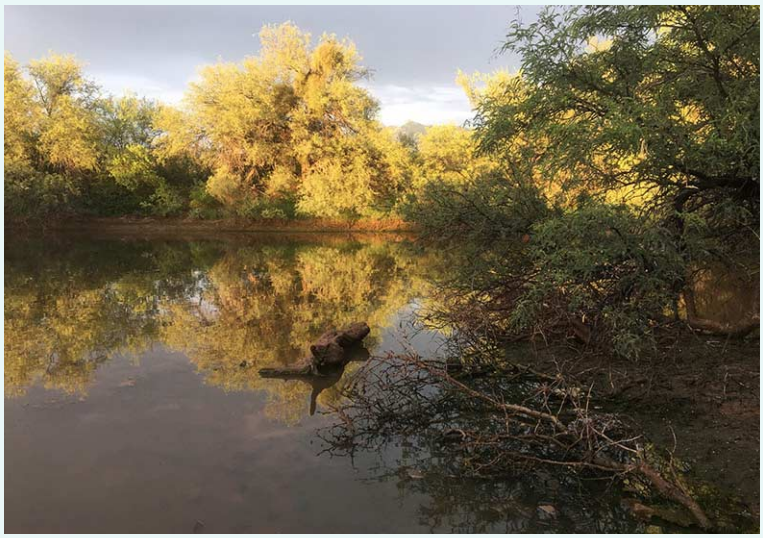
or visiting a nearby ranch on a whim to present the people there with a host gift of homemade smoked skipjack.

The more recent journeys are also more about natural science, less grueling, but more methodically documented. A chapter on tadpole shrimp and fairy shrimp draws attention to the extremely ephemeral nature of some life forms in the desert. There seem to be no bounds on the search for knowledge in this story, including these little shrimp, which live their entire lives in the short wet-cycle of a rainy season puddle. For the curious, even a sidebar to a trail run is an opportunity for exploration.

The last few chapters are brief lessons on butterflies, their life cycles, their names, their beauty, their diets, and a little of their natural history. There are charts on which species of butterfly use which kinds of plants, either for larval food or for adult food. Velvet mesquite is host to four butterfly species, globemallows another three species, and even grasses like side-oats gramma host a species known as the sheep skipper.

The author circumscribed a study area bounded (roughly) by "Interstate 10 on the south, Marsh Station Road/Davidson Canyon to the east, and Colossal Cave Road and the Vail townsite on the west," with the north boundary being mostly defined by Pantano Wash and Cienega Creek. The accompanying charts consist of lists of host plants (mentioned above) as well as selected plant lists for the area. The study area is rich habitat, and this view of the area from a plant/butterfly perspective is one very important way to think about the ecology there.

The entire book is a lesson in perspective, whether that of a butterfly or a young adventurer. The story is a very close look at some selected life stories that teach us something about the author, our natural history, and ourselves. The diary-like feel of the story draws the reader in, but the point of view doesn't feel as though it is limited to that of the author. If you have never propped your door open to allow caterpillars to move in and pupate, if you have never relocated a rattlesnake because it was sleeping where you put your bed, or if you have never hiked to the top of Rincon Peak without a plan, then you probably should read this book. Someone else went through all the hard work of weaving his dreams together with the everyday demands of life, and we all get to benefit by simply reading about it.



A charco built for watering livestock, which also serves as habitat for fairy and tadpole shrimp.

THE ARIZONA NATIVE PLANT SOCIETY
PO Box 41206
Tucson AZ 85717
www.aznativeplantsociety.org

Nonprofit Org
US Postage
PAID
Tucson AZ
Permit #690

Address Service Requested

Printed on recycled paper.

New Members Welcome!

People interested in native plants are encouraged to become members. People may join chapters in Cochise County (Sierra Vista), Flagstaff, Peach Springs, Phoenix, Prescott, Santa Cruz County, Tonto Basin, Tucson, Upper Gila, White Mountains, or Yuma, or may choose not to be active at a chapter level and simply support the statewide organization. For more information, please drop us a line, visit **www.aznativeplantsociety.org**, or get in touch with one of the chapter contacts below:

Cochise: Doug Ripley, 520.909.3132, aznpscochise@gmail.com

Flagstaff: Melissa Amberson, azmelissa@yahoo.com

Peach Springs: Carrie Cannon, Carrie.Cannon@hualapai-nsn.gov

Phoenix: Lisa Rivera, aznpsphoenix@gmail.com

Prescott: Sue Smith, PrescottNativePlantSociety@gmail.com

Santa Cruz: Robin Kulibert, santacruz.aznps@gmail.com

Tonto Basin: Becky Settje, beckysettje@hotmail.com

Tucson: Jack Dash, nativeplantstucson@gmail.com

Upper Gila: Kara Barron, kara@gwpaz.org

White Mountains: Jess Rollar, aznpswhitemountain@gmail.com

Yuma: Valerie Morrill, aznpsyuma@yahoo.com

Membership Form

Name:

_____

Address:

_____

City/State/Zip:

_____

Phone/Email:

_____

Chapter preferred:

❍ Cochise County ❍ Flagstaff ❍ Peach Springs ❍ Phoenix
❍ Prescott ❍ Santa Cruz County ❍ Tonto Basin ❍ Tucson
❍ Upper Gila ❍ White Mountains ❍ Yuma

Enclosed:

❍ $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/**