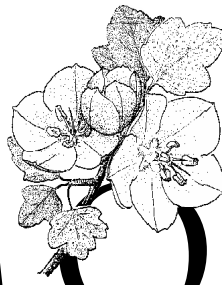


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FREMONTIA

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FREMONTIA

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CALIFORNIA NATIVE PLANT SOCIETY

Dedicated to the Preservation of the California Native Flora

The California Native Plant Society (CNPS) is an organization of laymen and professionals united by an interest in the native plants of California, open to all. Its principal aims are to preserve the native flora and to add to the knowledge of members and the public at large by monitoring rare and endangered plants throughout the state; by acting to save endangered areas through publicity, persuasion, and on occasion, legal action; by providing expert testimony to government bodies; and by supporting financially and otherwise the establishment of native plant preserves. Much of this work is done by volunteers through CNPS Chapters throughout the state. The Society's educational work includes: publication of a quarterly journal, *Fremontia*, and a quarterly *Bulletin* which gives news and announcements of Society events and conservation issues. Chapters hold meetings, field trips, and plant and poster sales. Non-members are welcome to attend.

Money is provided through member dues and funds raised by chapter plant and poster sales. Additional donations, bequests, and memorial gifts from friends of the Society can assist greatly in carrying forward the work of the Society. Dues and donations are tax-deductible.

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THE COVER: Boyden Cave limestones bisecting Monarch Divide in Kings River Canyon. Photograph by Dana York.

CALIFORNIA NATIVE PLANT SOCIETY

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DISCOVERING THE ENDEMIC PLANTS OF KINGS RIVER CANYON

by Dana York

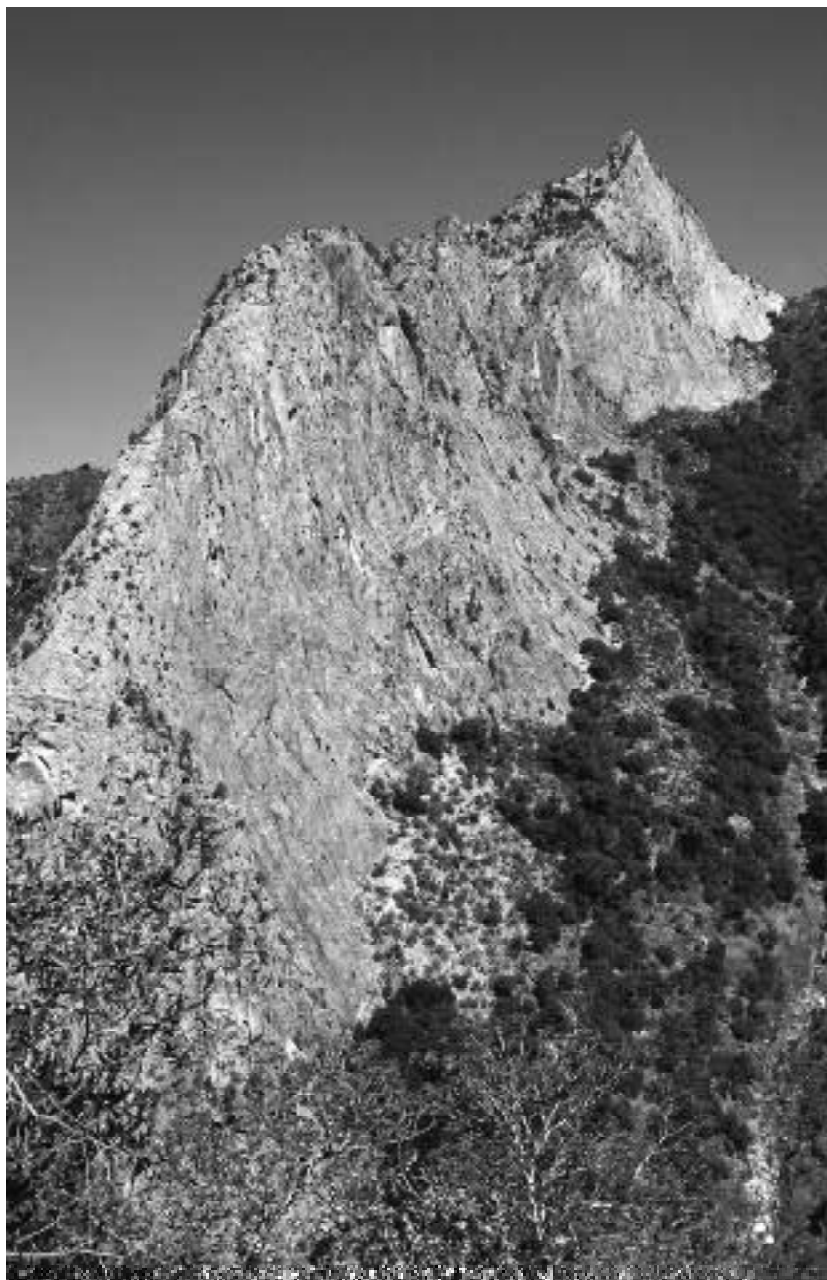
Early morning on July 21, 1995, I left my Sierra Nevada foothill home in Auberry for a two-hour drive to the Kings River. My desire to explore the deepest river canyon in North America was prompted by a discovery that occurred earlier that spring while fellow botanist Scott Wilson and I were exploring the Boyden Cave limestone outcrops. Although we were somewhat early for flowers, we unexpectedly came upon a new population of Tehipite Valley jewelflower (*Streptanthus fenestratus*) before a rainstorm forced us to quit. This jewelflower is endemic to Kings River Canyon, occurring between 3,000 to 6,000 feet elevation and covering a known area of approximately 50 square miles. Originally discovered by John Thomas Howell in the 1960s, the Tehipite Valley jewelflower was associated only with granitic sands. Prior to our discovery, the largest known population was in Tehipite Valley, just six air-miles from Boyden Cave. Because the limestone outcrops are covered with thousands of Tehipite Valley jewelflowers, it is likely that the species originated here and eventually colonized the known granitic populations. This discovery was just a taste of what was to come.

My plan was to return to the jewelflower population at 4,000 feet elevation, and to continue climbing higher on the limestone formation until I reached the 6,000-foot saddle. While I was driving, I kept thinking about how exciting it was on the previous trip to have discovered a new population of the rare Tehipite Valley jewelflower. I was full of anticipation for further rare plant discoveries. After driving for about an hour and a half,

my stomach started doing flip-flops. Attributing this to the excitement of the moment, I pulled over for an emergency "comfort"

stop and reconsidered the cause of my malady. I was so close to my destination that the thought of going back seemed foolish, so I

Upper 1,500 feet of the limestone outcrop directly across the Kings River from Boyden Cave. Monarch gilia (*Gilia yorkii*) was originally collected in the saddle (upper right-hand corner). Photographs by the author.



continued toward Boyden Cave with a case of stomach flu or food poisoning—but either way, I was not a happy camper! At Boyden Cave, I stuffed my pack full of supplies and proceeded across the river to the base of the first limestone outcrop. After several hours of climbing, I began to think that there was no end to the limestone nor to the poison oak. Sometime in the afternoon I attained my goal: a 6,000-foot elevation saddle dividing the middle and south forks of the Kings River. The ridge between the forks of the Kings River is known as Junction Ridge and it forms the western segment of a more extensive formation called Monarch Divide. It is also the dividing line between the Sierra and Sequoia national forests. Both forests administer this area as Monarch Wilderness. There on the ridge I saw my old friend Tehipite Valley jewelflower in full bloom. The jewelflower starts to flower at the bottom of the formation in March or April, and then continues to bloom higher and later as

Tehipite Valley jewelflower (*Streptanthus fenestratus*) from the limestones above Boyden Cave.



ENDEMIC PLANTS OF THE KINGS RIVER BASIN

<i>Cordylanthus tenuis</i> sp. <i>barbatus</i>	Fresno County bird's-beak
<i>Eriogonum nudum</i> var. <i>regirivum</i>	Kings River buckwheat
<i>Eriogonum ovalifolium</i> var. <i>monarchense</i> (in press)	Monarch buckwheat
<i>Gilia yorkii</i>	Monarch gilia
<i>Heterotheca monarchensis</i>	Monarch goldenaster
<i>Streptanthus fenestratus</i>	Tehipite Valley jewelflower

*known from the Boyden Cave limestones

summer approaches, with the ridge plants being the last to display their treasures.

EXPECTING THE UNEXPECTED

Just a few feet beyond the jewelflowers I spotted the inflorescences of buckwheats. My first thought was, "These little guys are weird!" The plants were densely matted with ball-like heads of flowers held just a few inches above their small round leaves. I only saw a handful of plants, mostly on small ledges or in crevices, on the north-facing side of the ridge. At the time, I broke off an inflorescence with a few leaves to take back home for further scrutiny. I have subsequently named this plant Monarch buckwheat (*Eriogonum ovalifolium* var. *monarchense* Madroñq in press). It is still only known from this location.

I left the buckwheat and began climbing down the limestone, following the base of a cliff. About ten minutes into the hike, I noticed numerous clumps of yellow composites all around me. I had not seen these on my trip up to the saddle, but here I was surrounded by a golden garden of sunflowers. The stems and leaves were silvery white with dense hairs. Each plant had numerous flowering heads with golden-yellow ligules. Like the buckwheat, I took a small sample of this plant for later analysis. Working

with John Semple (North American *Heterotheca* expert) and Jim Shevock (at the time, the Regional Botanist for the US Forest Service), we subsequently described this plant as Monarch goldenaster (*Heterotheca monarchensis*). It is endemic to the Boyden Cave limestones.

It was getting late into the afternoon and I still had a long way to go, but my body was not cooperating. I started to get painful leg cramps. Spending the night with minimal supplies and little water started looking like an option I would have to consider. Because of the heat, I knew my water would not last much longer so I pushed on. During the climb up I had crossed a spring at about the halfway point. Limping along, I managed to find the spring, hydrate my body, and refill the water bottles. Although I was momentarily optimistic, I still had 1,500 feet to descend through brush and steep limestone with painfully cramped leg muscles.

I managed to stumble my way down the last portion of the descent, arriving at my car in the early evening before it was too dark to see. This was a huge relief, but now I had a new problem. I could barely push in my car's clutch with my left leg. Shifting gears on the drive home became a deliberate act requiring planning and intense concentration. I have no recollection of arriving at my home. But I do know that I recovered in time to return to the Boyden Cave area less than two weeks later.



Monarch goldenaster (*Heterotheca monarchensis*) on limestone at the type locality above Boyden Cave.

RETURN TO KINGS RIVER CANYON

On July 31 I returned to Kings River Canyon with Jim Shevock. Having explored the Southern Sierra extensively and making several discoveries of previously unknown plants, I knew he would not pass up an opportunity to investigate the unusual flora of the Kings River limestones.

We climbed all day and made it to the Monarch goldenaster (*Heterotheca monarchensis*) site that I had discovered during my previous visit. Jim decided that he had climbed high enough and so, after we finished collecting material and taking photographs of the goldenaster, he stayed behind while I continued on alone. When I reached the saddle I noticed a wispy annual gilia with lavender flowers growing in crevices in the limestone. I collected several individuals of this gilia before continuing to the buckwheat popu-

lation, where I collected enough material to make several type specimen sheets. Armed with bags of collected goodies, I climbed back down to Jim. He was very intrigued by the gilia I had just discovered. This Kings River Canyon endemic gilia was subsequently named Monarch gilia (*Gilia yorkii*) by Jim Shevock and Alva Day (Polemoniaceae expert at the California Academy of Sciences in San Francisco).

I was hoping that the return down the limestone would be uneventful—unlike my previous trip—but this would not be the case. Because Jim drove from San Francisco for his first field outing of the season, the heat and strenuous conditions wreaked havoc on him. Like my previous trip, we were tempted to stay the night and continue out in the morning. However, our lack of water and camping gear were incentives to push forward and get off the outcrop. Just as it was getting dark we made it down to the

river, and Jim spent several minutes just sitting in the flowing water. It had been quite a day: we had made the first scientific collections for three previously unknown plants—a feat that had not occurred in California for a long time.

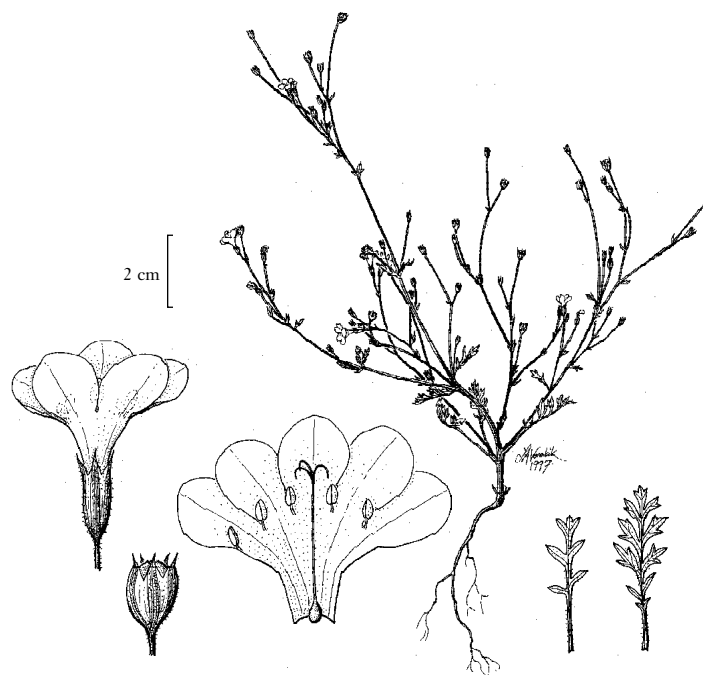
Following the discovery of these endemic plants and at the beseeching of both Dr. Kristina Schierenbeck (professor of Biology at California State University, Chico) and Jim, I spent the next five

Habit of Monarch buckwheat (*Eriogonum ovalifolium* var. *monarchense*), and a detailed illustration of a flower from holotype collection and photographs. Illustration by Laura Cunningham.



years exploring and documenting all the plants (including mosses with Jim) of the Kings River Basin. My master's thesis (partially funded by the CNPS), *A Phyto geographic Analysis of the Kings River Basin, California*, is a compilation of fieldwork, hundreds of hours of herbarium work, and comparative floristic analyses. I examined over 35,000 vascular plant specimens at the Herbarium of California State University, Fresno. Of these, nearly 4,000 specimens collected from the Kings River Basin were annotated and documented in my thesis. I also included data from nearly 1,900 specimens of my own. Also, various published and non-published lists accounted for several thousand records making a total of nearly 10,000 specimens cited in my analysis of the flora of the Kings River Basin.

Although natural habitats



Habit and detail drawings of Monarch gilia (*Gilia yorkii*) from holotype collections showing plant in flower and fruit. Magnified details (from left to right) include flower with calyx trichomes; calyx with mature, included capsule; dissected corolla with stamens and style; and basal and lower cauline leaves. Adapted from *Madroño* 45:138. Illustrations by Linda Ann Vorobik.



LIMESTONE ENDEMICIS

The Boyden Cave limestone endemics are likely neoendemics arising from desert ancestors. These endemics are more like their desert relatives than their congeners in the surrounding Sierra. There are several other species on these limestones that are more typical of those occurring in Mojave Desert habitats. This Mojave link was probably severed during an ice sheet event in the Quaternary. It is important to note that the Boyden Cave limestones are just below the southern Sierra's glaciated landscapes.

throughout the state are under siege on a daily basis, there are still special places left to discover and explore. Kings River Canyon is one of those places. Its endemic plants are the result of a magical mix of climate, geology, geomorphology, topography, soils, hydrology, and biology. It is also a place that demands respect. Although the rewards can be lavish, it is an unforgiving place to those who are not prepared. Over a period of five years, I made several more trips to the Boyden Cave limestones, finding new populations of the endemics and other rare plants. From my adventures I learned that determination, plentiful water, sturdy boots, good physical fitness, a happy gastrointestinal tract, and an active imagination are all necessary components for discovering botanical treasures in places such as Kings River Canyon. The next species is waiting to be discovered. The possibilities *are* imaginable!

Dana York, P.O. Box 264, Death Valley, CA 92328-0264

CALFLORA: CALIFORNIA PLANTS ONLINE

by George Hartwell

PIONEERS IN PERSPECTIVE

Charles Christopher Parry was a legendary explorer and botanist. His plant discoveries and collections, many of which were made during the mid-1800s as part of the United States and Mexican Boundary Survey, widely expanded the scope of knowledge of California flora (Ornduff, 1992).

In June, 1850, Parry wrote to his close friend and former professor, renowned taxonomist John Torrey at Columbia College, of a new discovery in San Diego:

I have been some 20 miles up the coast to the Soledad Valley to examine a seam of lignite which is exposed in the high bluff overlooking the beach—I here found a new species of pine growing in sheltered places about the bluff. Its characters are so unique I am in hopes it may be non-descript . . . if new, I wish it with your permission to bear the name *Pinus torreyana*. (Nichol, 2001)

Imagine what message Parry might have e-mailed Torrey if he could have dialed up the Internet and accessed the Calflora database, www.calflora.org, and its massive files containing detailed information regarding some 7,600 plant taxa known to exist in California today. He would have had at his fingertips a comprehensive database of plant distribution information. The records he could study deeply probe the experience of explorers before him, their observations, and the geographic locations of the species they reported. With current data he could have learned whether someone before him had reported an

unusual pine on that high bluff overlooking the beach.

Plant species names would be displayed to him in a manner correlated with names assigned the same species by others, past and present, in both scientific nomenclature and vernacular, or common use. He may have been able to learn that similar pines, what we now call *P. torreyana* ssp. *insularis*, occur on Santa Rosa Island, and he'd have seen where to go to study specimens or find the living trees.

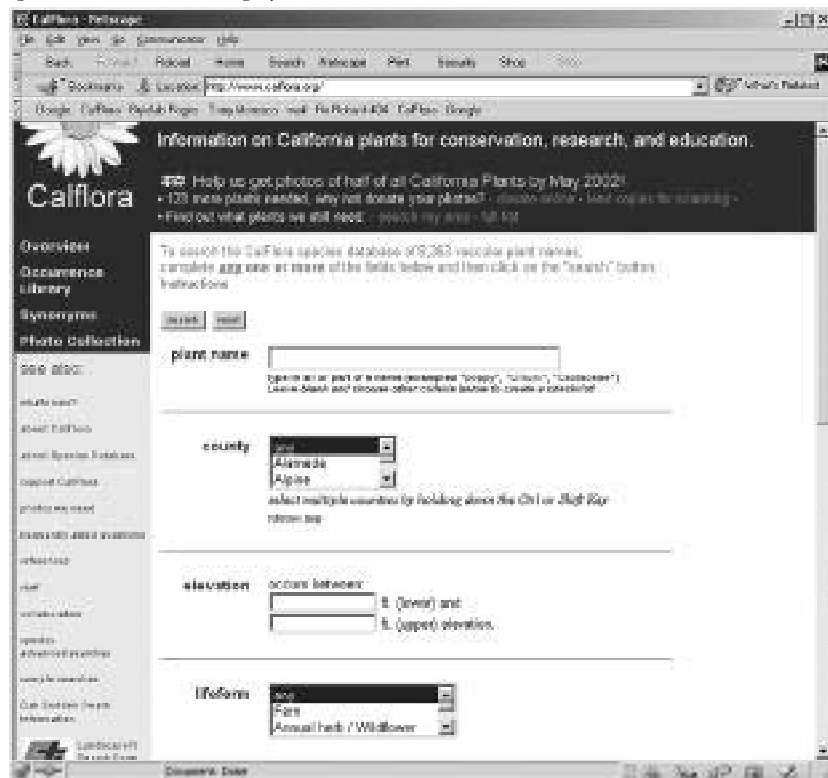
Tens of thousands of California plant species photographs would be available for him to look at, almost instantaneously, to help him determine quickly by comparison whether his pine-on-the-bluff really was so very different from known species.

LAND MANAGEMENT APPLICATIONS

Calflora's functionality goes far beyond individual observation records. It has become an indispensable tool for natural resource managers of all sorts. To explain why, let's go back to Parry's high bluff overlooking the San Diego coast. Remember the seam of lignite? When Parry set out, his purpose of the moment was to prospect for coal, of which lignite is one form (Nichol, 2001).

Calflora provides information critical to land managers that helps them determine what impacts their project will have on native plant resources. By accessing the species records from Calflora, Parry, local government officials, state and

Part of Calflora's homepage. Other "Advanced Query" pages give users many more options for search and display of information.





Photograph of Torrey Pine (*Pinus torreyana*) taken by Charles Webber from the California Academy of Sciences collection in CalPhotos, managed by the UC Berkeley Digital Library Project, which contains over 30,000 images of California plants searchable through Calflora.

federal agencies, a coal mining company, and others could examine the known range of Torrey pine and determine whether Parry's observation represented a previously unknown location for the species. In addition, Calflora data would have helped any one of them evaluate the relative abundance or rarity of the species and assess what effect a lignite mining operation on the bluff might have on distribution of the species as a whole.

CALFLORA AND CALIFORNIA'S OAK WOODLANDS

In a contemporary example of its extraordinary versatility and critical functionality, the Calflora database is proving to be a key element in helping researchers develop a plan to combat sudden oak death (sometimes called SOD) in California. Sudden oak death, caused by the pathogen *Phytophthora ramorum*, has been observed in coast live oak (*Quercus agrifolia*) and a growing list of other species, including black oak (*Q. kelloggii*), tan oak (*Lithocarpus densiflorus*), rhododendron (*Rhododendron macrophyllum*), huckleberries

(*Vaccinium* spp.), and most recently, coast redwoods (*Sequoia sempervirens*) (Frankel, pers. comm.). Concern that the disease may spread farther is so great that legislation that became law in October 2001 allocates \$3.5 million toward prevention, control, and management of sudden oak death. The enabling legislation, Assembly Bill 62 (www.leginfo.ca.gov/), co-authored by Assembly members Carol Migden (D-San Francisco) and Patricia Wiggins (D-Santa Rosa) observes:

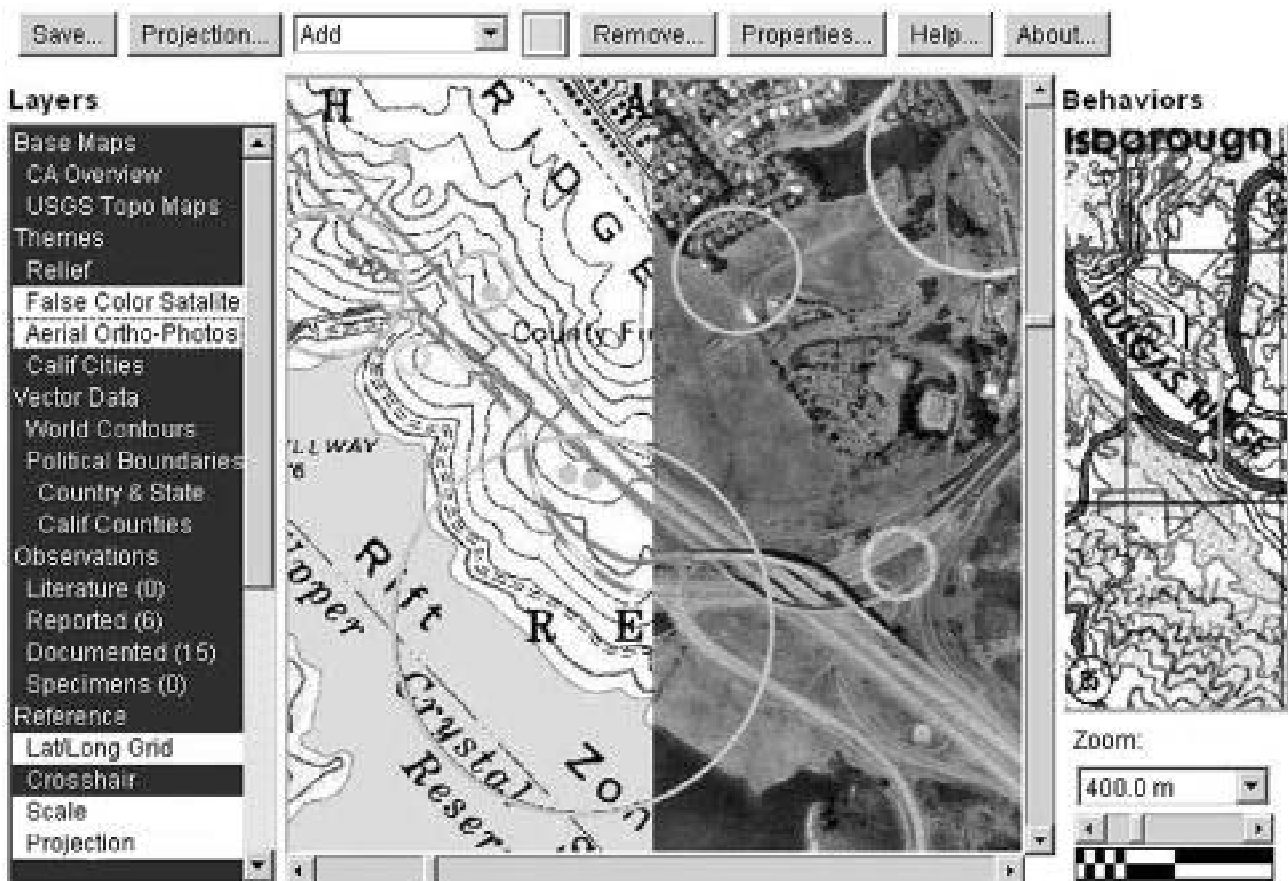
Scientists do not know whether this dieback will be limited to coastal oaks or whether sudden oak death

has the potential to spread to other regions of California, such as the Central Valley and the foothills of the Sierra Nevada Mountains. The unprecedented level of dieback of tan oak, coast live oak, and black oak poses several immediate and long-term environmental and public safety threats.

Susan Frankel, a member of the multi-agency California Oak Mortality Task Force, reports the Calflora database has been a real catalyst, accelerating the task force's success. "The Calflora database is being used as the basis for a survey to determine the incidence and im-

Over 5,500 contributed observations of black oak (*Quercus kelloggii*) to Calflora form the basis of this distribution map (originally in color). Each dot is an individual observation; shaded areas indicate county-level reports. Maps can be recreated each time the database is searched, providing the most up-to-date information available.





Some of the over 750,000 individual plant observations in Calflora can be visualized as dots on maps with the GIS Viewer developed by the UC Berkeley Digital Library Project. The Viewer features smooth pan and zoom, display of multiple data types, and location precision “fuzziness” displayed by different sized circles that are “hot linked” to the original observation. Background layers include USGS quad maps, three-meter resolution aerial photos, and other data types. Users can also add annotations, then save and share them with colleagues on the web.

AN “EIGHT-CHARACTER FILE NAME”

Calflora began in 1994 as a US Forest Service interdisciplinary research effort that examined the implications of forest management practices on wildlife, plant diversity, and ecosystem health. “Even in relatively widespread plant communities, like mixed conifer forests, when you cut timber or build roads across mile after mile of landscape, your actions can degrade native plant diversity,” Dennis commented. “Even if none of the species you affect is rare in an absolute sense, those local species losses have an effect that reverberates throughout the ecosystem.”

Calflora evolved from a research

project (with the “eight-character” file name of “calflora”) into a functional tool for assessing species and habitat impacts throughout California. “We needed to take existing data resources that are rich with information and put them into a form readily accessible to the people who need to use them: land managers and the public who participate in making land-use decisions,” Dennis said. “I was trying to make it possible for people to manage landscapes for plant diversity and have enough information at hand so they could do that.”

“The approach was not to create a new body of information. Instead, it was to use the new technologies we have to unite the sources of information that exist already,” she said. New uses for

Calflora’s rich data are discovered almost every day.

ON THE ROAD WITH CALFLORA

The California Department of Transportation (Caltrans) recognized the need to identify plant species native to highway project locations in order to restore roadsides to their natural appearance and function and to select locally native species for use in replacement vegetation plantings. Calflora developed a user interface for Caltrans that allows project designers—and any others who may access Calflora’s web pages—to create a list of species that might be expected to occur naturally on a specific site.

"In highway construction today, when native vegetation is removed, there is an emphasis on replacement of that vegetation where appropriate. The Calflora database provides Caltrans's landscape architects and biologists an opportunity to determine what plant species are likely to occur naturally at a specific location, and then create a mitigation plan from those data," said Gary Bush, Caltrans's chief of landscape architecture, now retired.

"The database query form is set up in a simple, easy-to-understand format. It's very easy for anyone making an inquiry to specify the location of their project and then determine what native plants are likely to occur in that place," he added.

CALFLORA IN THE CLASSROOM

Perhaps Calflora's greatest potential lies in its use as an educational resource in California's classrooms to help students and their science teachers learn about plant life in near and distant places.

Whitney Hartwell is a high school senior with an intense interest in the rare plant species of her area, Amador County's Ione chaparral. She maintains a web site with information regarding some of those rare species, www.ionechaparral.org. Her site provides a link to Calflora. "My web site deals with only a few plant species," she said. "By seeing and learning about those plants, people may become interested in the plant community as a whole and then they can use Calflora to learn what other plants grow in the Ione chaparral."

"I use Calflora to search for different species in my area and interesting plants that are endemic to other areas, too," she said. "One of the reasons I go [to the Calflora web site] is to look at the pictures. I can associate plant names with plants I've seen. Sometimes I hear

plant names and I don't know what the species look like. With Calflora, I can search the database using scientific or common names and learn much more about them," she said.

There is also a broader use for Calflora in the classroom. Students can discover what plant species could occur naturally in their state, county, city, near their school, or in their backyard. "An interesting thing teachers can do is assign projects where students need to use Calflora to learn about certain plant species and plant communities," Whitney noted. "They will discover the wealth of information that's available on the Internet, beyond downloading music online or shopping. I don't think children know what a wealth of information there is online and Calflora is a perfect example."

INFORMATION STRAIGHT FROM THE SOURCE

Calflora's data sets come from numerous sources ranging from state and federal public agencies to universities, non-government organizations, and private collections. In most instances, the information was arranged, stored, and made available in formats designed by the data owners. Few were compatible with others. Ann Dennis credits then-UC Davis graduate student Kwei-Lin Lum's 1975 transcription of plant distribution information from Munz, *A California Flora and Supplement* (1959 and 1968), as the genesis for the Calflora database.

"I decoded the Munz geographic data and overlaid that with the California Native Plant Society's inventory data for rare taxa," Dennis said. In addition, G. Fred Hrusa, PhD, developed a systematic manner of tabulating relationships between the different scientific names that have been



Lilium kelloggii
Kellogg's Lily



ID reviewed

Broussard 6105 1651 0910 0095
more information...



Lilium kelloggii
Kellogg's Lily



ID not reviewed

Potts 9189 3301 3541 0072
more information...

An online annotation system allows experts to confirm or correct plant identifications for submitted photos. Here, the top photo has been reviewed (checkmark) and the bottom has not (empty box). A similar system is planned for observations data in Calflora.

applied to a given group of plants over time. "Fred's name table made it possible for us to develop machinery that pulls together data



Stinging lupine (*Lupinus hirsutissimus*), a photograph contributed by John Game to the CalPhotos collection.

resources from widely different time periods. We originally used this machinery to update the Munz data to correspond to the names and species concepts we consider current, generally the ones you'll find in *The Jepson Manual*," Dennis explained.

According to Dennis, libraries of actual plant observations have grown to the point where it is no longer necessary to rely on those secondary sources. "Today, when you display a range map in Calflora, you can pull up the exact information on which it's based—who saw that plant there when, and what basis they had for saying so," said Dennis. "Often hundreds, even thousands of those specific observations lie behind each one of our maps."

With so many different types of users, and more discovering its versatility daily, managing Calflora's data in a manner easily accessible and equally useful for everyone is a substantial challenge. In February 2002 alone, Calflora received over 500,000 requests for information—not just hits on the web site, but

transactions in which requests for information were processed.

WHAT THE FUTURE HOLDS

Tony Morosco is Calflora's project manager, a botanist, and was a computer programmer for UC Berkeley's Digital Library Project. He administers the Calflora database and is responsible for its programming, data management, and hardware maintenance. Morosco views Calflora as an emerging utility that has enormous potential. "Calflora can serve as a dynamic information exchange center," he stated. "The botanical community at large will be able to share information seamlessly, rapidly, and with good documentation, thereby making observations on plants available almost instantly."

Morosco and Dennis are developing ways that will allow researchers and other observers to contribute new data to Calflora directly, and allow other users to submit comments on those data. "Being able to accept information from the public is one direction Calflora is going," Morosco explained. "Another is allowing expert users to review and verify data that are submitted. Third, we'll be able to alert interested parties when new data are submitted. Specialists in particular plant groups and others will be able to receive new reports, photographs, observations, and other information." Already, users can submit their digital photos via the website, and qualified reviewers can add annotations and corrections to the descriptions of any photo in the online collections.

But Calflora's growth—like plants in a garden—requires nurturing for success. "We started out as a research project to find out whether we could provide this service," Dennis said. "We have demonstrated that it can be done and that there are tens of thousands of

people who want this information. Calflora now needs the financial resources to expand its data, improve its functions, and encourage more public participation."

With increased support from scientific, business, academic, and individual users, Calflora can realize its goal: to become a clearinghouse for plant information for California that serves education, conservation, and science. The seed has germinated. You can help it grow and share in the thrill of discovery its use makes possible:

Every step I take into the fields, groves, and hills appears to afford new enjoyments. Here is an old acquaintance seen again; there a novelty—I feel an exultation. I am going to add a new object, or a page to science. This peaceful conquest has cost no tears, but fills my mind with a proud sensation of not being useless on earth, of having detected another link in the creative power of God. (*Author unknown, quoted in Nilsson, 1994*)

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Lincoln Constance on Railroad Ridge, White Cloud Mountains, Idaho, July 1994. Photograph by Barbara Ertter.

MEMORIES OF LINCOLN

by Barbara Ertter

When word came that Lincoln Constance, emeritus professor, Dean of Botany, Director of Botanical Garden, etc., etc., at the University of California at Berkeley had passed away on June 11, 2001 at the age of 92, the botanical community mourned the passing of yet another of its giants. Not only was the world's foremost expert on the Umbelliferae (Apiaceae—Parsley Family) lost, with no replacement in sight, but the breed of gentleman scholar which Lincoln epitomized came that much

closer to extinction. Multiple eulogies, published and presented at his memorial gathering in October 2001 (Baldwin, 2001; Park, 2001), extolled his long and distinguished career as scientist, administrator, and mentor, each personalized by unique reminiscences. I welcome the opportunity to add my own tribute, combining my own memories with highlights of some of Lincoln's lesser-known contributions and accomplishments.

My first exposure to Lincoln Constance was when I was a mere undergraduate at the College of

Idaho, a small liberal arts school in southwestern Idaho. My major advisor, Patricia L. Packard, had written to Lincoln seeking an expert opinion on some local floristic puzzles, and shared with me the pun contained within the detailed response: "I don't know beans about *Phaseolus*" [for those of you not up on all of your botanical latin, *Phaseolus* is the bean genus]. When I recall this now, after having had the immense pleasure of his personal friendship, I realize how even this earliest introduction exemplified not only his ready wit, but also



Lincoln Constance as an undergraduate student, 1928. Photograph courtesy of William Constance.

the amazing level of correspondence he maintained with colleagues around the world, or for that matter with anyone who asked his assistance.

Why Pat was asking Lincoln about legumes I have no idea, since his expertise was principally in Umbelliferae and Hydrophyllaceae (Waterleaf Family), which was certainly enough to keep any one

(or three!) people fully occupied. So fully identified was Lincoln with these two families that it may come as a surprise to learn that his doctoral work, under Willis Linn Jepson, was on *Eriophyllum* (woolly sunflowers) in the Asteraceae (Constance, 1937). This early association provided the justification for the establishment of *Constancea* as a new genus to accommodate *E.*

nevinii A. Gray when molecular evidence indicated it was only distantly related to other *Eriophyllum* (Baldwin, 2000).

IRRETRIEVABLY HOOKED

Curiosity about how Lincoln made the transition from woolly sunflowers to umbels, and his early career in general, led me to delve into his formative years. Perhaps Lincoln's choice of dissertation topic, for example, was influenced by the common name of Oregon Sunshine, evoking his boyhood in the environs of Eugene. An early natural history interest in taxidermy was short-lived, after "losing struggles with the skins of a decidedly dead squirrel and a few ill-fated birds put an early end to that ambition" (Constance, 1988). In his oral history (Constance, 1987; source of subsequent otherwise unattributed quotes), Lincoln describes how, while still in high school, he instead began spending Saturday mornings "hobnobbing" with the eminent Louis F. Henderson at the University of Oregon. Plants submitted for identification were sometimes set aside for the precocious youngster: "They used to save things that came in, if they couldn't identify them readily, to see if this young squirt could, by any chance, identify it. Sometimes I did. Of course, that was very exciting."

During his subsequent undergraduate years at the university, Lincoln had his first taste of professional-level collecting in 1928, when Henderson managed to obtain funds for field work in Klamath and Lake counties. Travel was dependent on "a stage which was usually an old seven-passenger automobile, which would go a couple times a week to some of these relatively widely dispersed towns." After being dropped off somewhere along the way, Lincoln would spend

the day collecting, hauling all his gear with him to the next town. If things didn't work right, "you might be there for three days waiting for the next stage." A catchfly collected by Lincoln during that summer was described by Henderson as a new species, *Silene insectivora* (now *S. nuda* ssp. *insectivora*), leaving Lincoln "irretrievably hooked" on botany (Constance, 1988).

After receiving his bachelor's degree in 1930, Lincoln was fortunate enough to obtain a teaching assistantship at the University of California at Berkeley. The stipend was barely sufficient to live on, even with meals budgeted at 50 cents a day. For his master's thesis, Lincoln undertook a floristic survey of a local peak, as was standard for many of Willis Linn Jepson's students. The resulting detailed study of Redwood Peak in the Oakland Hills provides an invaluable baseline on the East Bay's native redwood forest (done almost exactly halfway between its complete deforestation in the 1850s and the present condition). Incorporating the fledgling (and still somewhat suspect) field of ecology, as did fellow Jepson student Mary Leolin Bowerman in her flora of Mount

Diablo, Lincoln's published thesis (Constance, 1935) foreshadowed many of the land management issues just now being grappled with. Particularly noteworthy are such comments as "Even now it is rather late to attempt to obtain an idea of the natural vegetation of the region, and, within a few years, it will be altogether impossible," and "There seems little doubt that the Oakland Hills have suffered a climatic shift toward greater aridity, and that this has prevented the man-destroyed vegetation from regaining dominance."

Interspersed with his fieldwork on Redwood Peak, Lincoln spent his summers working as a seasonal naturalist in Crater Lake National Park in 1931 and 1932. For those who are only familiar with his more scholarly papers, it is a treat to read the interpretative essays he wrote for *Nature Notes from Crater Lake* during this period. These articles contain such whimsical lines as "The meadow itself is a giant's paint-pot, with dabs of all hues lavishly scattered over it," and "Crater Lake is experiencing a migration of butterflies resembling the flights of locusts which perturbed the Pharaohs of Egypt in ancient times," remi-



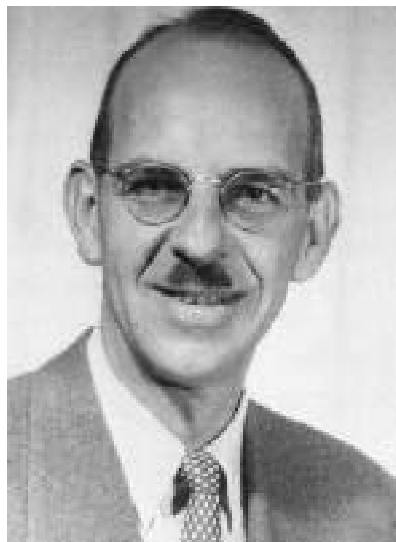
Lincoln Constance pressing plants on botanical society trip to Mt. Oso, 1948, with Rafael Rodriquez. Photograph courtesy of University Herbarium archives, UC Berkeley.

niscient of the style of his mentor, Jepson.

Lincoln's final pre-academic job, after receiving his PhD in the summer of 1934, was a plant survey of Bull Creek Flat in Humboldt County, just purchased as a preserve by the Save-the-Redwoods League.

Lincoln's first academic appointment began in fall of 1934 at Washington State College in Pullman: "I was paid for half-time, and I worked about two-and-a-half time." In addition to teaching courses in taxonomy and ecology, his herbarium responsibilities led him to collect extensively for exchange and to begin developing the correspondence network that would expand throughout his life. One high point during this period was his marriage to Sara (Sally) Luten, college sweetheart from their time at the University of Oregon. Another was his lasting friendship with his first graduate student, Reed Rollins, at

William (Bill) Constance and Sara (Sally) Luten Constance, passport photo for Chile, 1954 (left). • Lincoln Constance passport photo for Chile, 1954 (right). Both photographs courtesy of University Herbarium archives, UC Berkeley.





Lincoln Constance collecting *Lomatium observatorium* on Mount Hamilton, May 1993. At left, close-up of *Lomatium observatorium*. Photographs by Barbara Ertter.

the beginning of Rollins' own outstanding career as an expert on Cruciferae (Brassicaceae—Mustard Family): "Our mutual passion for field botany was facilitated by Reed's possession of a Model A Ford car and my occasional success in wangling small sums from the department to purchase the fuel to keep it running" (Constance, 1982).

Many of their joint fieldtrips were in adjacent Idaho, whose mountains provided a welcome relief from the windswept Palouse prairie. Together they described the plant that would eventually become Idaho's first federally listed species, *Mirabilis macfarlanei*.¹ The distinctive species was named for the boat pilot who pointed it out on "the annual spring vacation mass foray by motor launch through danger-

¹Note: newly-named species frequently do not have a common name, or have one that is repetitive of scientific name, e.g., "McFarlane's mirabilis."

ous white water to the bottom of mile-deep Hell's Canyon of the Snake River" (Constance, 1982). During this period, another of northern Idaho's rarest species was named after Lincoln, *Cardamine constancei* Detling.

Such rewards were insufficient to counterbalance Lincoln's disdain for the "smug little cow college," however, so that in 1937 he leapt at the chance to return to Berkeley, turning in his resignation prior to accepting the new position.

He came as Jepson's successor after the latter retired, in spite of Jepson's characterization of Lincoln's new professional home as "a nest of vipers." Settling quickly in, Lincoln began work on the first of the two families that would become his lifetime claims to expertise, the Hydrophyllaceae. He chose the family "because I wanted to work on a group that was well-represented in the area so I could study it in the field, and one that was small enough that you weren't always frustrated by the fact that some of its key representatives were in Asia or somewhere."

Research on the Hydrophyllaceae soon incorporated a seminal collaborative element, with the involvement of cytogeneticist Marion Cave. Having earned her own PhD in genetics in 1936, Marion obtained a research associate position in the botany department at UC Berkeley during her husband's career as a professor of economics at San Francisco State University. The two-decade long collaboration between Cave and Constance on the chromosome numbers of Hydrophyllaceae represented one of the pioneering applications of cytogenetics to plant systematics (Kaplan et al., 1997).

Lincoln's early years at Berkeley also saw the development of his most prominent collaboration, and the launching of his lifelong involvement with the Umbelliferae. Mildred Mathias, with whom he had corresponded regarding loans while at Pullman, had completed her doctoral work on *Cymopterus* at Washington University in St. Louis in 1929 (Gibson, 1995). Following her physicist husband Gerald Hassler to Berkeley, she was deeply involved in *Lomatium* at the time of Lincoln's arrival. Lincoln's knowledge of western geography proved to be an immense help in untangling various complexities, and Lincoln in turn was eager to get expert assistance with the many *Lomatium* he had collected in Pullman. The interaction blossomed into a full collaboration that continued long after the Hasslers left Berkeley, with Mildred eventually obtaining her own faculty appointment and prestige at UCLA.

In Mathias's introduction to Lincoln's oral history, she recalls that, when faced with the looming deadline for a treatment of the Umbelliferae for *North American Flora*, "I did a serious bit of arm-twisting and the team of Mathias & Constance was born." Lincoln himself recalls that, around 1940, "she came in one day and said, 'Gerald

and I are going to have a family, and I'm going to give up the Umbelliferae, and I want you to take them over.' . . . I countered the proposal—that I would work with her until she had completed all of the commitments she had made, and she had made plenty.” Reflecting back on his productive collaborations with Cave and Mathias decades later, Lincoln ruefully wondered: “I do not know whether these two associations with remarkably talented women were examples of continued exploitation or liberation, but they were of inestimable value to me” (Constance, 1988).

SETTING THE FIELD AFIRE

Having traced Lincoln's path to the beginning of a 40-year career at Berkeley, followed by another two decades of productive post-retirement research, I leave to others the full biography that is certainly called for. As mere highlights of his illustrious professorial career, I note that Lincoln published over 200 papers and supervised 29 graduate students, most of whom went on to produc-

tive careers of their own around the world. With Mathias and a diversity of other collaborators, he described 165 new plants, mostly from western North America, Mexico, and South America. Several of Lincoln's more thought-provoking papers, notably “The Versatile Taxonomist” (1951) and “Systematic Botany—An Unending Synthesis” (1964), stand today as landmark efforts to strike a balance among conflicting approaches to systematics. This productivity was sufficient to make Lincoln a shoo-in as the third recipient of the newly established Asa Gray Award in 1987, with yet one more feather added to his cap when his first student, Reed Rollins, was presented the fourth award the following year. Even more outstanding, Lincoln's scholarly accomplishments overlapped his long service as a capable administrator, during which he served variously as department chair, dean, vice chancellor, and even acting chancellor for a brief period. Needless to say, being part of the UC Berkeley administration during the turbulent sixties left Lincoln with a decidedly sour taste for the era that is nearly synonymous with Berkeley.

Douglass Henderson and Lincoln Constance relaxing on porch of Lincoln Log Cabin Motel in Stanley, Idaho, July 1994. Photograph by Barbara Ertter.



Professor Lincoln Constance, University of California at Berkeley, 1952. Photograph courtesy of University Herbarium archives, UC Berkeley.

Beyond these core elements of Lincoln's career, there are several lesser-known episodes from this period that are worth bringing to light, beginning with his World War II experience. Mere months after the birth of his and Sally's only child, William (Bill), in December 1942, Lincoln was recruited by a friend from Pullman to join the Office of Strategic Services: “I was getting increasingly embarrassed to be here, alive and not in uniform, and I expected to be drafted most anytime.” As geobotanist (“the government's first geobotanist, I think”), research analyst, and editor, “Our job was supposedly to prepare background material ostensibly for the use of our invading forces. We tried to find out all we could find out about Sicily, and North Africa, and Normandy, and so on. . . . Some people went overseas, but by and large

NEW TAXA IN WESTERN NORTH AMERICA (INCLUDING BAJA CALIFORNIA) AUTHORED OR CO-AUTHORED BY LINCOLN CONSTANCE

GENERA with Author(s)

Shoshonea Evert & Constance

SPECIES AND VARIETIES with Author(s)

Angelica calli Mathias & Constance
Arabis cruciata Constance & Rollins
Cymopterus douglasii R. L. Hartman & Constance
Cymopterus williamsii R. L. Hartman & Constance
Douglasia gormanii Constance
Douglasia laevigata var. *ciliolata* Constance
Eriophyllum lanatum var. *ballii* Constance
Eriophyllum parishii Hall ex Constance
Gilia congesta var. *burleyana* Constance & Rollins
Gilia congesta var. *montana* Constance & Rollins
Gilia congesta var. *pseudotypica* Constance & Rollins
Gilia spicata var. *cephaloides* Constance & Rollins
Gilia spicata var. *tridactyla* Constance & Rollins
Hydrocotyle acuminata var. *pubescens* Mathias & Constance
Ligusticum calderi Mathias & Constance
Lilaeopsis masoii Mathias & Constance
Lomatium ciliolatum var. *booveri* Mathias & Constance
Lomatium columbianum Mathias & Constance
Lomatium cuspidatum Mathias & Constance
Lomatium erythrocarpum Meinke & Constance
Lomatium frenchii Mathias & Constance
Lomatium bamblesii Mathias & Constance
Lomatium idahoensis Mathias & Constance
Lomatium inyoensis Mathias & Constance
Lomatium observatorium Constance & Ertter
Lomatium peckianum Mathias & Constance
Lomatium quintuplex Schlessman & Constance
Lomatium ravenii Mathias & Constance
Lomatium rollinsii Mathias & Constance
Lomatium shevockii R. L. Hartman & Constance
Lomatium stebbinsii Schlessman & Constance
Lomatium tracyi Mathias & Constance
Mirabilis macfarlanei Constance & Rollins
Oreonana purpurascens Shevock & Constance
Perideridia bacigalupii T. I. Chuang & Constance
Perideridia bolanderi subsp. *involuta* T. I. Chuang & Constance
Perideridia gairdneri subsp. *borealis* T. I. Chuang & Constance
Perideridia leptocarpa T. I. Chuang & Constance
Phacelia amabilis Constance
Phacelia beatleyi Reveal & Constance
Phacelia cookii Constance & Heckard
Phacelia gentryi Constance
Phacelia pulcherrima Constance
Phacelia stebbinsii Constance & Heckard
Phacelia strictiflora var. *connexa* Constance
Phacelia strictiflora var. *lundelliana* Constance
Phacelia strictiflora var. *robbsii* Constance
Phlox colubrina Wherry & Constance
Podistera yukonensis Mathias & Constance
Pseudocymopterus longiradiatus Mathias, Constance & Theobald
Sanicula moraniana P. Vargas, Constance & B. G. Baldwin
Sanicula tracyi R. H. Shan & Constance
Shoshonea pulvinata Evert & Constance
Tauschia booveri Mathias & Constance

FAMILY

Apiaceae (Umbel Family)

FAMILY

Apiaceae (Umbel Family)
 Brassicaceae (Mustard Family)
 Apiaceae (Umbel Family)
 Apiaceae (Umbel Family)
 Primulaceae (Primrose Family)
 Primulaceae (Primrose Family)
 Asteraceae (Sunflower Family)
 Asteraceae (Sunflower Family)
 Polemoniaceae (Phlox Family)
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 Apiaceae (Umbel Family)
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 Apiaceae (Umbel Family)
 Apiaceae (Umbel Family)
 Nyctaginaceae (Four-O'clock Family)
 Apiaceae (Umbel Family)
 Apiaceae (Umbel Family)
 Hydrophyllaceae (Waterleaf Family)
 Hydrophyllaceae (Waterleaf Family)
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 Apiaceae (Umbel Family)
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 Apiaceae (Umbel Family)

almost all were working from published materials of one sort or another, or somebody's confidential reports. It was an erratic kind of thing; you wouldn't do anything for days, and then would work all night for three nights in a row. I was pretty cynical about most of it."

With the war's end, Lincoln returned to Berkeley in 1945. Two years later, however, he was recruited for a temporary appointment at Harvard "to advise and assist in reorganization of the botanical establishment there." As interim director of the herbarium, "I discovered that my prime duty was to convince the former director, Professor Fernald, that he had indeed retired." Although it was clear that Harvard had its eye on Lincoln for a permanent appointment, he chose instead to return to Berkeley. He was, however, instrumental in getting his former student Reed Rollins appointed as Fernald's replacement, a post that served both Rollins and Harvard well, to Lincoln's further credit.

A later episode, which was significantly less satisfying to Lincoln, brought great glee to those of us who stumbled across the yellowed

SPECIES NAMED FOR CONSTANCE

Androsace constancei Wendelbo (nom. nov.
 for *Douglasia gormanii* Constance)
 Primulaceae (Primrose Family)
Arabis constancei Rollins
 Brassicaceae (Mustard Family)
Bupleurum constancei Nasir
 Apiaceae (Umbel Family)
Cardamine constancei Detling
 Brassicaceae (Mustard Family)
Carex constancei Stacey
 Cyperaceae (Sedge Family)
Eryngium constancei M. Y. Sheikh
 Apiaceae (Umbel Family)
Lupinus constancei W. Nelson & J.P. Nelson
 Fabaceae (Legume Family)
Nama constancei D. Bacon
 Hydrophyllaceae (Waterleaf Family)
Phacelia constancei Atwood
 Hydrophyllaceae (Waterleaf Family)



Barbara Ertter, Lincoln Constance, and Margaret Henderson in White Cloud Mountains, Idaho, July 1994. Photograph by Douglass Henderson.

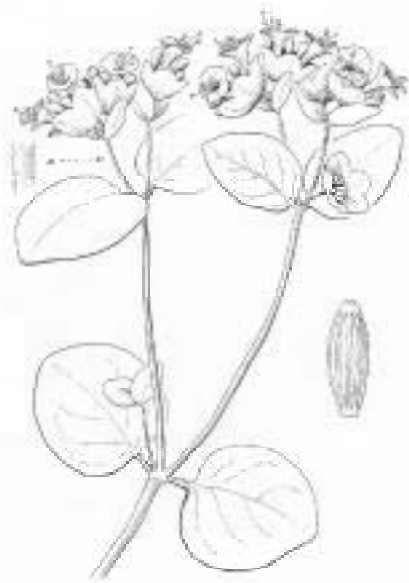
newspaper clippings in the UC herbarium scrapbook. In August 1952, when on vacation with his family in the mountains near Bend, Oregon, Lincoln made his way up Three-Fingered Jack to a point from which all ways down looked the same. As summarized by his son, "He guessed wrong, descended into a valley, realized he was lost, followed a stream downhill for about 12 hours, set a signal fire, which went out, and then another, which got away and burned five acres before the Forest Service put it out. He eventually found a road and walked into camp, little the worse for wear, admitting to having set the fire." The newspapers, needless to say, had a heyday, concocting headlines such as "UC Prof Gives Self 'Hotfoot'" and "Prof. Sought Flora But He Fauna Fire."

Judging from the frequency and fondness of latter reminiscences, perhaps the most pleasurable memorable interludes during Lincoln's career were his two extended trips to temperate South America, accompanied at least part of the time by his family. The first trip, to Chile and Argentina on a Guggenheim Fellowship in 1953–54, is recorded in detail in Lincoln's oral history, but available references to the return trip in 1967–68 are surprisingly sparse. As recalled by his son Bill, much of the second visit was spent in Patagonia and Tierra del Fuego, where "travel was by Power wagon on muddy, rocky, dirt roads, one of which led to the airstrip, where Tom Goodall took his two-engine Cessna to get to and from the outside world." In addition to an abundance of umbels and

multiple trans-hemispheric comparisons with the California flora, the real treasures of both trips were lifelong friendships established with Latin American counterparts, which Lincoln cultivated with great pleasure.

FROM ICON TO FLESH-AND-BLOOD

The early history and subsequent episodes detailed above, interesting enough in their own right, also provide added dimension to my unabashedly personal reminiscences given here and, taken as a whole, help convert a near icon into a flesh-and-blood human. I write this recalling how, at the time I arrived in Berkeley in 1985, Lincoln was one of the most respected



Mirabilis macfarlanei, Nyctaginaceae.
Drawing by J.R. Janish, from *Vascular
Plants of the Pacific Northwest*, V3, used
with permission of UW Press.

giants in my chosen field, to the extent that I was in awe of now having him as a colleague. By this time he had been officially “retired” for over a decade, which meant he could now devote full time daily to his beloved “humble umbels.” The opportunity for regular contact increased when he chose to relocate his office along with the herbaria to interim quarters in the Marchant Building, an arrangement that continued when the University and Jepson Herbaria returned to fancy new quarters on campus in 1994. Nevertheless, he was still on a professional pedestal in my book, which made me hesitant to assume anything beyond polite collegueship.

This changed when Lincoln’s pleasure in returning to campus was dampened by the death of his beloved wife of 56 years. The months of tending Sally during her long decline drained Lincoln, physically as well as emotionally, to the extent that he never fully bounced back after her death in May 1992. According to his son Bill, Lincoln’s life work was largely a dedication to Sally. With her death, Lincoln had lost his great love, and life would never be the same.

In an effort to help him through

this difficult time, I began spending more time with Lincoln. Thinking like a botanist, this meant taking him on field trips beyond what he was inclined to tackle on his own (though he remained adamantly resistant to the slightest hint of solicitousness!) One of the first trips was a drive to the top of Mount Hamilton in May 1993, to relocate a *Lomatium* that had been photographed by Nigel Hancock among the Lick Observatory complex. When the photograph was sent to Lincoln, he had excitedly recognized it as a species he had known only from a handful of herbarium specimens, insufficient for describing a new *Lomatium*. For my help in tracking down this and adjacent populations, I ended up as co-author of *Lomatium observatorium* (Constance & Ertter, 1997).

Later that same year, we drove up and over Ebbett’s Pass, returning through peak fall colors in Hope Valley. A more poignant trip was two years later, in 1995, when we drove to UCLA for the memorial service of Lincoln’s long-time collaborator, Mildred Mathias. Later in the summer, I assisted Lincoln with one of the first of the Weekend Workshops newly instituted by the Friends of the Jepson Herbarium (on Umbelliferae, of course!) Somewhere around this time I found a t-shirt for him on Telegraph Avenue, with the Gary Larson cartoon of “Early vegetarians returning from the kill” carrying over their heads a giant carrot! After initial reluctance, Lincoln eventually tried the shirt on, claiming it was the first t-shirt he had ever worn!

By this time we had essentially “adopted” each other into an extended family, setting the stage for a trip to the Ertter family cabin in McCall, Idaho. Having no grandchildren of his own, and only a single niece, Lincoln adapted well to being immersed in the Ertter clan, surrounded by my parents,

various siblings, nieces, and nephew. He recalled McCall as the town where he had rendezvoused with Francis Pennell during his early years, for the purpose of chasing *Penstemon* through Idaho. One long day’s drive from the cabin took us back to Lincoln’s old northern Idaho stomping grounds, where he and Reed Rollins had once traced the route of Lewis and Clark. We took another side trip to the Stanley Basin, where Lincoln finally viewed the Sawtooth Mountains after having long given up the hope of ever doing so. There we rendezvoused with Douglass Henderson of the University of Idaho and his wife Margaret, a year before Doug’s tragic death. After we all spent the night in the aptly named Lincoln Log Cabins, Doug drove us to the top of Railroad Ridge, where Lincoln was able to wander one last time among subalpine umbels.

My most cherished memory of the Idaho trip, however, was at the annual meeting of the Idaho Native Plant Society, which was held that year in McCall. Lincoln decided to come to the evening presentation with me, but had asked to remain

Lincoln Constance wearing umbelliferous t-shirt, July 1994. Photograph by Barbara Ertter.





Lincoln Constance and Barbara Ertter at Josephine Lake, Idaho, July 1994. Photograph by Christopher Davidson.

anonymous. Throughout the presentation, which included a segment on *Mirabilis macfarlanei*, this quiet elderly gentleman remained in the background, only a minor curiosity to the gathering of Idaho's botanically inclined. In the free-for-all discussion that followed, however, Lincoln couldn't help but reminisce to those seated nearby on the discovery of the *Mirabilis*, and the boat-captain for whom it was named. The multiple conversations around the room gradually quieted, as the realization spread that the elderly gentleman was Lincoln Constance himself, until the entire gathering was listening raptly to his every word. For all his request for anonymity, I could tell that Lincoln was thriving on the attention!

Alas, the opportunity for additional extended trips was curtailed when Lincoln suffered an episode of congestive heart failure in 1996, which sapped his physical vigor. Subsequent mental difficulties led to further complications as Lincoln responded unexpectedly to an antidepressant combination that "worked too well." During the resultant two-month hypomanic stage in 1997, which those of us who bore with him refer to as "Hurricane Lin-

coln," his otherwise impeccable sense of proportionality was seriously askew. As a result, the legitimate germ of a good idea would balloon preposterously: preposterous, that is, to all except Lincoln, who became increasingly hurt as we seemingly dismissed his brilliant ideas and sincere efforts to help. My favorite example was how he was going to use his old friendship with Glenn Seaborg, Nobel-prize winning physicist who occasionally liked to hike on Mount Diablo, to garner support from other Nobel-prize winners for the revised flora that I was working on!

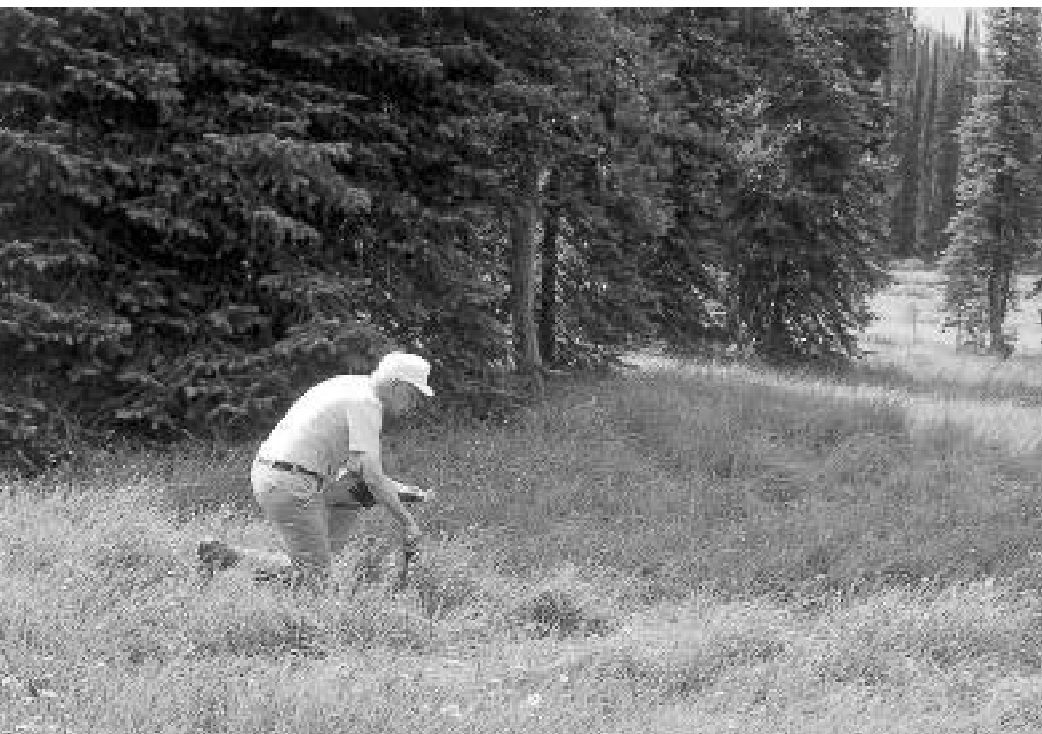
My most intense memory from this period, a sobering but at the same time deep personal experience with Lincoln, occurred on Thanksgiving Day of 1997. Instead of spending a quiet day at home as initially planned, I found myself catering to Lincoln's insistence that we look for an odd *Lomatium* on the top of Mt. St. Helena. In addition to it not exactly being the right time of year to look for a spring-flowering plant, there was a locked gate between us and the site. Still, it was a beautiful day for a drive to Napa Valley, so I decided to acquiesce at least to the extent of driving

to the locked gate. After missing a rendezvous with Lincoln's son Bill, we overshot the summit gate and started dropping down the north side of Mt. St. Helena toward Middletown. My attempt to turn around gave Lincoln the opportunity to escape from the car and scamper up the serpentine slope. He disappeared into the *Cupressus* forest, purportedly looking for an anomalous mistletoe that he thought he had once found. I tried calling him back to the car, but in vain. I finally went looking and found him sitting at the bottom of a draw, where his brief spurt of energy had given out. Propping him up in the gathering dusk, I managed to steer him over the terrain back to the highway, by which time night had fallen. How we managed to avoid getting hit by the rushing traffic as we worked our way along the narrow verge to the turn-out where I left the car, I'll never know.

As unflattering as such episodes are in isolation, they are to me an integral part of the whole person. With moderating layers temporarily stripped away, it was possible to appreciate the deliberately cultivated elements of Lincoln's gentlemanly persona that counted to his credit as hard-won accomplishments. At the same time, one primal aspect that shone through strongly, even during the worst of this period, was his sincere drive to be of help, and his acute dismay that those closest to him seemingly dismissed his efforts in this regard. I accordingly treasure my memories of Lincoln from this brief period, and chose to share them as part of my tribute to this great gentleman botanist.

EPILOGUE

Although his ability to retrieve memories remained impaired, preventing him from doing further research during his remaining years,



Lincoln Constance collecting *Ligusticum* in central Idaho, July 1994. Photograph by Barbara Ertter.

Lincoln did regain full lucidity and his hallmark sense of humor. He was accordingly able to enjoy the public celebration held on his 90th birthday, when oral tributes were supplemented by two scrapbooks full of congratulatory letters from

THE LINCOLN CONSTANCE MEMORIAL FUND

Gifts in Lincoln's memory can be made to The Lincoln Constance Memorial Fund at the University and Jepson Herbaria, UC Berkeley. Funds will be used to support *Constancea: University of California Electronic Publications in Botany*, a new publication named in Lincoln's honor, and to curate botanical collections, especially the Apiaceae.

Please mail to: The Lincoln Constance Memorial Fund, University and Jepson Herbaria, UC, 1001 Valley Life Sciences Bldg. #2465, Berkeley, CA, 94720-2465

colleagues around the globe. The final weeks prior to his death, at age 92, were a period of grace during which Lincoln actually regained much of his former sharpness, enthusiastically discussing research with visiting colleagues. Soon thereafter, however, he informed Bill that he was "checking out," a prediction made good on June 11, 2001, after a bout of pneumonia. According to Bill, "He certainly was tired of being old, but not tired of life. I'm pleased to report that, up to the end, Lincoln still had that twinkle in his eye."

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The Sonoma spineflower (*Chorizanthe valida*) occupies 2.5 acres of coastal prairie where grazing has occurred for over a century. Research has suggested that this rare plant is dependent on grazing to reduce competition with non-native vegetation. Photograph by Barbara Moritsch.

TAKING STEPS TOWARD LONG-TERM PRESERVATION OF THE SONOMA SPINEFLOWER

by Michelle Coppoletta and Barbara Moritsch

In January 1990, *Fremontia* reported on the rediscovery of the Sonoma spineflower (*Chorizanthe valida*) in Point Reyes National Seashore (Volume 18, No. 1). The plant had last been recorded in 1903 and was presumed to be extinct until a group of amateur botanists led by Wilma Follette of the Marin Chapter of the California Native Plant Society (CNPS) discovered specimens growing in a grazed pasture on the Seashore. Until recently, this single population was the only known occurrence in the world. Over the past ten years much progress has been made in the reestablishment and protection

of the federally endangered spineflower. Through the combined efforts of the Point Reyes National Seashore Association (PRNSA), a devoted cadre of CNPS volunteers, and the vegetation managers of the US National Park Service (NPS) a second population of Sonoma spineflower was established from seed in the Seashore in 2000.

The Sonoma spineflower was first described in 1877 by Sereno Watson from specimens collected by Ilya G. Vosnesensky, an entomologist and curator of the zoological museum in St. Petersburg, Russia, who traveled and collected in Northern California in 1840 and

1841. These early collections indicate that the flower once had a much broader range in Marin and Sonoma counties. Intensive agriculture and urbanization since the early 1900s have significantly altered the species habitat and today the Sonoma spineflower is limited to one native and one introduced population encompassing approximately 1 hectare (2.5 acres) of coastal prairie.

The Sonoma spineflower is a robust, annual member of the buckwheat family (Polygonaceae). It is distinguished by broad lance-shaped basal leaves, dense head-like clusters of pink flowers, and spine-tipped bracts. These spines are



At one time believed to have gone extinct, the Sonoma spineflower is known today from a single location worldwide located in the coastal prairie of Point Reyes National Seashore. In 2000, through the combined efforts of resource managers, CNPS volunteers, and the Point Reyes National Seashore Association, a second population of Sonoma spineflower was established from seed. Photograph by Doreen Smith.

believed to facilitate seed dispersal by attaching the seed to passing animals (US Fish and Wildlife Service, 1998). During the flower's peak blooming period, between June and August, the Sonoma spineflower emits a strong floral scent that attracts many insect visitors. Known foragers include honeybees (*Apis mellifera*), yellow-faced bumblebees (*Bombus vosnesenki*) and solitary, ground-nesting wasps (*Bembix americana comata*) (Davis, 1988). The coastal habitat of the Sonoma spineflower also supports numer-

ous other rare plant species, including Point Reyes horkelia (*Horkelia marinensis*), large flowered linanthus (*Linanthus grandiflorus*), North Coast phacelia (*Phacelia insularis* var. *continentis*) and Gairdner's yampah (*Perideridia gairdneri* sp. *gairdneri*).

It is believed the Sonoma spineflower is presently limited in distribution by both its restriction to well-drained, disturbed, sandy soils and its apparent dependence on grazing by cattle or other wildlife. Prior to the settlement of Point Reyes and the subsequent introduction of cattle to the peninsula, grazing by elk and other ungulates may have played a role in the perpetuation of the Sonoma spineflower (Davis and Sherman, 1992). In 1988 a study was conducted to investigate the effects of cattle grazing on the Sonoma spineflower population. The study suggested that in the absence of grazing, non-native plants could outcompete the spineflower (Davis and Sherman, 1992). These ecological requirements, coupled with the spineflower's narrow endemism (restriction to a certain region or part of a region), make it particularly vulnerable to events such as disease, fire, flood, or other circumstances that could eliminate the population and cause extinction.

Populations with small numbers of individuals may also suffer from excessive inbreeding and a lack of genetic diversity. This can result in restricting the species ability to survive only within a very narrow range of environmental conditions and may eventually lead to a loss of reproductive fitness. Establishment of additional populations is essential to the Sonoma spineflower's suc-

cess. These populations will reduce the vulnerability of the species to change, amend the effects of genetic drift, and supply additional genetic diversity to the main population (Falk and Holsinger, 1996).

THE NEED FOR MANAGEMENT

CNPS volunteers and NPS staff began monitoring the Sonoma spineflower population shortly after its rediscovery in 1980. Recorded numbers of plants have varied widely, ranging from 2,000 to 30,000 individuals within a three-year period. Fluctuation in these numbers may be attributed to the natural variability within the species (resulting from climate and weather patterns), intermittent observations made at differing times of the year, and a lack of standardized monitoring methods.

In response to the inconsistency in monitoring methods and results, the US Fish and Wildlife Service (USFWS) published a recovery plan in 1998 that outlined habitat conservation, management, and monitoring guidelines for the restoration of the Sonoma spineflower (USFWS, 1998). The ultimate goal of this plan is to establish two additional self-sustaining populations within the Seashore that demonstrate a potential for growth and long-term persistence. Once these two populations are established, the Sonoma spineflower will be considered for downlisting or delisting (the removal or change of protected status under the federal Endangered Species Act).

In 1999, the PRNSA provided the Seashore with funds to monitor, evaluate, and develop management strategies for the Sonoma spineflower in accordance with the USFWS recovery plan. The monitoring plan, currently in the final stages of development, focuses on developing scientifically based,

The Sonoma spineflower. Illustration by Windom Elliot.



repeatable monitoring protocols to obtain reliable population numbers each year, to track and record cattle grazing levels, and to monitor composition and cover of native and non-native vegetation in the population area. The plan includes proposals to expand the existing population of the Sonoma spineflower beyond its current boundary and to establish additional populations in suitable habitat in the Seashore. In support of the conservation of this species, Sonoma spineflower seed has been collected and placed in long-term storage in the seed bank facility of the Rancho Santa Ana Botanical Garden. This collection can provide seed for future research and reintroduction projects and protect the species against catastrophic events that could eliminate the *in situ* population.

POPULATION EXPANSION

The first effort to expand the Sonoma spineflower population was undertaken by Liam Davis, a graduate student at Sonoma State University, in 1988. Three 2x2 meter plots were established within the coastal grassland pasture of the main population. To facilitate gene flow by insect pollen foragers, the three plots were placed 100-200 meters from the original population (Davis and Sherman, 1992). The soil was lightly disturbed with a rake and 1,000 seeds were dispersed by hand and pressed into the soil by foot. Monitoring over the next three years revealed that all three trial plots had successful establishment and reproduction with two plots expanding outside of the original seeded area (Davis and Sherman, 1992). After twelve years one of these seed plots continues to support spineflowers, with a population count of 691 plants in 2000. Using these seed plot methods as a guideline, two more trial plots were

established 150 meters from the main population, in 1999. One year after planting, the seed plots each support over 50 plants.

Based on the success of the seed trials, NPS vegetation managers began to search for sites away from the main population that would be suitable for Sonoma spineflower reintroduction. By consulting historic records, soils maps, and local plant taxonomists and by conducting field searches to identify potentially appropriate habitat, a site was identified for trial planting. The site, located on a historic ranch 1.5 km south of the main population, is believed to be the location where a Sonoma spineflower specimen was collected by A.D.E. Elmer in 1903. It is also the site of the historic Point Reyes Post Office and was a major center of shipping activity for peninsula ranchers in the early 1900s. In fall 1999, cattle troughs were removed from the selected site, the soil was lightly disturbed with a rake, and 1,000 seeds collected from the main colony were planted.

In 2000, the trial plot was revisited and found to support 34 Sonoma spineflower plants, all of which produced flowers and many of which later set seed. The PRNSA generously provided additional funding to continue to manage this species, and two more plots were established within 200 meters of the first trial plot. Each plot was sown with 1,000 seeds collected from the main population. By early summer 2001 the first trial plot, established in 1999, contained 182 Sonoma spineflowers and had expanded beyond the original seed plot boundary. Of the two plots established in 2000, one was successful, with 77 Sonoma spineflower plants by June 2001.

The success of these seed trials suggest that the boundaries of the main population of Sonoma spineflower can be expanded through seeding and the establishment of additional populations in suitable

habitat. Trial seed plots placed over a wide range of habitat types will help managers better understand the species tolerance levels, limiting factors, and habitat requirements. Control and field experiments also will help determine factors that limit the Sonoma spineflower to a narrow geographic range and will aid in identifying suitable habitats for its expansion.

Whether or not the new populations will persist over time cannot be predicted now. Nevertheless, the establishment of a second population away from the main population is significant because it reduces the probability of extinction from catastrophe and moves us one step closer to the long-term conservation of this species.

ACKNOWLEDGMENTS

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Drainage networks of watercourses occur across deserts from steep canyons to gently-sloping washes, as seen from the crest of the southeastern Granite Mountains in the Mojave National Preserve looking to the south. Photographs by the author.

VEGETATION IN WATERCOURSES OF THE EASTERN MOJAVE DESERT

by Julie M. Evens

When most people think of the Mojave Desert, they envision rugged, sparsely-vegetated mountains, vast arid expanses of creosote bush-dotted alluvial fans, and closed salty basins. However, a rich and complex collection of riparian forests, woodlands, and shrublands occur in Mojave Desert watercourses. As compared to surrounding uplands,

watercourses usually sustain a more luxuriant growth of plants, comprising a large percentage of the most unique and biologically diverse environments of this desert ecosystem. The vegetation is particularly productive, structurally complex, and biologically rich in watercourses, including a high number of endemic, rare, and endangered plant species. These vegetation pat-

terns appear to be expressions of water availability, water-induced disturbance, and other changing environmental elements.

TYPES OF DESERT WATERCOURSES

Most desert watercourses experience periodic flooding during

heavy precipitation events, and then they may remain dry for extended periods. They are disturbance-dependent systems that occur in drainage networks across deserts. They can particularly vary with respect to the amount of water flow, topography, and substrate.

Watercourses can be defined by their topographic position relative to mountains, alluvial fans, and basins of the desert. Three different categories of desert watercourses can be distinguished in the Mojave: canyons, arroyos, and washes. High in desert mountains, canyons cut deeply through the bedrock with V-shaped gorges. Narrow canyon watercourses originate on steep upper mountain slopes and become prominent on lower slopes as canyon bottoms. Storm waters carry massive amounts of debris, sand, and rocks through these steep narrow canyons where vegetation is often scattered among smoothed bedrock staircases, large boulders, rock outcrops, and gravel flats.

With immense force, flood waters carry sediments and rocks to broad, gently-sloping watercourses on alluvial fans. Arroyos usually deeply incise the upper alluvial fans at canyon mouths and are sometimes underlain by pediment. Washes shallowly incise the lower alluvial plains of the bajadas with their even gentler slopes and finer rock surfaces. Washes are ubiquitous in the Mojave Desert, scouring vast alluvial plains in dendritic or reticulate patterns. In strong storms, lowland washes transport water to basins that replenish groundwater aquifers.

NEED FOR SAMPLING VEGETATION IN WATERCOURSES

Desert watercourses are classified as riparian habitats even though they may not contain flowing water for many years. Many plants are found only within their channels and

do not occur in the surrounding uplands. These plants are restricted to desert watercourses because they depend on periodic water-induced disturbance for renewal, stimulation, and continuance. Watercourses provide habitats for these disturbance-related species, as well as annuals, long-rooted perennials, and occasionally upland species.

Watercourses house a diversity of animals as well as plants. They provide important habitats for feeding and nesting animals such as bighorn sheep, warblers, phainopeplas, red-spotted toads, and skinks. Because of the relatively lush and palatable foliage in these habitats, watercourses strongly attract non-native cattle and burros, which can cause devastating effects through trampling, grazing, and waste concentration.

Since watercourses sustain high plant and animal diversities, studies of watercourses can provide land-managing agencies with a wealth of quantitative resource information. However, few studies have focused on the distinct vegetation patterns

seen in desert watercourses, and the mountains of the eastern Mojave Desert especially have been neglected. By acquiring knowledge of watercourse vegetation patterns and related environmental factors, agencies can create better management schemes that protect and preserve plants in a multi-species approach rather than a single-species approach.

Ecologists with the US Geological Survey's Mojave Vegetation Mapping Project recently have classified the vegetation in the Mojave Desert. Lead ecologists Kathryn Thomas and Todd Keeler-Wolf have created a map and classification of the vegetation types across this vast desert. I had the opportunity to work for Kathryn and Todd, as well as for Jim André of the University of California Granite Mountains Desert Reserve. As we sampled vegetation in numerous uplands and some watercourses, I observed that vegetation quickly changed every few hundred meters down a single watercourse. This vegetation patterning was more

An intermittently flooded shrubland of *Baccharis sergiloides* (desert mulefat) occurs in a mesic, bedrock-exposed canyon of the Granite Mountains.



TABLE 1. VEGETATION TYPES IN WATERCOURSES OF THE EASTERN MOJAVE DESERT

Alliance Type	Dominant in Alliance	Common Name
Forest	<i>Quercus chrysolepis</i>	canyon live oak
Woodland	<i>Pinus monophylla</i>	singleleaf pinyon pine
Temporarily Flooded Woodland	<i>Populus fremontii</i>	Fremont cottonwood
Shrubland	<i>Acacia greggii</i>	catclaw
	<i>Encelia virginensis</i>	Virgin River brittlebush
	<i>Hymenoclea salsola</i>	cheesebush
	<i>Prunus fasciculata</i>	desert almond
	<i>Quercus turbinella</i>	desert scrub oak
Dwarf-Shrubland	<i>Salvia dorrii</i>	desert sage
Intermittently Flooded Shrubland	<i>Baccharis sergiloides</i>	desert mulefat
	<i>Chilopsis linearis</i>	desert-willow
	<i>Chrysothamnus paniculatus</i>	sticky rabbitbrush
	<i>Ephedra californica</i>	California desert tea
	<i>Pseudotsuga spinozus</i>	smoketree
Temporarily Flooded Shrubland	<i>Salix exigua</i>	narrowleaf willow

¹ Alliances represented in less than three samples (all other alliances are represented in at least three samples)

complex than our sampling efforts captured, with tremendous numbers of species and intricate spatial patterning that had only been sug-

gested in books and other accounts. I began formulating my master's thesis (with John Sawyer at Humboldt State University) with these

patterns in mind. My primary goal was to capture and better describe this detail in watercourses of the eastern Mojave Desert.

A grove of *Quercus chrysolepis* (canyon live oak) found in a spring-fed, north-facing canyon of the Providence Mountains.



STUDY DESIGN

To describe vegetation detail of eastern Mojave watercourses, I studied watercourses of a wide altitudinal gradient and on two rock types. I chose eight distinct watercourses, each with a nine km active channel. Four were found on granite and four on limestone, two common rock types in the eastern Mojave. The watercourses were mainly within the Mojave National Preserve, accessed from Interstates I-40 to I-15, and flowing out of the high elevation ranges of the Granite, Providence, New York, and Clark mountains.

I used a modified CNPS relevé protocol for sampling the vegetation. I recorded vegetation and environmental variables in 264 plot samples, including vascular plant composition, species percent cover,

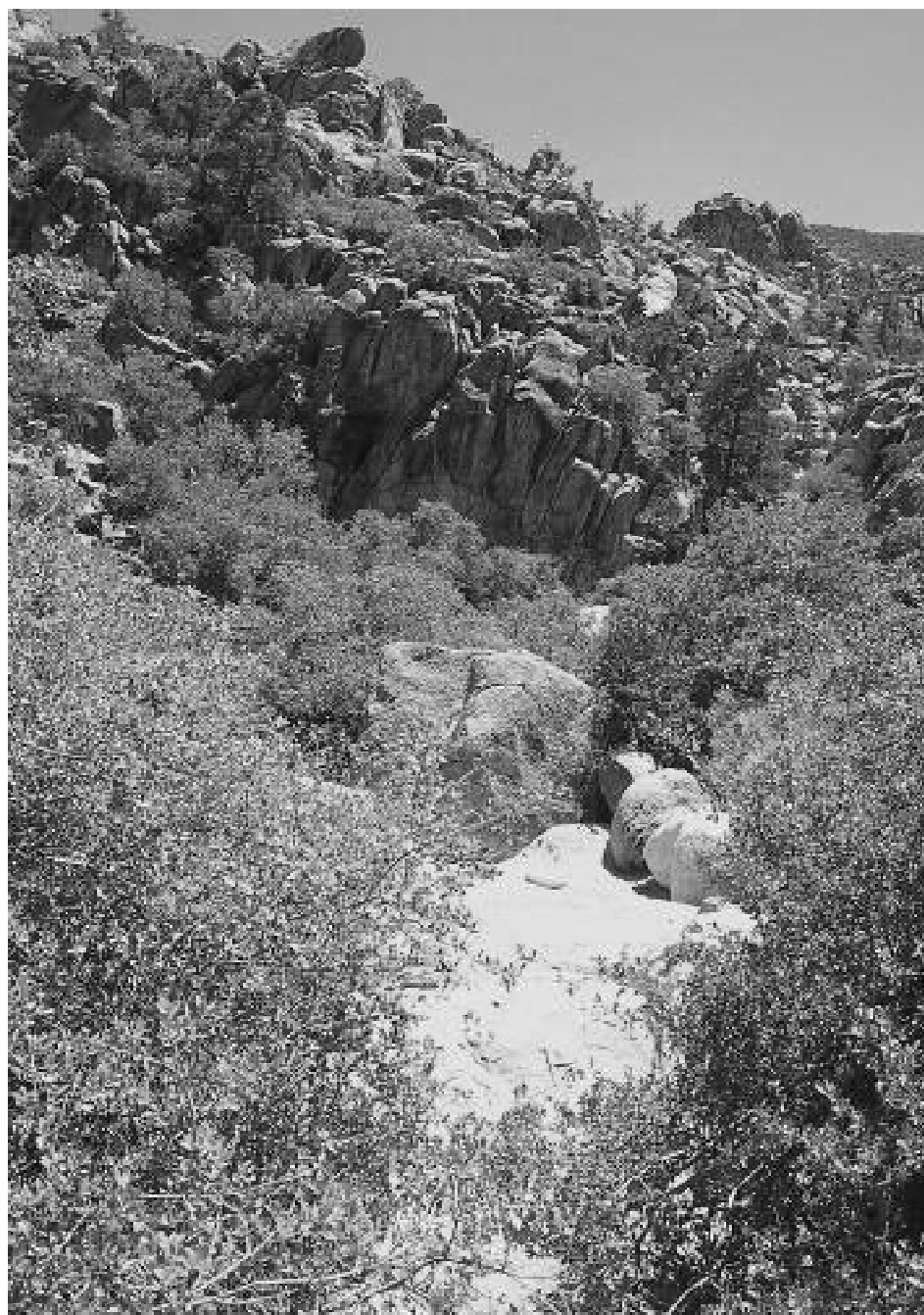
elevation, slope, aspect, surface rock, and sediment characteristics. In the 1998 spring of sampling, I documented a prolific number of annuals, yet in the following spring I found a meager number (with 99 total native annuals identified). Because of this variability, I only analyzed data of perennials and hearty non-natives. I used standard classification, ordination, and gradient analyses to obtain the following results. See my thesis (Evens, 2000) for a full description of methods and analyses used.

FROM THE BROAD VIEW

I identified 245 vascular plant species in all watercourse samples. Of these plants, 232 were perennial native species and 13 were non-native species. Further, 21 of the native species are classified as endangered, rare, or of limited distribution.

I also identified complex plant associations, in which I classified the watercourse vegetation into 15 major types, called "alliances." Each alliance was based on distinguishing structure, a dominant or characteristic overstory species, and other distinctive species as done for series in CNPS's *Manual of California Vegetation* (Sawyer and Wolf, 1995). I followed the conventions of The Nature Conservancy's National Vegetation Classification (TNC, 1999) in my classification of one forest, one woodland, one temporarily flooded woodland, five shrubland, one dwarf-shrubland, five intermittently flooded shrubland, and one temporarily flooded shrubland alliances (see Table 1).

The spatial patterning of vegetation was affected strongly by topography. Regardless of rock type, canyon bottoms had the highest number of plant species, greatest percent coverage of plant strata, and highest number of vegetation types.



A tall shrubland of *Quercus turbinella* (desert scrub oak) in a north-facing canyon of the New York Mountains.

Likewise, a distinct set of species and vegetation types occurred in the canyon zone. Other sets of species and vegetation types occurred in arroyo and wash zones, which were more similar in species composition to each other than to the canyon zone. While topography strongly influenced vegetation, the local patterning of vegetation was

modified also by substrate, aspect, elevation, and regional location.

CANYON VEGETATION

In 80 canyon samples, I encountered a total of 221 plant species, or 90% of all plants identified in the study. Per sample, I found an aver-



A colorful, dwarf-shrubland of *Salvia dorrii* (desert sage) occurs in a limestone-rich arroyo of the Clark Range at the mountain front.

age of 36 species and up to 57 species, astounding numbers for most desert samples. Species primarily found in canyons were *Baccharis sergiloides*, *Brickellia californica*, *Castilleja linariifolia*, *Elymus elymoides*, *Pinus monophylla*, and *Salvia mohavensis*. Further, I recognized 10 alliances in canyons.

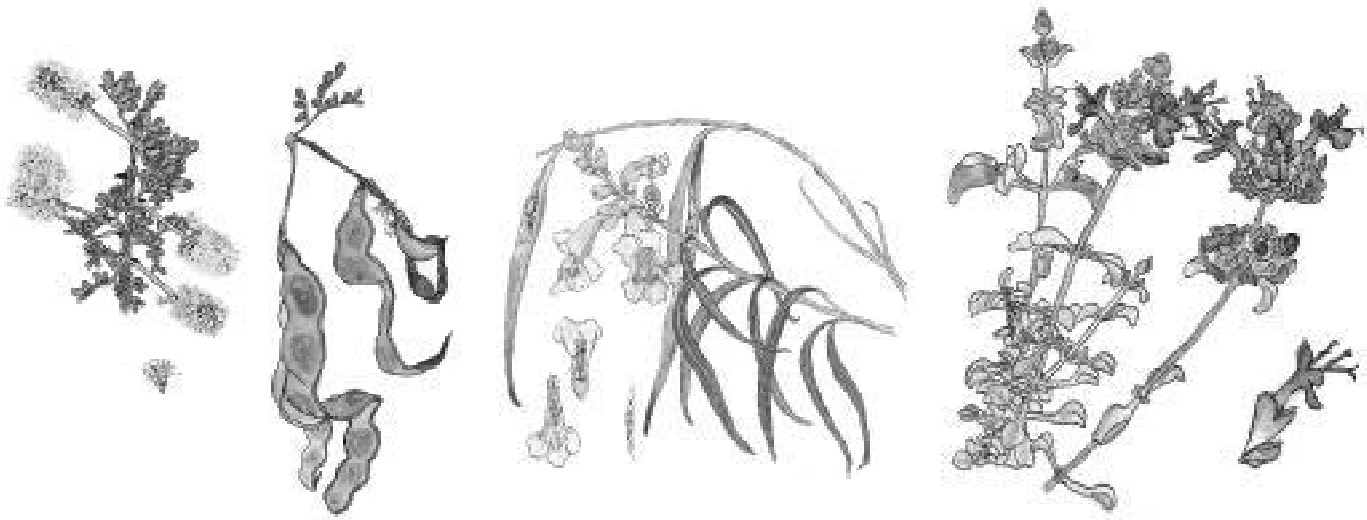
The higher sections of most canyons contain coniferous woodlands of *Pinus monophylla* (singleleaf pinon pine). These pines along seasonal watercourses blend into the surrounding stands of upland pines. The canyon and upland stands differ, though, in understory plants

since the canyons contain many riparian associates such as *Ageratina herbacea*, *Fallugia paradoxa*, *Prunus fasciculata*, and *Rhus trilobata*, whereas the uplands have upland associates like *Ephedra viridis*, *Juniperus osteosperma*, and *Keckiella antirrhinoides*.

In contrast, distinct and widely scattered groves of *Quercus chrysolepis* (canyon live oak) are confined to north and east-facing, spring-fed sites, such as in the upper canyons of the Providence Mountains. This oak has a wider distribution in other more mesic regions of California, and it ranges into the mountains of

Arizona and Baja California. *Quercus chrysolepis* in association with *Rhamnus ilicifolia*, composes a relatively lush broad-leaved evergreen forest with a variety of other plants such as *Brickellia californica*, *Erigeron utahensis*, *Hedeoma nanum* ssp. *californicum*, *Leymus salinus* ssp. *mohavensis*, and *Rhamnus tomentella* var. *ursina*.

Groves of *Populus fremontii* (Fremont cottonwood) and *Salix exigua* (narrowleaf willow) are even more infrequently found. These broad-leaved deciduous relatives occur along perennial canyon streams that temporarily flood. Individuals of



Acacia greggii, catclaw (left), *Chilopsis linearis*, desert-willow (middle), *Salvia dorrii*, desert sage (right). Illustrations by the author.

Populus fremontii form open to dense woodlands while those of *Salix exigua* form almost continuous shrublands. Associated with both types are *Baccharis sergiloides* in the Granite Mountains, and numerous wetland species such as *Epilobium canum* ssp. *canum*, *Juncus mexicanus*, *Muhlenbergia rigens*, and *Typha domingensis*.

Quercus turbinella (desert scrub oak) is restricted to cool, upper and lower granitic slopes of the New York Mountains and Midhills. This evergreen shrub oak lines canyon banks in particularly dense clumps, growing significantly taller along watercourses than in surrounding upland sites. It grows with *Pinus monophylla* and *Baccharis sergiloides* forming tall and diverse shrublands with species such as *Castilleja linariifolia*, *Bouteloua curtipendula*, *Fallugia paradoxa*, *Galium munzii*, *Mirabilis coccinea*, *Pellaea mucronata*, and *Woodsia oregana*.

Salvia dorrii (desert sage) is a bright purple-flowered, exceptionally aromatic, gray-leaved shrub that forms another rare canyon type. Populations of pure *Salvia dorrii* occur in calcareous, cobbled channels with a myriad of species such as *Castilleja angustifolia*, *Escobaria vivipara* var. *deserti*, *Gutierrezia microcephala*, *Opuntia phaeacantha*, *Penstemon palmeri*, *Purshia mexicana* var. *stansburyana*, *Prunus fasciculata*, *Yucca baccata*, and possibly emergent trees of *Pinus monophylla*. This *Salvia*

scrub is scarce in lower canyons and arroyos of the Clark Mountains.

Thickets of *Baccharis sergiloides* (desert mulefat), with its broom-like and impenetrable green branches, consistently occur in upper and lower canyons. *Baccharis sergiloides* shrublands form associations with *Muhlenbergia rigens*, *Prunus fasciculata*, and *Rhus trilobata*. These shrublands are true indicators of water, especially occurring in granitic canyons that have intermittent flooding, saturated soils, standing pools of water, and permanent springs such as in the Granite and Providence mountains.

Two other vegetation types consistently occur in drier and lower canyon sites. Tall shrublands of *Acacia greggii* (catclaw acacia), with its tangle of usually leafless and effectively barbed "wait-a-minute" branches, stretch widely across coarse rocky canyons, arroyos, and washes. *Acacia* is certainly conspicuous with the deep red, parasitic mistletoe, *Phoradendron californicum*, that often covers the shrub. Tall shrublands of *Prunus fasciculata* (desert almond), with its tangle of densely intricate branches and small leaves, occur in gravelly canyons and arroyos. *Prunus* is particularly

Shrublands of *Acacia greggii* (catclaw acacia) are a conspicuous component of canyons, arroyos, and washes, such as in the Granite Mountains.





Shrublands of *Ephedra californica* (California desert tea) occur in sandy arroyos and washes of the Granite Mountains.

noticeable with the silky tent webs that caterpillars form in their branches during early spring.

ARROYO AND WASH VEGETATION

I encountered 151 species, or about 61% of all plants identified, in 181 arroyo and wash samples, and I found an average of 22 species per sample. Species found most frequently in these watercourses are *Ambrosia eriocentra*, *Brickellia incana*, *Encelia virginensis*, *Ephedra californica*, *Erodium cicutarium*, *Eriogonum inflatum* var. *inflatum*, and *Erioneuron pulchellum*. I recognized nine alliances (seven in arroyos and six in washes).

Stands of *Chilopsis linearis* (desert-willow) line many rocky arroyos and braided washes as well as canyon

bottoms. *Chilopsis linearis* has impressive, large-flowered drooping branches that gracefully overhang various other plants in structurally diverse stands. It associates with *Prunus fasciculata*, *Hymenoclea salsola*, *Salvia dorrii*, *Viguiera parishii*, and *Chrysothamnus paniculatus*. *Chilopsis linearis* is common in mid-elevations of the Sonoran and Chihuahuan deserts as well as the eastern Mojave Desert in intermittently flooded watercourses.

Patches of *Encelia virginensis* (Virgin River brittlebush) in association with *Salvia dorrii* are uncommon in the eastern Mojave Desert, and can be found sparingly in limestone-rich arroyos of the Clark Mountains. These brightly-flowered small shrubs form a species-rich mosaic with other vibrant species like *Mirabilis pumila*, *Penstemon palmeri*, *Psilostrophe cooperi*, *Sphaeral-*

cea ambigua var. *ambigua*, *Salazaria mexicana*, and *Yucca baccata*.

Tall shrublands of *Pseudotsamnus spinosus* (smoketree) are local but conspicuous in parts of the southeastern Mojave Desert. *Pseudotsamnus spinosus* has a wispy, skeleton-like gray appearance most of the year except in spring when covered in royal blue blooms. The shrublands contain only a few other widely spaced individuals such as *Ephedra californica*, *Hymenoclea salsola*, *Artemisia arborea*, and *Senecio flaccidus* var. *monoensis*. They are found in braided washes of granitic and volcanic sediments below the Granite Mountains, and become more common in the Sonoran Desert.

Thickets of *Ephedra californica* (California desert tea), *Hymenoclea salsola* (cheesebush), and *Chrysothamnus paniculatus* (sticky rabbit-brush) occur as separate vegetation

TABLE 2. WATERCOURSE VEGETATION TYPES AND HABITATS

(Geologic substrate is denoted by G = granitic, L = calcareous, and B = both granitic and calcareous.)

Dominant in Alliance	Canyon	Arroyo	Wash
<i>Pinus monophylla</i> (singleleaf pinyon)	B		
<i>Quercus chrysolepis</i> (canyon live oak)	B		
<i>Baccharis sergilloides</i> (desert mulefat)	G		
<i>Populus fremontii</i> (Fremont cottonwood)	G		
<i>Quercus turbinella</i> (desert scrub oak)	G		
<i>Salix exigua</i> (narrowleaf willow)	G		
<i>Prunus fasciculata</i> (desert almond)	B	B	
<i>Salvia dorrii</i> (desert sage)	L	L	
<i>Acacia greggii</i> (catclaw)	B	B	B
<i>Chilopsis linearis</i> (desert-willow)	B	B	B
<i>Encelia virginensis</i> (Virgin R. brittlebush)		L	
<i>Ephedra californica</i> (California desert tea)		G	G
<i>Hymenoclea salsola</i> (cheesebush)		G	G
<i>Chrysothamnus paniculatus</i> (rabbitbrush)			B
<i>Psoralea arguta</i> (smoketree)			G

types in nearly pure stands throughout the eastern Mojave Desert. *Ephedra californica* forms shrublands in sandy granitic arroyos and washes of the Granite Mountains. This *Ephedra* is particularly conspicuous with one to two meter tall green stems that are usually leafless, thin, upright, and broom-like. *Hymenoclea salsola* is the most ubiquitous wash shrub lining many granitic washes and disturbed roadsides, such as in the Granite and Providence mountains. It is straw-colored most of the year, but in spring bright green leaves—unusually scented (some say like old cheese) and threadlike—overtake it. *Chrysothamnus paniculatus* forms dense shrublands in gravelly washes of the Granite and Providence mountains. Its leaves are dark green, resinous, and linear, and its stems become black-banded by a fungus. *Ephedra californica* and *Hymenoclea salsola* are strong constituents of Sonoran desert washes while *Chrysothamnus paniculatus* is affiliated with the Great Basin.

CONCLUSIONS

This study provides a classification of the complex vegetation patterns in eastern Mojave Desert

watercourses. These patterns may appear confusing at first look; however, an eye to detail, consistent and careful measurement in quantitative samples, and use of computer analyses reveal consistent vegetation types that are related to environmental elements (see Table 2). Some vegetation types are rare, while some are widely distributed. I identified new alliances not described for the Mojave Desert, California, with the dominant species of *Quercus chrysolepis*, *Quercus turbinella*, and *Salvia dorrii*. I also documented new alliances not previously described elsewhere with the dominant species of *Baccharis sergilloides*, *Chrysothamnus paniculatus*, and *Prunus fasciculata*.

The 15 alliances broadly serve as umbrellas or “habitats” for rare and common plant species (some exotic) that occur in the canyons, arroyos, and washes. Specifically, canyons contained a higher number of rare species (see Table 3) as well as more exotic species (see Table 4) than arroyos and washes. An endangered, bright pink-flowering herb, *Penstemon stephensii*, occurred only in canyons on granite,

A tall, arching shrubland of *Chilopsis linearis* (desert-willow) occurs in an intermittently flooded, gravelly arroyo of the Granite Mountains.



TABLE 3. SPECIAL PLANTS IN WATERCOURSES OF THE EASTERN MOJAVE DESERT

Species	CNPS List
<i>Penstemon stepheni</i> (Stephen's beardstongue)	1B
<i>Ageratina herbacea</i> (desert ageratina)	2
<i>Erigeron utahensis</i> (Utah daisy, Utah fleabane)	2
<i>Leymus salinus</i> ssp. <i>mojavensis</i> (hillside wheat-grass)	2
<i>Maurandya antirrhiniflora</i> (violet twining snapdragon)	2
<i>Mirabilis coccinea</i> (red four o'clock, red umbrella-wort)	2
<i>Physaria chambersii</i> (Chamber's double bladderpod)	2
<i>Agave utahensis</i> var. <i>nevadensis</i> (Clark Mtn agave)	4
<i>Aloysia wrightii</i> (oreganillo)	4
<i>Asclepias asperula</i> ssp. <i>asperula</i> (antelope horns)	4
<i>Astragalus nutans</i> (Providence Mtns. milk-vetch)	4
<i>Cryptantha tumulosa</i> (New York Mtns. cryptantha)	4
<i>Eriogonum heermanni</i> ssp. <i>floccosum</i> (Clark Mtn. buckwheat)	4
<i>Fendlerella utahensis</i> (yerba desierto)	4
<i>Galium angustifolium</i> ssp. <i>gracillimum</i> (slender bedstraw)	4
<i>Galium munzii</i> (Munz's bedstraw)	4
<i>Hedeoma pumilum</i> ssp. <i>californicum</i> (Calif. mock-pennyroyal)	4
<i>Petradoria pumila</i> ssp. <i>pumila</i> (rock goldenrod)	4
<i>Quercus turbinella</i> (desert scrub oak, shrub live oak)	4
<i>Tetradymia argyrea</i> (striped horsebush)	4
<i>Tragia ramosa</i> (desert tragia)	4

KEY:

1B = California Native Plant Society (CNPS) listed as endangered in California and elsewhere

2 = CNPS listed as rare or endangered in California, more common elsewhere

4 = CNPS listed as plant of limited distribution

TABLE 4. EXOTIC PLANTS IN WATERCOURSES OF THE EASTERN MOJAVE DESERT

Species in Canyons	Frequency
<i>Agrostis viridis</i> (water bent)	occasional
<i>Avena fatua</i> (wild oat)	rare
<i>Bromus diandrus</i> (ripgut grass)	common
<i>Cynodon dactylon</i> (bermuda grass)	occasional
<i>Polypogon monspeliensis</i> (rabbitfoot grass)	occasional
<i>Sisymbrium orientale</i>	rare
<i>Sonchus oleraceus</i> (common sow-thistle)	occasional
Species in Canyons, Arroyos, and Washes	Frequency
<i>Bromus madritensis</i> ssp. <i>rubens</i> (foxtail chess)	abundant
<i>Bromus tectorum</i> (cheat grass)	abundant
<i>Bromus trinius</i> (Chilean chess)	occasional
<i>Erodium cicutarium</i> (filaree)	abundant
<i>Schismus barbatus</i> (Mediterranean grass)	abundant
<i>Tamarix ramosissima</i> (tamarisk)	common

and a rare red-flowering herb, *Mirabilis coccinea*, occurred continuously from canyon to wash also on granite. The five other CNPS List 2 species were only in canyons primarily on limestone, such as the twining violet-flowering *Maurandya antirrhiniflora* ssp. *antirrhiniflora*.

Of the 14 CNPS List 4 species identified as having limited distribution, four occurred in canyons and arroyos on granite and limestone, which were *Astragalus nutans*, *Galium angustifolium* ssp. *gracillimum*, *Quercus turbinella*, and *Tragia ramosa*. Another occurred from arroyo to wash on limestone, which was the silvery-tufted and white-flowered *Cryptantha tumulosa*. The other nine species were exclusive to canyons such as *Asclepias asperula* ssp. *asperula* with its dark and light chocolate-colored flowers. Further, seven exotic species resided in wet canyons, while six were spread widely across canyons, arroyos, and washes (see Table 4).

The information presented here should provide botanists and naturalists with a richer appreciation of the diversity and organization of nature, in what superficially may be perceived as a harsh and inhospitable environment. And the more detailed understanding of the biota and ecological arrangement of these vegetation types can be utilized by land-managing agencies and conservation organizations to ensure representation and sustenance of the rich and varied life of Mojave Desert watercourses.

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The wash shrubland of *Hymenoclea salsola* (cheesebush) commonly contrasts the upland bajada shrubland of *Larrea tridentata* (creosote bush) such as in this vegetation plot and the environs of the Providence Mountains.

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NOTES AND COMMENTS

LETTERS TO THE EDITOR

Dear Editor,

Thank you and congratulations for the new *Fremontia*! Mine came through the mail surprisingly unscathed and I really appreciate the look of it. I particularly like having the full table of contents attractively integrated with the front cover. Page 2 was packed with useful information, and I also liked the placement of the classifieds inside the back cover, with the contributors and editorial on the outside. All very thoughtful.

For composition, right down to the typography, every page—as well as the whole—is a work of art. I love your drawings, too. If that were not enough, you even used many of my favorite authors in both the articles and book reviews! Native plant horticulture is a major interest of mine.

I would love to see an article about cultivation of the Shasta snow wreath. I suppose by now that at least some of the botanic gardens are gathering some experience with it.

Best regards.

Jeffrey A. Caldwell, Cupertino, CA, Santa Clara Valley Chapter

[Editor's Note: An article on growing Shasta snow wreath (*Levisia cliftonii*) will appear soon.]

[The following was included as a comment to the Editor in a non-Fremontia letter;

but if you have an opinion on this matter, please send your "vote" to the Editor either electronically or in writing (see masthead for address).]

Dear Editor,

My perennial quixotic request, as a former CNPS president and long-time member of the Publications Committee: Give up the three-hole punch in *Fremontia*. How many fingers does it take to count members who actually put them in a three-ring binder?

James P. Smith, Jr., Arcata, CA, North Coast Chapter

Dear Editor,

Your article on growing redwoods stated that the viability period of sequoia (*Sequoiadendron giganteum*) seeds is short. I have found quite the opposite.

I helped process sequoia cones harvested from the Case Mountain logging in about 1953. I think our yield was about 1000 pounds of seed, which was sent to Mannings Seed Company in Roy, Washington. We were paid as it was sold. The seed was stored at +10 degrees F. in their storage facilities in Tacoma.

When Bent Gerdes bought the company in 1968 (and changed the name to Silvaseed Company), there was a small amount remaining. I think most of the sequoias planted in this 15-year period were from Case Mountain seeds. Although I don't know about the quality of the seed, it

was apparently viable after 15 years. My experience is that spring collections from snowbreaks and windfalls yield about 25% germination seed, while fall collections from squirrel caches yield 50% to 65% germination. According to *Giant Sequoia Ecology* (1980), 85% of the squirrel-cut cones are two to five years old, while cones can stay live on the tree up to 20 years. The spring collections will have large numbers of poor (old and immature) cones. The old cones have poor viability and the young cones yield immature seeds. These immature seeds will look good in a cut test, but will dry quickly. This may give the appearance of a short shelf life.

The squirrels will cut immature cones at the beginning of fall, after the first frost, but I have never seen them store them. However, it is not always easy to identify an immature cone. They seem to firm up and lose their yellowish tinge during the first cold weather.

I have stored seed in a 50-degree refrigerator, and inside a shady barn that allowed for air circulation with no apparent loss of germination. I once picked up seed from Three Rivers that had been left in the top drawer of a metal file cabinet which was standing outside for two years, that also yielded the expected germination. In short, redwood seed has a good shelf life and is easy to store.

Larry Otter, Springville, CA, Alta Peak Chapter

BOOK REVIEWS

Illustrated Field Guide to Selected Rare Plants of Northern California, edited by Gary Nakamura and Julie Kierstead Nelson. 2001. Agriculture and Natural Resources Publication 3395, University of California, Oakland, CA. 370 pages. \$36.00 softcover.

The editors have collected beautiful color photographs from more than 70 contributors, distribution maps, drawings, and general biological infor-

mation for 149 taxa on the California Native Plant Society's Lists 1A and 1B for the ten northernmost California counties.

One might think at first that restricting the species to only those that occur in the northern counties gives the reader a very limited resource. Not so, however, because within those counties occur the Coast Ranges, Klamath area, southern Cascades, Modoc Plateau, and the northern part of the Great

Central Valley. Major vegetation types here include coast redwood forest, marine and freshwater wetlands, coastal dune scrub, chaparral, foothill woodland, mixed evergreen forest, mixed conifer forest, montane meadows, upper montane forest, mixed sub-alpine woodland, alpine tundra, cold desert scrub, juniper woodland, vernal pools, and low elevation grassland. Altogether, 24 CNPS habitat types, ten Jepson subregions, and the elements of

three floristic provinces are included.

There is a brief overview section that describes the CNPS categories of rarity and endangerment, together with definitions from the California Department of Fish and Game, and a listing of state and federal laws that protect plants.

Each plant is presented in alphabetical order by scientific name—from *Abronia umbellata* to *Viola primulifolia* ssp. *occidentalis*—and each gets two pages of text organized in a repeating layout of information; consequently one can work through the book easily. The book's size (5.5 x 8.5 inches) is very handy for the field and its spiral binding allows every page to be fully opened and utilized. There is no wasted space in this publication.

The close-up plant photographs and the more distant photographs of vegetation and landscape are crisp, revealing, informative, and often artistic. Here, for example, is Tom Griggs' back-lit photo of *Tuctoria greenii* with the sun shining through its long epidermal hairs, or there is Vivian Parker's spectacular photo of Castle Crags rising up in front of a purple-blue sky, the locality for *Campanula shetleri*. Even the least photogenic taxa (for example, *Atriplex depressa*) become fascinating in these photographs. Drawings add even more detail. They have been taken from more than 20 books or sources but nearly a third come from *The Jepson Manual*.

The book ends with an index of scientific and common names, a list of references, a glossary, and a map of geographic subdivisions of California referred to in the book. I recommend this gem to amateur or professional botanists in northern California with a special interest in rare plants.

Michael Barbour, Plant Ecologist,
Environmental Horticulture Dept.,
UC Davis, CA 95616

Forested Communities of the Upper Montane in the Central and Southern Sierra Nevada, by Donald A. Potter. 1998. USDA Forest Service, General Technical Report PSW-GTR-169, Albany, CA. 319 pages. Free upon request. Softcover. **A Guide to Forested Communities of the Upper Montane in the Central**

and Southern Sierra Nevada, by Donald A. Potter. 1994. USDA Forest Service, R5-ECOL-TP-003, Albany, CA. 164 pages. Free upon request. Softcover.

This is a marvelous pair of books that summarizes two decades of field work by Donald Potter, a tireless zone/province ecologist for the Sequoia, Sierra, and Stanislaus National Forests of California. The region described extends from Lake Tahoe south to Lake Isabella—a range of more than three degrees of latitude—

and generally between 5,000 and 9,000 feet elevation along both west and east flanks of the Sierra Nevada.

Part of the value of these two publications is due to very readable overview sections on physiography, climate, geology, soils, and history of disturbance of the upper montane zone. The author defines forests of this zone as characteristically containing red fir, *Abies magnificavar. magnificavar. shastensis*. Forests here experience the deepest and longest-lasting snowpacks in Cali-

DESERT PLANTS



The Jepson Desert Manual Vascular Plants of Southeastern California

Bruce C. Baldwin, Steve Boyd, Barbara J. Ertter, Robert W. Patterson, Thomas J. Rosatti, and Dieter H. Wilken, Editors
Margriet Wetherwax, Managing Editor

"This much-needed volume incorporates new information about the status and range of many California desert plants. This book will facilitate access to information about our deserts, and will lead to increased respect and attention to them. We warmly welcome it."

—Jake Stagg, Past President of the
California Native Plant Society

\$35.00 paper

Cacti

Biology and Uses

Park S. Nobel, Editor

"There is nothing in the world like this book. It should be in every library and on the bookshelves of all those interested in cacti. The book will be an important resource for plant physiology, agronomy, and horticulture classes at both the undergraduate and graduate level."

—Bruce Smith, Brigham Young University

This comprehensive book, compiled by a well-known cactus biologist, includes authoritative, up-to-date chapters by thirty-five contributors

from around the world on topics ranging from evolution to biotechnology. It is the first book of its kind to compile information on cactus biology, ecology, and uses in one convenient place.

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fornia. Soils are typically Inceptisols on granitic or volcanic substrates.

The most important disturbances here, in terms of tree mortality, are lightning strikes, avalanches, and disease. Wind throw and catastrophic fire occur, but are less important. Potter points out that *Heterobasidium annosum* (root rot) has become an especially "abundant" pathogen in the upper montane during the twentieth century, in contrast to the relatively low importance of *Cronartium ribicola* (white pine blister rust), compared to the lower montane zone. Very few fire scar studies have been published for this zone, and the few that exist indicate an average surface fire-return interval of 25 to 100 years, much longer than that in the better-studied lower montane zone. Average fire size is less than 10 acres, although fires larger than 1,000 acres occur occasionally. These surface fires are low to moderate in intensity.

Fire scar records show no change in the fire-return interval until post-1875, at which time the interval began to lengthen. Fire-suppression management became effective in the upper montane by the 1930s. Grazing was most significant as a disturbance between 1860 and the 1950s. Logging did not become a major disturbance in the upper montane until post-World War II, because the financial yield per acre was low compared to pine-dominated stands at lower elevations. Since then, significant portions of forested land has been clear-cut, thinned, select-cut, or salvage-logged. Clear-cuts were generally smaller than 30 acres and afterward were planted with Jeffrey pine saplings. In many cases, plantings of red fir were failures for unexplained reasons.

The larger portion of each book (80%) was devoted to descriptions of 26 associations. These community types were statistically separated out from 757 samples subjectively located throughout the study area in stands "with no evidence of recent disturbance" and with tree canopy cover greater than 10%. Data taken included: cover by trees, shrubs, forbs, grasses, and mosses by species; tree density and basal area; and more than 80 abiotic stand traits. A total of 104 taxa were encountered and quantified.

The standard Forest Inventory Assessment (FIA) sample design was used, which includes a one-tenth acre fixed plot coupled with variable-radius plots.

An easy-to-use three-page key requires one to answer questions about the identity of a relatively few species of trees, shrubs, and herbs. Each association is named according to its dominant taxa. Some association names reflect only one plant (e.g., "mountain hemlock association," "western juniper association," "red fir association") but most reflect two or more names. Names joined by a hyphen indicate that they share the same canopy layer or growth form (e.g., "red fir-white fir-Jeffrey pine association"). Names separated by a slash indicate that they occupy different canopy layers or are different growth forms (e.g., "Jeffrey pine/huckleberry oak association"). This choice of nomenclature is standard among North American ecologists.

Each association includes a color photo showing the appearance of the vegetation; prose paragraphs that summarize the association's distribution, habitat, soil, forest structure and composition, productivity, and management recommendations; and tables on cover of each major growth form category, of major species, and of habitat traits. Snow course records from 193 locations were included in the roster of site factors.

Appendices include a lengthy table on "autecological relationships of selected plants," which summarizes 35 vegetation and site factors for 42 species of trees, shrubs, forbs, and grasses. Another appendix is a list of scientific and common names and acronyms for all taxa. Two extensive sections complete the book: one a glossary, the other a list of cited literature. The 1994 publication comes in a field-friendly, rugged ring binder with rigid plastic covers. It is a condensed version (only 164 pages) of the 1998 publication (319 pages), but still contains all elements of the larger book. One unique element is an environmental summary of each association, including 15 environmental factors, productivity, site index, wood volume, and basal area.

Because many of the species and associations described occur outside of

the Sierra Nevada, I can recommend the pair of books very highly to anyone who works with natural montane vegetation throughout California.

Michael Barbour, Plant Ecologist,
Environmental Horticulture Dept.,
UC Davis, CA 95616

Mosses and Other Bryophytes: An Illustrated Glossary, by Bill and Nancy Malcol. November 2000. Micro-optics Press. Distributor: Timber Press, Inc., Portland, OR. 226 pages. \$39.95 hardcover.

There are few things I find more aggravating than trying to use a dichotomous key to identify a plant while being unsure what the author had in mind by using a particular term as a diagnostic feature. Definitions of plant terms without illustrations for this botanist leave much to be desired. However, when definitions are accompanied by carefully selected illustrations, a glossary can indeed be a helpful tool. Now along comes this wonderful and much needed illustrated glossary of terms used in the study of bryophytes (mosses, liverworts, and hornworts). This glossary met all of my expectations and exceeded them in nearly every category.

The authors have done a remarkable job of bringing this glossary into production. Just wait until you see the quality of the 970 color images it contains! While the authors reside in the Southern Hemisphere and many taxa used throughout the glossary are primarily from that part of the globe, this glossary is no less useful for those of us in the Northern Hemisphere since many of the cosmopolitan species used in the illustrations are also present here in California.

You will find few books that have as many high quality photographs as this one; many of the microscope images are simply stunning. Perhaps the book's best feature is the way it handles definitions. Terms are cross-referenced, with words in boldface displayed elsewhere in the glossary. This arrangement makes it easy to compare terms and compare the associated color images of the feature in question. The definitions are notably clear and succinct. The definitions coupled with excellent images especially help

define the terms as they are used in bryology. This is a key point because some of the terms used in the study of flowering plants are also used in bryophytes but do not always mean the same thing. The book itself is a convenient size (6 x 8.5 inches) with a sturdy hard-back binding, high quality paper, and two to six color images per page. Another nice feature at the back of the glossary is an illustrated index arranged by scientific name.

Anyone with an interest in learning more about bryophytes will find this illustrated glossary a wonderful reference. This glossary will make the journey of bryophyte discovery so much more rewarding now that every bryological term you are likely to encounter in a key or species description is clearly defined and illustrated. With a price of under \$40, this illustrated glossary is indeed a bargain.

James R. Shevock, USDI National Park Service, Pacific West Region, 1111 Jackson St., Suite 700, Oakland, CA 94607-4807

BOOKS RECEIVED

The Habitat Garden Book: Wildlife Landscaping for the San Francisco Bay Region, by Nancy Bauer. 2001. Coyote Ridge Press, P.O. Box 192, Sebastopol, CA 95473, (707) 829-3910. 56 pages. \$14.95 softcover.

A delightful and easy-to-use guidebook for creating backyard habitat for birds, butterflies, and beneficial insects, specifically in the San Francisco Bay Area. Emphasis is on native plants—the heart of the garden—as well as regionally appropriate non-natives that provide food and nectar, color and scent. Color photos show specific plants for attracting local butterflies and birds. Beginners and experienced gardeners alike will find new ideas and a diverse group of plants that will transform their gardens into sanctuaries for themselves and local wildlife. Author Nancy Bauer is a garden columnist and wildlife habitat gardener.

The Heart of America, by Tim Palmer. 1999. Island Press/Shearwater Books. Washington, D.C.; Covelo, California. 338 pages. Black and white photographs by the author.

COAST REDWOOD

A Natural and Cultural History

Written by Michael Barbour, Sandy Lydon, Mark Borchert, Majorie Poppen, Valerie Whitworth, and John Evans
Published by Cachuma Press

Publishers of *Oaks of California* and *Conifers of California* are pleased to announce *Coast Redwoods: A Natural and Cultural History*, the first contemporary illustrated book to focus exclusively on the complete natural and cultural history of the world's tallest tree. *Coast Redwood* contains more than 230 color and 100 historic b&w photos and covers the trees entire range from Big Sur to southern Oregon.

SPECIAL OFFER TO CNPS MEMBERS: Order *Coast Redwood* directly from Cachuma Press and we'll take 10% off the retail price. With tax, handling, and shipping included, you pay only \$30 for the softcover and \$40 for the hardcover. If you would like to take advantage of this offer, please prepay by personal check to Cachuma Press, P.O. Box 560, Los Olivos, CA 93441 (805-688-0413). Please note this discount with your check. We will promptly send your copy of *Coast Redwood*.



A general treatment of the landscapes of North America and their vegetation, this book looks at our country's terrain through the author's travels, and reflections of what once was. It is a great introduction to many vegetation types, including those in California, and an insightful look at how we might save what is left of our natural heritage. Palmer is a fine writer, and his prose flows, which is another incentive for reading this book.

Tinkering with Eden: A Natural History of Exotics in America, by Kim Todd. 2001. W.W. Norton & Company, NY. 302 pages. \$26.00, hardcover. Illustrated by Claire Emery.

Although this book focuses primarily on animals, it helps the reader understand the history and human element of why these often biologically devastating introductions occur, and makes suggestions about how we can learn from our mistakes.

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PUBLICATIONS

The Habitat Garden Book: Wildlife Landscaping for the San Francisco Bay Region by Nancy Bauer; color photos. \$14.95 includes tax and shipping. Coyote Ridge Press, P.O. Box 192, Sebastopol, CA 95473

Flora & Fauna Books, 121 First Avenue South, Seattle WA 98104, Tel. (206) 623-4727, Fax. (206) 623-2001, ffbooks@blarg.net, Specializing in Botany, Gardening, Birding, and Ecology, both new and out-of-print. We carry a large inventory of Floras, Keys, and Field Guides for the

west coast and worldwide. A large selection of our inventory is now available on the web: www.abebooks.com/home/FFBOOK/

ECOLOGICAL RESTORATION

Ecological restoration journal. In the 2002 June issue, read about converting 74 acres from 95% weeds to 85% native grasses and wildflowers without grazing, burning, tilling, or herbicides. THE REVEGE EDGE, Craig Dremann, since 1972.

REVEGETATION STANDARDS

Native California grassland and desert ecological restoration standards and costs, plus pictures showing results. www.ecoseeds.com/standards.html

EDITORIAL

While reading this collection of articles, I am struck by the importance of the human experience in learning about California's native plants. Dana York's article leads me up into the Sierra on an adventure, and it reminds me that such a large part of understanding and appreciating native plants and their habitats comes from days spent exploring and discovering in the company of fellow botanists.

George Hartwell's article about Calflora looks at this wonderful Internet tool through the lens of human experience. He compares, for example, Torrey's historic discovery of a unique pine on the southern Califor-

nia coast (*Pinus torreyana*), to the electronic explorations of a high school student, whose virtual field trip into the wild leads her to discover spectacular photos of California natives.

When I invited Dr. Barbara Ertter to write a tribute to Dr. Lincoln Constance, who passed away this past year, I had a specific goal in mind. Lincoln Constance was and is an icon of botany, and several formal tributes have been written about his long and distinguished career already. I asked Barbara, who knew Lincoln well, to share with us a glimpse of the man that we might have known if we had shared a day in the field with him. It is only through such experiences that one

truly appreciates the greatness of the man, who was not just extremely accomplished, but was equally gracious.

The last two articles allow us to experience the fruits of working in the field. Michelle Coppoletta and Barbara Mortisch report on their findings of the Sonoma spine-flower (*Chorizanthe validi*), and Julie Evens summarizes her studies of eastern Mojave watercourses. Through their writings and photos we visit these sites, imagine their floras, and return in spirit to a day that we might have spent reveling, with our friends or co-workers, in the beauty and diversity of California's native plants.

Linda Ann Vorobik, Editor

CONTRIBUTORS

Michelle Coppoletta, botanist with the USDI National Park Service in Point Reyes National Seashore, Marin County, California, specializes in rare plants.

Barbara Ertter, research botanist and administrative curator at the University and Jepson Herbaria, UC Berkeley, is especially interested in western floristics and botanical history.

Julie M. Evens, CNPS vegetation ecologist, worked on vegetation mapping projects for Sequoia and Kings Canyon of the National Park Service, and the Mojave Desert Ecosystem Program of the USGS/Biological Resources Division.

George Hartwell worked for 11 years at Caltrans, where he created the Caltrans Botanical Management Area programs. He now is public information officer for the California Highway Patrol, and is an amateur botanist passionate about the Ione rare plant species.

Barbara Moritsch is a plant ecologist working for the USDI National Park Service at Point Reyes National Seashore, Marin County, California.

Dana York, formerly a district biologist for the California Department of Transportation in Fresno, has been the botanist for Death Valley National Park since 1999.

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