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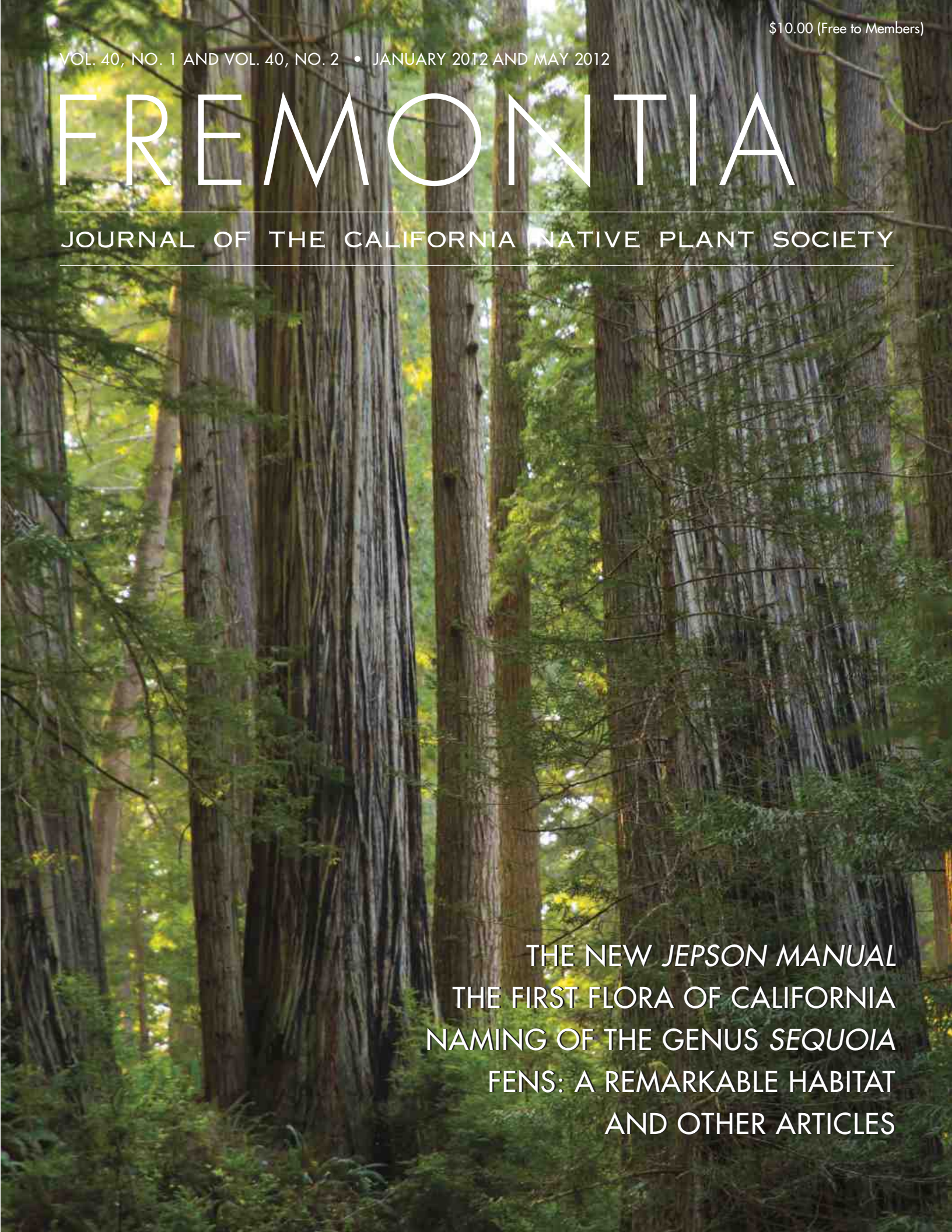

THE NEW *JEPSON MANUAL*
THE FIRST FLORA OF CALIFORNIA
NAMING OF THE GENUS *SEQUOIA*
FENS: A REMARKABLE HABITAT
AND OTHER ARTICLES

FREMONTIA

VOL. 40, NO. 1, JANUARY 2012 AND
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CALIFORNIA NATIVE PLANT SOCIETY

Dedicated to the Preservation of the California Native Flora

The California Native Plant Society (CNPS) is a statewide nonprofit organization dedicated to increasing the understanding and appreciation of California's native plants, and to preserving them and their natural habitats for future generations.

CNPS carries out its mission through science, conservation advocacy, education, and horticulture at the local, state, and federal levels. It monitors rare and endangered plants and habitats; acts to save endangered areas through publicity, persuasion, and on occasion, legal action; provides expert testimony to government bodies; supports the establishment of native plant preserves; sponsors workdays to remove invasive plants; and offers a range of educational activities including speaker programs, field trips, native plant sales, horticultural workshops, and demonstration gardens.

Since its founding in 1965, the traditional strength of CNPS has been its dedicated volunteers. CNPS activities are organized at the local chapter level where members' varied interests influence what is done. Volunteers from the 33 CNPS chapters annually contribute in excess of 97,000 hours (equivalent to 46.5 full-time employees).

CNPS membership is open to all. Members receive the journal *Fremontia* three times a year, the quarterly statewide *CNPS Bulletin,* and newsletters from their local CNPS chapter.

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CNPS members and others are welcome to contribute materials for publication in *Fremontia*. See the inside back cover for submission instructions.

Staff and board listings are as of February 2013.
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THE COVER: Towering coast redwoods *(Sequoia sempervirens)* along the James Irvine Trail in Prairie Creek Redwoods State Park, Humboldt County, CA. Photograph by Spencer Dykstra, www.spencerdykstraphotography.zenfolio.com.

THE NEW *JEPSON MANUAL* AND ACCOMPANYING RESOURCES OF THE JEPSON FLORA PROJECT

by Bruce G. Baldwin and Staci Markos

In early January 2012, the Jepson Herbarium was pleased to announce the publication of *The Jepson Manual: Vascular Plants of California, Second Edition* (Baldwin et al. 2012). This thorough revision of the 1993 *Manual* (Hickman 1993) was a product of years of effort by an international team of more than 300 authors and a dedicated group of editors, staff, and illustrators, together with the contributions of many generous donors, including numerous Friends of the Jepson Herbarium and members of CNPS.

California species of death camas, such as *Toxicoscordion exaltatum*, are now classified in a different genus and a different family (Melanthiaceae) than in the 1993 *Jepson Manual* (previously in *Zigadenus*, in family Liliaceae) based on a revised understanding of their relationships. Photograph by Barry Breckling.

The project was initiated shortly after publication of *The Jepson Desert Manual: Vascular Plants of Southeastern California* (Baldwin et al. 2002), when it became clear that the extraordinarily rapid pace of change in our understanding of the California flora had rendered much of the 1993 *Manual* obsolete only a decade after its publication. That situation demanded action because *The Jepson Manual* had become the primary reference on California's native and naturalized vascular plant diversity for science and society.

HISTORICAL BACKGROUND

The Jepson Herbarium's lead role in producing the 1993 and 2012 manuals reflects our museum's mission, as laid out by Willis Linn Jepson, who endowed the herbarium to carry on his life's work in California floristics. Jepson (1925) authored the first comprehensive statewide manual on California vascular plant diversity (*A Manual of the Flowering Plants of California*), among his many books and other publications. He also wrote several volumes of his more detailed *A Flora of California* (Jepson 1909–1943), which remained unfinished at the time of his death in 1946. The treatment of Rubiaceae, by Lauramay Dempster, became the last printed installment of Jepson's *Flora*, in 1979.

Shortly after establishment of the Jepson Herbarium at UC Berkeley in 1950, Philip Munz, at Rancho Santa Ana Botanic Garden, published *A California Flora* (Munz 1959) in collaboration with David Keck, and thereby preempted the need for the Jepson Herbarium to go forward with a revision of Jepson's (1925) manual. Instead, the first Jepson curator, Rimo Bacigalupi, concentrated his efforts on baseline documentation of California plants through extensive collecting and description of previously undescribed diversity, with a special focus on plant groups not included in Jepson's unfinished *Flora*.

Rimo's successor, Larry Heckard, carried on and expanded that role, and hatched the plan with Jim Hickman to produce a new statewide manual of Californian vascular plants, while the two were conducting floristic work in the early 1980s in the Snow Mountain region of the High Inner North Coast Ranges (Heckard and Hickman 1985). That effort became the Jepson Manual Project, which culminated in the 1993 work. Sadly, Larry did not live to see *The Jepson Manual* published and Jim died shortly after its release. One wonders if they could have predicted just how successful and influential the 1993 *Manual* would become.

THE JEPSON FLORA PROJECT

In 1994 the Director of the University and Jepson Herbaria, Brent Mishler, and the Trustees of the Jepson Herbarium launched the Jepson Flora Project. Its mission was to pursue a broad array of floristic initiatives for California, including an eventual revision of *The Jepson Manual* and the development of a number of online resources. The Flora Project (see http://ucjeps.berkeley.edu/jepsonflora) embodies Jepson's floristic mission for the herbarium and has remained the overarching framework for our efforts. In addition to print resources (*The Jepson Manual* and *The Jepson Desert Manual*), the Flora Project includes a diversity of complementary electronic resources that are readily accessible through the Jepson

Online Interchange for California Floristics (more below).

THE SECOND EDITION OF *THE JEPSON MANUAL*

Summarizing how the second edition of *The Jepson Manual* differs from the 1993 *Manual* is difficult. In addition to extensive taxonomic and nomenclatural changes (described in part below), there are important changes to geographic distributions, elevational ranges, and the status of non-natives and native taxa of special concern. The glossary is expanded, flowering times are given, and over two-thirds of the taxa are now illustrated. Waifs (239 taxa)—aliens that are not reproducing sufficiently to become established parts of the local flora—are included in the keys to identification. All of the introductory sections have been revised, and there is a new chapter that discusses the geologic, climatic, and vegetation history of California.

TOP: **Pilot Ridge fawn lily (*Erythronium taylori*) is an example of a California species that was first collected by botanists *after* publication of the 1993 *Jepson Manual*. Photograph by Jennie Haas. • BOTTOM: Stinkwort (*Dittrichia graveolens*) is an invasive composite that has become widely naturalized in California since publication of the 1993 *Jepson Manual*. Photograph by Robert E. Preston.**

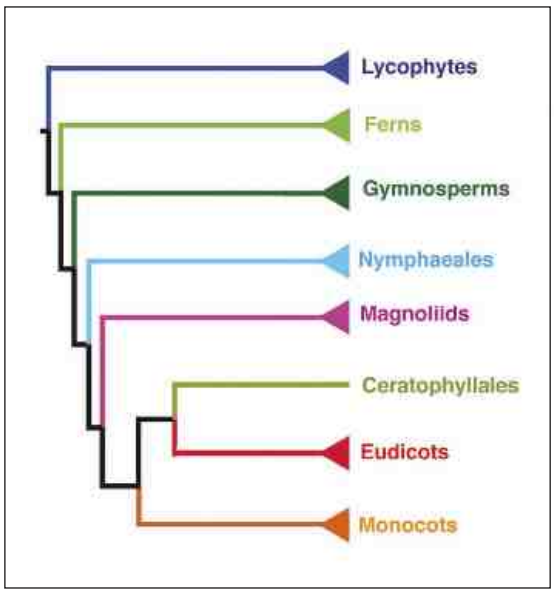
PHILOSOPHICAL CHANGES

Important philosophical considerations guided revision of *The Jepson Manual* (discussed at more length in the introductory philosophy section of the book) and resulted in the following outcomes:

- The *Manual* now includes treatments of all native and naturalized vascular plant taxa judged to be scientifically defensible, even if those taxa are difficult or impossible to identify with 10x magnification.
- Keys to identification are improved and more consistent with descriptions of taxa, making the *Manual* easier to use.
- The new *Manual* has been kept to one volume of similar size to the 1993 *Manual,* while the number of taxa that are described and illustrated has been increased.

Another change in philosophy adopted in the new *Manual* was a stricter adherence to the criterion of *monophyly* (a monophyletic group includes all descendants of a common ancestor). That change required a major reclassification of families, genera, and sometimes species, subspecies, and varieties. In addition, the overall organization of families in the 1993 *Manual* into larger plant groups (ferns, gymnosperms, dicots, and monocots) required revision. This change was due, in part, to recent evidence showing that ferns,

FIGURE 1. THE EIGHT MAJOR GROUPS OF VASCULAR PLANTS IN THE NEW *JEPSON MANUAL*.



***The Jepson Manual, Second Edition*, is organized to follow current understanding of vascular plant phylogeny. Families are grouped into eight major clades of vascular plants (represented by different colors here), but in the text are arranged alphabetically within each major group.**

as treated previously, are not a natural group if delimited to include lycophytes—club-mosses (Lycopodiaceae), spike-mosses (Selaginellaceae), and quillworts (Isoetaceae)—which are no more closely related to ferns than to seed plants (Raubeson and Jansen 1992).

Other studies have shown that Californian dicots include four monophyletic groups, two of which (Ceratophyllales and eudicots) may be more closely related to monocots than to the other two dicot groups (Nymphaeales and magnoliids) (see Soltis et al. 2010). Accordingly, plant families in the new *Manual* are organized (alphabetically by family) within each of eight major groups: lycophytes, ferns, gymnosperms, Nymphaeales, magnoliids, Ceratophyllales, eudicots, and monocots.

The endpapers just inside the back cover are helpful because they display a phylogenetic tree of Californian plant families, with the eight major groups (Figure 1) highlighted and page numbers indicated for each of those groups and for each family. That tree serves as a phylogenetic index and an aid in identifying plants to family. The tree also shows graphically that the new *Manual* classifies taxa based on phylogeny—their inferred evolutionary relationships based on analyses of DNA, morphology, and other lines of evidence.

TAXONOMIC CHANGES

Perhaps the most challenging attributes of the second edition are the taxonomic changes, which are in part the result of a major revision of family and generic classifications that followed from studies of phylogeny by scientists worldwide over the last 20 years. Major changes in classification have also been necessary for species, with improved understanding of relationships at finer scales. In the new *Manual*, 6,502 native and 1,099 non-native species, subspecies, and varieties are recognized for California.

TAXA NEW TO SCIENCE

Arguably the most exciting changes in the new *Manual* are the more than 130 species, subspecies, and varieties that were described as new to science after treatments in the 1993 *Manual* were completed. Many of these new taxa are rare or narrowly distributed California endemics, including striking, obviously novel finds that had not been collected prior to 1993, such as the Pilot Ridge fawn lily (*Erythronium taylori*; Liliaceae) and Guggolz's harmonia (*Harmonia guggolziorum*; Asteraceae). Most were described on the basis of new studies that led to taxonomic reassessment of previously collected plants. That is, most newly described taxa already resided in herbarium collections, where they had been overlooked, misunderstood, or unresolved as to taxonomic status. ("Hidden," undescribed plant diversity residing inside herbaria has increasingly become appreciated as a major value of such collections; see Bebber et al. 2010).

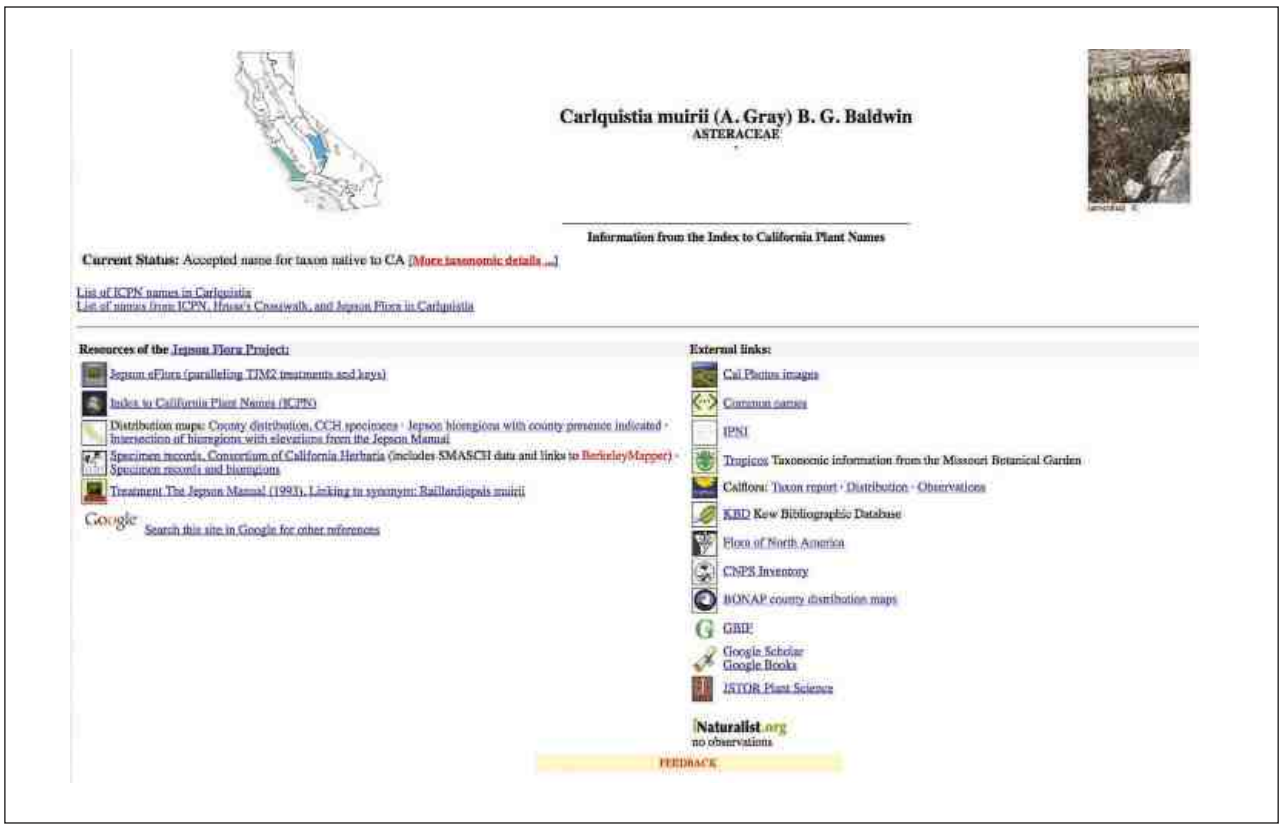
CRYPTIC DIVERSITY

Other examples of "hidden" diversity that are recognized in the new *Manual* include taxa that are so difficult to distinguish from closely related taxa that they were either undetected or, at most, equivocal prior to molecular (DNA) work. A good example of such cryptic diversity is *Lasthenia gracilis* (Asteraceae), which had been treated as part of *L. californica* (California goldfields) until molecular studies showed that it was not even the closest relative of typical *L. californica* (Chan et al. 2000). The two species can be distinguished by their pappus characteristics but only if pappus is present, and it is often absent in both. They have widely overlapping geographic distributions but are generally found in different soils where they co-occur (Rajakaruna et al. 2001). Such evolutionarily distinctive but morphologically indistinct species are important to recognize taxonomically so that our classification of California plants captures irreplaceable, natural groups that warrant scientific attention and conservation (Baldwin 2000).

ALIENS

Another challenging type of diversity to document in California is the rapidly growing alien component, including naturalized and waif taxa. Since the 1993 *Manual* was published, some non-native plants not recognized then as part of the

FIGURE 2. JEPSON ONLINE INTERCHANGE FOR CALIFORNIA FLORISTICS.



A sample page from this online resource, which contains floristic, taxonomic, nomenclatural, and conservation information for Californian plant taxa from the Jepson Flora Project and external resources, including the *CNPS Inventory of Rare and Endangered Plants*.

flora have become dangerous and widespread invasives (e.g., stinkwort, *Dittrichia graveolens*; Asteraceae) or have become worrisome incipient invaders (e.g., giant salvinia, *Salvinia molesta*; Salviniaceae). In consultation with California weed experts, much effort was invested during preparation of the new *Manual* to distinguish between alien taxa that are truly naturalized, and those that are sporadically occurring but not yet persistent by natural reproduction (i.e., waifs).

Such decisions are complicated by the rapidly changing status of non-native plants, and often by insufficient documentation as to whether such plants have become established in natural areas. Further complicating things are the sometimes difficult decisions about habitats that qualify as sufficiently natural to be included in the flora.

Active efforts by others to document the weed flora of agricultural and other human-tended areas in California—which include many weeds not found in wildlands and wildland interfaces—ensure that those plants will be possible to identify using other resources (e.g., DiTomaso and Healy 2007). Misrepresenting such plants as part of the California flora would have ballooned the size and complexity of *The Jepson Manual* unnecessarily.

MAKING SENSE OF IT ALL

As part of the The Jepson Online Interchange for California Floristics (http://ucjeps.berkeley.edu/interchange, Figure 2), resources are available to help users adapt to the new classifications in the second edition. One of those resources, the Index to California Plant Names (ICPN), includes information on the status of formal scientific names that have been used for native and naturalized plants, often with citations of literature where recent nomenclatural and/or taxonomic changes were published or discussed. A simple search on a species, subspecies, or varietal name through the Jepson Interchange yields direct links to a wide diversity of information on that taxon from the Jepson Flora Project and from external resources.

Linked from those pages (and elsewhere) are Jepson eFlora treatments, which closely parallel the revised *Jepson Manual* treatments and include additional unabridged information (in blue text) that could not be included within the page constraints of the new printed *Manual*. The most significant unabridged content in the Jepson eFlora is full treatment of nearly 240 species, subspecies, and varieties of waifs. The eFlora treatments also provide detailed maps for each of the 7,601

Sierra foothills brodiaea *(Brodiaea sierrae)* is a Californian species that was described as new to science in 2006 based on recent taxonomic studies, more than 100 years after it was first collected by botanists. Photograph by George Hartwell.

native and naturalized taxa included.

Other helpful tools available through the Jepson eFlora include: 1) Dynamic Concordance, which allows input of plant names from the 1993 *Manual* to search for changes in the second edition; 2) a searchable list of names that were included in the 1993 *Manual* but are not included in the second edition (i.e., superseded names); and 3) a mechanism to generate lists of names used in the eFlora in a spreadsheet-compatible format. Corrections to the second edition of *The Jepson Manual* also are posted in the Jepson Interchange as errata (http://ucjeps.berkeley.edu/JM12_errata.html).

WHAT'S NEXT?

The experience of producing the new *Manual* taught us a great deal about the challenges of pursuing floristics in a state the size of California, in an age of rapid change in scientific understanding, environmental conditions, and digital resources. Tackling a revision of the *Manual* every decade or so is an immense task that moves too slowly for today's world. Conservation of the California flora would benefit significantly from having online floristic resources that are updated as needed. That approach would make it possible to have at one's fingertips the most up-to-date information on California's native plants and habitats.

To meet that need, the Jepson Flora Project will seek to update the Jepson eFlora and the associated Index of California Plant Names on a regular basis. That task will require continuing cooperation across the botanical community and close monitoring of floristic discoveries. At the same time, we will continue to develop other online resources of the Jepson Flora Project, and to cooperate with the Consortium of California Herbaria, which is the foundation of vouchered floristic data on which we all depend. We also are seeking to facilitate development of new applications that make plant identification easier, such as key parsing that takes advantage of plant distributional data on regional and local scales.

We are grateful for the wide collaboration that made it possible to produce the new *Jepson Manual,* and look forward to continuing this partnership across the California botanical community to meet the floristic challenges ahead.

REFERENCES

Baldwin, B.G. 2000. Roles for modern plant systematics in discovery and conservation of fine-scale biodiversity. Madroño 47: 219–229.

Baldwin, B.G., et al., eds. 2002. The Jepson Desert Manual: Vascular Plants of Southeastern California. University of California Press, Berkeley, CA.

Baldwin, B.G., et al., eds. 2012. The Jepson Manual: Vascular Plants of California. 2d ed. University of California Press, Berkeley, CA.

Bebber, D.P., et al. 2010. Herbaria are a major frontier for species discovery. Proceedings of the National Academy of Sciences, US. 107: 22169–22171.

Chan, R., B.G. Baldwin, and R. Ornduff. 2002. Cryptic goldfields: A molecular phylogenetic reinvestigation of *Lasthenia californica* sensu lato and close relatives (Compositae: Heliantheae sensu lato). *American Journal of Botany* 89: 1103–1112.

Dempster, L.T. 1979. Rubiaceae. Vol. 4, Part 2 of *A Flora of California.* Jepson Herbarium and Library, Berkeley, CA.

DiTomaso, J.M., and E.A. Healy. 2007. Weeds of California and Other Western States. University of California Division of Agriculture and Natural Resources, Oakland, CA.

Heckard, L.R., and J.C. Hickman. 1985. The vascular plants of Snow Mountain, North Coast Ranges, California. *Wasmann Journal of Biology* 43 (1&2): 1–42.

Hickman, J.C. 1993. The Jepson Manual: Higher Plants of California. University of California Press, Berkeley, CA.

Jepson, W.L. 1909–1943. A Flora of California. Vols. 1–3. Associated Students Store, Berkeley, CA.

Jepson, W.L. 1925. A Manual of the Flowering Plants of California. Associated Students Store, Berkeley, CA.

Munz, P.A. 1959. A California Flora. University of California Press, Berkeley, CA.

Rajakaruna, N., et al. 2003. Edaphic races and phylogenetic taxa in the *Lasthenia californica* complex (Asteraceae: Heliantheae): An hypothesis of parallel evolution. *Molecular Ecology* 12: 1675–1679.

Raubeson, L.A. and R.K. Jansen. 1992. Chloroplast DNA evidence on the ancient evolutionary split in vascular land plants. *Science* 255: 1697–1699.

Soltis, D.E., et al. 2010. Assembling the angiosperm tree of life: Progress and future prospects. *Annals of the Missouri Botanical Garden* 97: 514–526.

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TWO CHAMPIONS OF CALIFORNIA BOTANY: THE CALIFORNIA BOTANICAL SOCIETY AND THE CALIFORNIA NATIVE PLANT SOCIETY

by Michael C. Vasey, V. Thomas Parker, and Staci Markos

What was botany like in California one hundred years ago? Surely native plants were much more abundant, the full magic of California's flora was still relatively unknown, and the botanical community was limited.

By the mid- to late 1800s, rather than sending plant collections to Europe or the eastern United States, a core group of California botanists began creating institutions to develop a California botany profession. Albert Kellogg, Katherine Brandegee, Carl Purdy, E.L. Greene, Willis Linn Jepson, Alice Eastwood, William Dudley, Marcus Jones, and a handful of other botanists focused on plant collecting and publishing new plant species for California.

They were mainly based in two institutions with well-established herbaria: the California Academy of Sciences in San Francisco and the University Herbarium on the UC Berkeley campus. While the task of identifying California's diverse flora ruled the day, experimental botany in Europe had begun to emerge in the late 19th century and academic institutions in California began to focus as well on this new science of plant physiology and plant ecology.

In addition to documenting the flora, these early botanists developed organizations to gather together and share their points of view. One example was the California Botanical Society, founded in 1913. Willis Linn Jepson initiated the effort to form the Society and envisioned a broad organization that would promote botanical research and diffuse "accurate botanical knowledge, in an accessible form, amongst the people" (Anon. 1916). The journal *Madroño* was (and continues to be) a key element of the Society's mission to engage Californians (professionals, amateurs, and the public) in learning about California's remarkable flora and taking measures to conserve native plants.

That same year, the Second International Phytogeographical Excursion came to California in early September, 1913 (Beidleman 2009; see sidebar on page 8). Working with Henry Cowles, a pioneering plant ecologist from Chicago, as well as other local botanists, Jepson laid the groundwork for this gathering of botanical luminaries from around the world and, by all accounts, it was a smashing success and drew international attention to California's unique flora.

Reflecting on the beginning years of the California Botanical Society, Jepson commented (Jepson 1938):

> The backbone of the Society, the most eligible and vital part of the membership, in the earliest years, consisted in the main of those who were not professional botanists in the strictest sense, but men in other fields, most often in field of applied botany such as agriculture, horticulture, agronomy, silviculture, or forestry; but also including men in medicine, dentistry, and pharmacy, and various business occupations.

To summarize, the original impetus for the California Botanical Society was both to further the science of botany in California by, in part, providing a professional journal (*Madroño*) to accomplish that end, and also to engage a much broader community of Californians (professionals, amateurs, and the public) in learning about California's remarkable flora and taking measures to conserve California native plants. Citizen science, then as now, played a major role in clarifying and conserving the complex and fascinating plant diversity that is our treasured botanical legacy.

Willis Linn Jepson in 1897 at the age of 30 while collecting in Ukiah. Jepson published *A Flora of California* in 1899. He later coordinated the founding of the California Botanical Society in April 1913, and served as its first president from 1913–1915. He was a native Californian and one of California's most distinguished early botanists. Image courtesy of the University and Jepson Herbaria Archives, University of California, Berkeley.

By the early 1960s, a booming

THE SECOND INTERNATIONAL PHYTOGEOGRAPHIC EXCURSION
September 1913

After visiting the East, Midwest, Colorado, and then the Pacific Northwest, a party of internationally renowned botanists arrived in the San Francisco Bay Area on September 6, 1913. Among them were some of the founders of plant sociology, geobotany, community ecology, and ecosystem ecology. They came from Switzerland, Germany, England, the Netherlands, the eastern United States, and elsewhere. This was the first visit of botanists of such great stature since Sir Joseph Hooker and Asa Gray visited the California Academy of Sciences in 1880.

Included were such notables as Carl Schröter (Zurich), Ove Paulsen (Copenhagen), Carl von Tubeuf (Munich), T.J. Stomps (Amsterdam), Arthur Tansley (Cambridge), Adolf Engler (Berlin), Frederich Clements (Minneapolis), Henry Cowles (Chicago), and Alfred Dachnowski (Columbus). The party left the next day for Yosemite and the Mariposa Big Trees, later visiting Mount Tamalpais, salt marshes near Redwood City, and the Monterey Peninsula before heading to Arizona.

In honor of this group, Jepson arranged for the first banquet celebration of the California Botanical Society. Most of these visitors spoke briefly to give their impressions of the California flora. Typical of these comments was one by Carl von Tubeuf, a pioneer in biological control of plant pathogens:

> When a lad, I read in the geographies of your high mountains, wonderful trees, and fields of glorious bloom. It was the dream of my youth to see this paradise. Now, in this evening of my life, I come with my colleagues. We are not disappointed, we are astonished; what we find is finer than any dream.

Many visitors commented on the energy Americans displayed in their activities to develop our country. At the same time, they were perplexed at what they saw as rampant destruction without consideration of the future. They encouraged Americans to work toward conserving their landscapes and building botanic gardens.

post-war recovery distracted the public from a looming ecological crisis. By the time it became clear that California's habitats were disappearing under these growth pressures, some California plant species were already extinct and many others were in danger of going extinct. Biological science had become more professionalized, experimental, and centered in academia. There was a desperate need for an organization focused on native plant conservation.

As one destructive project after another became apparent, the California Native Plant Society (CNPS) was founded in 1965 as the organization dedicated to communicating California's native plant diversity to the public, developing various conservation tools for protecting that diversity, and mobilizing the public in the effort to appreciate and protect the California flora from heedless development.

At the time, G. Ledyard Stebbins recalled that no other organization, such as the Sierra Club or The Nature Conservancy, had the specific mandate to protect California's rare plants, and "The professional botanical societies were making gestures, but not undertaking vigorous, concerted action" (Stebbins 1990).

The rest, of course, is history. CNPS now hosts approximately 9,000 members in 33 chapters scattered in every corner of California. A statewide staff and board coordinates and provides support for the activities of these chapters. Native plant sales, plant walks, posters, conferences, *Fremontia*, the *CNPS Bulletin,* monthly programs, and stewardship activities keep the public actively informed about the value of and threats to our native plant diversity. CNPS is a leader in vegetation studies and rare plant inventories in conjunction with the California Department of Fish and Wildlife. Most importantly, CNPS is vigilant in making sure that federal and state laws intended to protect California native plants are enforced, and it partners with numerous other nonprofit environmental groups to protect California's native plant legacy.

During the past 30 years there has been an increased convergence between CNPS and the California Botanical Society. Advances in understanding biological diversity, such as insights provided by molecular systematic biology, have brought to light a clearer picture of species that are worthy of being conserved. Advances in community ecology, conservation biology, and restoration ecology are providing a firmer foundation for building conservation strategies. Conservation policies such as the Natural Communities Conservation Planning Act provide a strong conservation policy framework and have generated the need for more botanical consultants and agency biologists.

The need for adaptive management and monitoring has also stimulated new opportunities for networks of citizen scientists to work with professional scientists to ramp up the

scale of conservation activities that will be necessary to achieve our conservation goals. Furthermore, native plant propagation and conservation gardens are emerging as a key to conserving the California flora in the face of major challenges, including habitat loss and climate change.

Today our continued understanding of the flora is due in large part to the collective work of CNPS members working throughout the state who have published scientific research, descriptions of new taxa, and noteworthy collections in *Madroño*. By contributing to *Madroño*, CNPS members have long played an important role in the California Botanical Society, and by providing access to research papers and other important floristic and ecological information, the California Botanical Society has helped inform the science-based conservation strategies adopted by CNPS—a truly synergistic effort!

In April 2013, the California Botanical Society will celebrate its centennial and we are proud to share this achievement with the California Native Plant Society, our partner in protecting and understanding the native plants and habitats of California. To all CNPS members, we extend a warm invitation to attend the centennial celebration of the California Botanical Society that will be held in Berkeley, California (April 12–14, 2013). We hope you can join us! Additional details are provided in the sidebar below.

Group photograph of members of the 2nd International Phytogeographical Expedition at the General Sheridan Tree in Mariposa Grove, Yosemite National Park, on September 9, 1913. This party of distinguished plant scientists later attended the first annual banquet of the California Botanical Society in Oakland on September 12, 1913. Image courtesy of the University and Jepson Herbaria Archives, University of California, Berkeley.

Finally, in honor of the centennial for the California Botanical Society and because of the shared history between the two groups, we are offering a 25% discounted membership fee for CNPS members. To take part, please go to www.calbotsoc.org. Click the "membership" button at the top of the home page, and then click on "pay-online." The pull-down menu for "membership type"

THE CENTENNIAL CELEBRATION OF THE CALIFORNIA BOTANICAL SOCIETY
April 12–14, 2013

Reaching one hundred years is a significant accomplishment for any organization. The California Botanical Society is celebrating this achievement with special field trips, a professional symposium, "Botanical Frontiers: Past and Future," and a meeting where current graduate students can present their research.

The symposium will feature eight renowned scientists who work in evolutionary biology, ecology, conservation, and restoration ecology. These include Bruce Baldwin (UC Berkeley and convening editor of the second edition of *The Jepson Manual*) and Aaron Liston (Oregon State University); ecologists Todd Keeler-Wolf (California Department of Fish and Wildlife), Anna Jacobsen (CSU Bakersfield), and David Peterson (University of Washington and the US Forest Service); invasive species experts Carla D'Antonio (UC Santa Barbara) and Ragan Callaway (University of Montana, Missoula); and restoration ecologist Richard Hobbs (University of Western Australia). This stellar group of speakers will reflect on important topics that are likely to dominate the science of California botany well into the future.

Following the symposium there will be a banquet presentation featuring Kent Holsinger (University of Connecticut), a plant evolutionary biologist and a native Californian.

More information on each speaker and the centennial celebration can be found at http://www.calbotsoc.org/centennial.html).

ABOVE: **Brett Hall (left), president, CNPS, and Tom Parker (right), president, California Botanical Society, after an exploratory trip to the "fern cave" (pictured below) at the Sierra Buttes, Sierra County, CA (background) to check on the status of the green spleenwort. This excursion was in advance of a well-attended Centennial botanical field trip to the Lakes Basin region of Sierra County on July 14, 2012.** • RIGHT: **Green spleenwort (*Asplenium viride* Huds.) growing in a limestone seam at the mouth of a cave on north-facing metavolcanic cliffs found on the south butte of the Sierra Buttes, Sierra County, CA. Originally discovered by prominent botanist G. Ledyard Stebbins in July 1953 (UC996165), this is the only known locality for this species in California. Although still present, fern individuals appear to be dying back, and their status should be monitored more frequently given their potential susceptibility to rapidly changing climate. Photograph by Michael Vasey.**

will have a special category for CNPS members. This offer is good for the 2013 centennial year!

REFERENCES

Anon. 1916. *Founding of the Society.* Madroño 1.

Beidleman, R.G. 2009. To California with Jepson's "Phyto-Jogs" in 1913. *Madroño* 56: 49–56.

Jepson, W.L. 1938. Viae felicitatis: The beginning years of the California Botanical Society. *Madroño* 4: 276–286.

Stebbins, G.L. 1990. The California Native Plant Society: Then and now. *Fremontia* 18: 3–8.

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THE FIRST FLORA OF CALIFORNIA AND THE SERENO WATSON, WILLIAM BREWER, AND ASA GRAY COLLABORATION

by Liam H. Davis

In 1864 botanist William Henry Brewer gave his California botanical collection to Asa Gray to house in the Gray Herbarium at Harvard University. The large Brewer plant collection contained numerous specimens from his approximately four years botanizing up and down California between 1860 and 1864. Asa Gray, probably the best known US botanist of the nineteenth century, was mentor to young botanists who were actively cataloging newly described plant species throughout the United States and its adjacent frontiers.

Along with Sereno Watson, who was later employed at the Gray Herbarium, these three botanists collaborated on a taxonomic compilation that became the most comprehensive listing of California plants at that time. Subsequently Brewer, Watson, and Gray published the first Flora of California in two large volumes. Volume I (1876) presents the authors as Brewer, Watson, and Gray while the subsequent Volume II (1880) cites Watson as sole author. The history of this extraordinary collaboration is a story of chance encounters with distinguishing personalities.

BREWER AND THE CALIFORNIA SURVEY (1860–1864)

As a student, Brewer entered Yale University in 1848 to study chemistry and agriculture. Although he took a hiatus from his studies for a short period to teach sciences, he later enrolled again at Yale and in 1852 he graduated. A few years later in 1855 Brewer traveled to the European city of Heidelberg to study chemistry with Robert Bunsen, and to Munich to study agriculture and organic chemistry with Justus von Liebig.

Then in the summer of 1856 we first learn of his botanical field interests. According to a biographical memoir of Brewer, "During vacation periods he would do excursions throughout Germany and Switzerland studying botanical specimens and minerals. . . . He walked six hundred miles through Switzerland, botanizing in many localities and collecting a wealth of botanical material" (Chittenden 1927).

After returning to the United States in 1860, Brewer taught at what is now Washington and Jefferson College in Pennsylvania. Shortly thereafter, his young wife Angelina Jameson died giving birth to a stillborn son. That same year, a classmate and friend, George J. Brush, recommeded Brewer to Josiah Dwight Whitney who was heading up the newly formed Geological Survey of California. Whitney invited Brewer to join the project and he enthusiastically accepted.

Whitney had been appointed in 1860 as the state geologist for California by the California State Legislature and was instructed to undertake a comprehensive geologic survey of the new state of California. Whitney had decided that his California survey would be different from his previous state surveys. This one would not only cover geography and geology, but also botany, zoology, and paleontology. Whitney reasoned that someone like Brewer,

Some members of the 1864 California Geological Survey field party. From left to right: James T. Gardner, Richard D. Cotter, William H. Brewer (seated), and Clarence King. The party surveyed and named Mount Brewer in their exploration of the California High Sierra.

KEY FIGURES IN THE DEVELOPMENT OF THE FIRST FLORA OF CALIFORNIA

Sereno Watson (1826–1892)

Graduated from Yale University in 1847, and after various jobs, traveled to California and joined Clarence King's 40th Parallel Survey in 1866 as a botanical field assistant. In 1870 began working with Asa Gray at the Gray Herbarium of Harvard University. An author of the two volumes of *The California Flora.*

William Henry Brewer (1828–1910)

Worked on the first California Geological Survey during 1860–1864. In 1865 he became the first chair of agriculture at Yale University's Sheffield Scientific School, where he served until his retirement in 1903. Coauthored the first of the two volumes of *The California Flora.*

Asa Gray (1810–1888)

Considered the most important and influential American botanist of the nineteenth century. Gray was instrumental in unifying the taxonomic knowledge of the plants of North America. In 1870 he invited Sereno Watson to assist him at the Gray Herbarium at Harvard University. Coauthored the first of the two volumes of *The California Flora.*

Clarence King (1842–1901)

American geologist, mountaineer, and art critic. Served under William Brewer in the California Geological Survey during 1863–1864. Later in 1866, King hired Sereno Watson as a botanical field assistant on the 40th Parallel Survey across Nevada, Utah, and Wyoming. King was the first director of the newly formed United States Geological Survey from 1879–1881.

with a multidisciplinary background in several sciences, would fit nicely into Whitney's California survey planning scheme.

As the survey got underway, Whitney soon developed a profound regard for Brewer. As a result Brewer was given more responsibility and was asked to supervise several of the other scientists working on the project. At the same time, Brewer pursued his expertise in botany on the Geological Survey of California.

Whitney's California survey expeditions periodically came into conflict with the state legislature, which was primarily interested in obtaining more information about California gold. The California Gold Rush of 1848–1855 began in 1848 when gold was discovered at Sutter's Mill, a sawmill in Coloma, El Dorado County. Estimates were that 300,000 people flocked to California during that period. However, only a handful of people ended up with fortunes from the gold. But this mass insurgence of people propelled California to qualify for statehood in 1850.

Whitney had argued in written communications with the state legislature that the 1860 California state survey was not a prospecting party for gold. The legislature grew weary of his protests and Whitney's budget began to dwindle. Brewer attempted to keep his Geological Survey of California botanical endeavors funded as best he could. While on the survey Brewer would give local talks when invited by audiences interested in his work.

Brewer was the first botanist to visit and collect extensively throughout many of the remarkable and varied California plant habitats during his four years on the Geological Survey of California. For example, Brewer was fascinated when visiting the California High Sierra flora for the first time. As he pressed plants in his collection he posted ambitious letters to Asa Gray over the marvels of seeing giant sequoias for the first time.

In 1863 Brewer by chance met Clarence King, a young Yale graduate who was fascinated by nameless California high mountains he had learned about in college. Both men were on a steamer traveling from Sacramento to San Francisco. It was King who recognized Brewer based on others' recollections at Yale, who had described Brewer's tall, gaunt appearance. The young King was hoping to meet up with Brewer at the Whitney geologic survey headquarters in San Francisco, because King wanted to join the Geological Survey of California and climb those tall California mountains.

Since Brewer was in charge of the California survey work, King approached this stranger and inquired if he was indeed William H. Brewer. King then handed him a letter of recommendation from one of his Yale professors who knew Brewer.

This survey and King's later successful 40th Parallel Survey (1866–1869), together with his regular and widely published *Atlantic Monthly* articles on mountaineering in the Sierra Nevada, established his reputation as a young and extraordinarily successful explorer. King would later become the first director, at age 37, of the United States Geological Survey, serving from 1879 to 1881.

KING AND THE 40TH PARALLEL SURVEY (1866–1869)

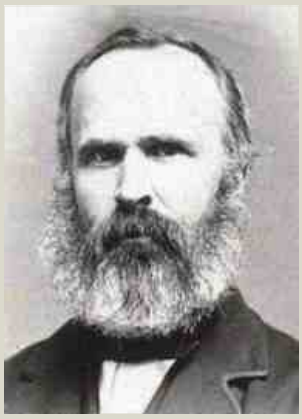
King proved so capable on the California survey that he asked Brewer to support King's idea of a "40th parallel survey." At that time the military was fully involved in any surveys of newly acquired federal (non-state) lands which were being rapidly settled. Brewer then wrote Edwin Stanton, who was the Secretary of War in Washington, D.C., asking him to meet with King, and Stanton agreed.

William Whitman Bailey (1843–1914)

Served as the first botanist on the 40th Parallel Survey. Was assigned a novice field assistant named Sereno Watson, whom he supervised and taught. Bailey became a botany instructor at Brown University in 1877, where he remained until retiring as a professor in 1906.

Daniel Cady Eaton (1834–1895)

After his bachelor's degree at Yale University, studied botany under Asa Gray at Harvard. Eaton returned to Yale and became botany professor and herbarium curator. At Yale in 1869, Eaton urged his friend and colleague, Sereno Watson, to write to Asa Gray and offer to donate his plant specimens of the 40th Parallel Survey to the herbarium.



Josiah Dwight Whitney (1819–1896)

Professor of geology at Harvard University while also chief of the California Geological Survey from 1860–1874. Hired William Henry Brewer to work on the Survey (1860–1864). Then returned to teach at Harvard's Lawrence Scientific School.

At the meeting, King argued that the purpose of his proposed civilian (not military) survey was simply to recommend a proposed best 40th parallel route for the western section of the transcontinental railroad system, Stanton supported the idea, and soon afterward Congress passed a bill authorizing it. King was then appointed as geologist to head up the survey.

In 1864 Brewer's California survey ended. He housed his California plant collection of about 2,000 species with Asa Gray at Harvard. Brewer stayed and worked with Gray on the collection from December 1864 until April 1865. Then he re-

turned to his alma mater, Yale University, to accept the first Chair of Agriculture at Yale's Sheffield Scientific School. Brewer had no idea when he would return to his work on the California flora.

BREWER MEETS SERENO WATSON

After the Civil War ended, Watson traveled to California. Accounts stated that he had no definite idea what he was going to do there, although he was aware that King was undertaking a 40th parallel survey expedition. Brewer writes in his biographical memoir on Watson:

> He spent two or three months in the Sacramento Valley, and when at Woodville he heard that the expedition under Clarence King had started across the mountains. He resolved to join it. From the terminus of the railroad he set out alone on foot, crossed the Sierra Nevada, and found his way to the camp of the party, which was then on the Truckee River.

In 1866 King hired William Whitman Bailey as the 40th parallel survey botanist, and later hired Sereno Watson (who eventually became curator of the Gray Herbarium at Harvard University) as his botanical field assistant. Bailey came with a written recommendation from Asa Gray, his former botany instructor. The 25-year-old Bailey's excitable personality contrasted markedly with that of his new field assistant, Sereno Watson, who was a quiet, middle-aged, resolute man (later to became the principal botanist of the first flora of California).

In 1866 Sereno Watson had shown up at the King survey field encampment along the Truckee River in Nevada seeking work. At the time King, Bailey, and other team members were organizing the beginnings of their survey. Given his past history, Watson seemed an unlikely candidate for a field assistant on a geological survey. He had involved himself in a variety of business investments, none of which had worked out. He had also tried a number of sporadic, unrelated academic endeavors, and later devoted five years to his brother's insurance business, but still had not found his "niche."

Sereno Watson, prominent nineteenth century US botanist, in the Gray Herbarium at Harvard University. Watson played a leading role in developing the first flora of California.

In 1866 Watson stood before Clarence King unemployed, again with no career and no future. Accounts state Watson was barefoot when he walked into the King encampment. Watson provided King with a letter of introduction, signed by a friend of King's from Hartford, Connecticut. As Watson and King conversed, King became aware that both he and Watson had taken the same chemistry course at Yale. King found some commonality with this unusual man.

Watson offered King his services for free. After considering the status of Bailey, who was sick with fever at the time, King directed Watson to assist Bailey without salary. The 42-year-old Watson was perhaps the oldest person in the survey party. Most were in their twenties, including King and Bailey. From this remarkable beginning, the field assistant Sereno Watson would go on to be recognized as one of the great American botanists of the nineteenth century.

Despite contrasting personalities, Bailey's supervision of Watson melded into a professional relationship built primarily on newfound mutual respect. Bailey enjoyed training Watson, and working under Bailey's instruction, Watson's field work developed into a passionate love for botany. As for Bailey, he found in Watson a combination of an eager field assistant and personal medical physician. During the first year of the survey, an ailing Bailey posted a letter to Asa Gray describing Watson thus:

> I will give you an account of my summer's work. It was much interrupted by sickness, chiefly fever and ague. . . . My associate in this department, Mr. Watson, was well all the time—very energetic and industrious—his herbarium probably contains twice the number which I have collected. I cannot speak in terms of too high praise of this gentleman. . . . [He] works early and late and seems never tired or ruffled.

Bailey's sickness persisted. After four more months of illness, Bailey tendered his resignation. King wrote in his letters, as quoted by Brewer:

> I then installed Watson in charge of botany. He was then as nearly perfectly happy as I have ever seen a human being . . . he wore a free, careless air . . . till his connection

> with the Fortieth Parallel Survey ceased. . . . This was technically the beginning of his professional career as a botanist.

Later in 1869, Watson concluded his participation in the 40th parallel survey and found space at the Yale herbarium to begin work on his 40th parallel plant collection, under its curator Daniel Cady Eaton. Eaton warmly welcomed Watson. Eaton and Watson had each separately botanized on different occasions in Utah.

With Brewer and Watson at Yale at the same time, it is reasonable that at the Yale herbarium, both Brewer and Watson began face-to-face discussions concerning each other's botanical interests and particularly each other's significant plant collection.

Eaton had done his graduate work under Asa Gray at Harvard. He urged Watson to share his 40th parallel plant specimens with Gray for study. On December 9, 1869, Watson wrote to Asa Gray introducing himself and joked, "[You have heard] that I have been gathering weeds" and offered Gray use of any of his 40th parallel plant material. One can only imagine how eager Gray was to examine the entire collection.

Watson was likewise determined to visit and examine the large and prestigious Gray Herbarium collection and inquired whether this might be possible. Asa Gray extended an invitation, and Watson soon journeyed to Harvard. As it happened, Watson then remained working at the Gray Herbarium for the rest of his life. The "Botany of the 40th Parallel" by Sereno Watson was published in 1871 under the guidance of Asa Gray.

THE CALIFORNIA FLORA VOL. I (1876) AND VOL. II (1880)

Beginning in 1875, Brewer and Watson began corresponding about a collaboration strategy to publish the California flora. Brewer confessed that his solo attempt to do so had been unfruitful: "[My] Botany of California . . . work went on intermittently and was not completed." An extraordinarily large collection of letters between Brewer and Watson from 1875 to 1879 details their work together on the California flora, as well as their close friendship. They are housed at the New York Botanical Garden.

Brewer stated that his California "work and that of Dr. Watson had much in common. Geographically they covered adjoining regions having many physiographic and climatic features in common. Many of the species were the same." In direct reference to California itself, Brewer adds,

> More than sixty government expeditions of our own country had been into this region. . . . To collect the American portions into one reference list would be an immense work . . . tedious, time-consuming, uninteresting clerical drudgery. Dr. Watson did not shrink from this.

At the end of *The California Flora*, Vol. II (pages 553–9) Brewer contributes a fascinating seven-page account of the men and women who botanized chronologically in California and its adjacent boundaries (up to 1880). This unique report is not readily available and many people are not even aware of it. This comprehensive report can be found on the Internet at: http://www.archive.org/details/botany__02geol.

REFERENCES

Bailey (William Whitney) Papers. Brown University Library, Providence, RI. Henry E. Huntington Library, San Marino, CA. New York Botanical Garden Library, The Bronx, New York, NY.

Bailey, W.W. 1899. *Botanizing: A Guide To Field Collecting And Herbarium Work*. Kessinger Publishing Company, Whitefish, MT.

Brewer (William Henry) Papers. Archives, The LuEsther T. Mertz Library. The New York Botanical Garden Library, The Bronx, New York, NY.

Brewer, W.H. 1966. *Up and Down California in 1860–1864,* ed. Francis P. Farquhar. University of California Press, Berkeley, CA.

Brewer, W.H., S. Watson, and A. Gray. 1876. *Botany of California, Vol. I.* John Wilson and Son, University Press, Cambridge, MA.

Brewer, W.H. 1903. Biographical Memoir of Sereno Watson: 1820–1892. National Academy of the Sciences. Washington, D.C.

Chittenden, R.H. 1927. Biographical Memoir of William Henry Brewer: 1828–1910. National Academy of Sciences, Washington, D.C.

Dupree, A. H. 1968. *Asa Gray: 1810–1888.* Belknap Press of Harvard University Press, Cambridge, MA.

Gray, A. Letters Archives. Gray Herbarium Library. Harvard University, Cambridge, MA.

Hague, J.D., ed. 1904. *Clarence King Memoirs. The Helmet of Mambrino.* Century Association. G.P. Putnam's Sons, New York, NY.

King, C. 1997. *Mountaineering in the Sierra Nevada,* ed. Francis P. Farquhar. University of Nebraska Press, Lincoln, NE.

Moore, J.G. 2006. King of the 40th Parallel. Stanford University Press, Stanford, CA.

Watson, S. 1880. *Botany of California, Vol. II.* John Wilson and Son, University Press, Cambridge, MA.

Wilson, R. 2006. *The Explorer King.* Simon & Schuster Press, New York, NY.

Wilkens, T. 1988. *Clarence King, a Biography.* University of New Mexico Press, Albuquerque, NM.

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HOW THE BRODIAEAS GOT THEIR NAME

by Robert E. Preston

In the summer of 1792, Captain George Vancouver, in command of H.M.S. Discovery, led an expedition to chart the coast of the Pacific Northwest, exploring and mapping the San Juan Islands, Puget Sound, and other islands and waterways between there and what was later named Vancouver Island. Aboard was Archibald Menzies (1754-1842), the ship's naturalist, a naval surgeon by training but who also came from a family of botanists. Menzies was sponsored by Sir Joseph Banks (1743-1820), the great sponsor of British science and himself a ship's naturalist with Captain James Cook.

Archibald Menzies (1754–1842), naturalist aboard HMS Discovery during the Vancouver Expedition, collected the first brodiaea specimens. Courtesy of the Linnean Society of London.

THE DISCOVERY OF BRODIAEAS

Menzies made good use of the time allotted him for natural history observations, collecting specimens of plants, animals, and invertebrates, and taking copious notes on their use by the native peoples. Menzies reported in his journal on May 28, 1792, that he had observed native women gathering ". . . a little bulbous root of a liliaceous plant which on searching about for the flower of it I discovered to be a new Genus . . . " Although Menzies recognized that his collections included new genera and many new species, he deferred the naming of his discoveries to others.

Menzies' little lily-like plants are now what we call brodiaeas. Brodiaeas include the genus *Brodiaea*, in the strict sense, but also the closely related *Dichelostemma*, and the name is also sometimes applied to the more distantly related *Triteleia*. This is the story of how the brodiaeas got their name. It is a story that has many classic elements: intrepid explorers, rival botanists, a comedy of errors—and even pirates. It is also a story that reminds us that botany is a human endeavor, and despite the alleged objectivity of the measurements, molecules, statistics, and cladograms that we now employ, it is a process subject to all of the whims, foibles, and prejudices that plague our species.

Upon returning to England, Menzies made his specimens, field notes, and drawings available to his colleagues. James Smith (1759–1828) was the first to mention the new liliaceous species in his textbook, *An Introduction to Physiological and Systematical Botany*. In his discussion of the flowers of lilies and lily-like plants, Smith cited "two species of a new genus, found by Mr. Menzies on the west coast of North America." However, before Smith could describe the new species, he was beaten to it by his botanical rival Richard Salisbury (1761-1829), which started a nomenclatural dispute that took nearly a century to resolve.

Formerly friends and even roommates, Smith and Salisbury had a falling out over various personal and professional differences, with Salisbury going so far as to accuse Smith of plagiarizing Linnaeus' generic treatments. In 1808, their enmity came to a head. In the February 1, 1808 edition of *The Monthly Magazine,* Samuel Frederick Gray (1766–1828), reporting on new species that had recently been described in the English botanical literature, noted in an aside that former friends Salisbury and Smith had become "inveterate enemies." Salisbury and Smith had argued over Salisbury's claim to have suggested the name *Smithia sensitiva* (a member of the Fabaceae with leaves that fold up when touched) in honor of Smith, and Salisbury's account of the naming included an insinuation that the name also befitted Smith's personal character. Gray suggested that Salisbury's version of the story was believable, although he tactfully neglected to mention Salisbury's dig at Smith. However, he did observe that Salisbury seemed to go out of his way to "wound his former friend."

Salisbury's barbs must have stung, as Smith felt that his namesake had been earned by careful work. Smith promptly responded in a letter to the editor of *The Monthly Magazine,* scolding Gray for seeming to take Salisbury's side, calling Salisbury a "traitor" for twisting his account into a personal attack, and

further accusing him of calumny. Salisbury fired back with his own letter to the editor, who rejected it on the grounds that it contained too many "allegations and insinuations." Not to be deterred, Salisbury self-published and distributed the letter.

On March 1, 1808, at the peak of the feud, Salisbury "scooped" Smith by publishing the description of a new genus, *Hookera,* giving the names *Hookera coronaria* and *Hookera pulchella* to the plants that Menzies had collected and that Smith had mentioned in his textbook. Salisbury named the genus for William Hooker (1779–1836), the publisher and illustrator of *Paradisus Londinensis*, where the description was published. Salisbury disagreed with Smith on many points of floral morphology, and Salisbury used his description to rebut Smith's interpretation of these species' flowers.

On March 4, 1808, just three days after the publication date of *Hookera*, Smith finished a paper describing ten species of a new moss genus, *Hookeria*, named for his friend William Jackson Hooker (1785–1865). The next day, on March 5, 1808, Smith completed his own descriptions of Menzies' new species, which he read before the Linnean Society on April 19, 1808. Smith proposed the genus *Brodiaea*, in honor of his friend and mentor James Brodie (1744–1824), with two species, *B. grandiflora* and *B. congesta*, based on Menzies' collections and field notes.

Gray continued to drop snippets about the bad blood between Salisbury and Smith among his reviews of the latest taxonomic works, but by the September edition of *The Monthly Magazine,* he began to feel that his reporting about the feud was making it of more lasting importance than their respective contributions to botany. In the *Monthly Botanical Report* for December, 1808, Gray laid the Salisbury/Smith rivalry to rest with the following closing remark: "With respect to the name of *Hookera*, or *Brodiea* [sic], we shall not attempt to decide which will be likely to be handed down to posterity . . . " Unfortunately for Salisbury, his unpopularity within the botanical establishment apparently led to Smith's fellow botanists entering a gentleman's agreement to ignore *Hookera.* For the next 75 years, the name *Hookera* was disregarded in favor of the name *Brodiaea.*

THE CONTROVERSY RENEWED

In the late 1860s, Alphonse de Candolle was charged with developing a set of formal rules to govern the formation and application of botanical names. These rules were adopted at the International Botanical Congress held in Paris in August, 1867. Known as the "Lois," these rules of nomenclature included an Article establishing the principle of nomenclatural priority. Article 15 of the Lois stated that each group of plants could have only one name, which was "the most ancient, whether adopted or given by Linnaeus, or since Linnaeus." The rule of priority set off a frenzy of historical research to discover and resurrect the earliest known names published for plant species, which would supplant the later, often more widely known names.

James Edward Smith (1759–1828) named the genus *Brodiaea* for his friend and mentor, the Scottish botanist James Brodie. In the portrait, sensitive smithia *(Smithia sensitiva)* appears on the left-hand page of the open book. Courtesy of the Linnean Society of London.

TABLE 1. NAMES OF *BRODIAEA* SPECIES PUBLISHED IN THE BOTANICAL LITERATURE, 1808–2010.

SPECIES	AUTHOR	DATE OF PUBLICATION
Brodiaea coronaria (published as *Hookera coronaria*)	Richard Salisbury	1808
Brodiaea grandiflora (synonym of *B. coronaria*)	James E. Smith	1810
Brodiaea californica	John Lindley	1849
Brodiaea minor (published as *Brodiaea grandiflora* var. *minor*)	George Bentham	1857
Brodiaea terrestris	Albert Kellogg	1859
Brodiaea stellaris	Sereno Watson	1881
Brodiaea filifolia	Sereno Watson	1881
Brodiaea rosea (published as *Hookera rosea*)	Edward L. Greene	1886
Brodiaea orcuttii (published as *Hookera orcuttii*)	Edward L. Greene	1886
Brodiaea leptandra (published as *Hookera leptandra*)	Edward L. Greene	1887
Brodiaea synandra (synonym of *B. leptandra*)	Amos A. Heller	1903
Brodiaea insignis (published as *Brodiaea synandra* var. *insignis*)	Willis Jepson	1922
Brodiaea nana	Robert F. Hoover	1936
Brodiaea appendiculata	Robert F. Hoover	1937
Brodiaea howellii (an invalid name)	Alice Eastwood	1938
Brodiaea jolonensis	Alice Eastwood	1938
Brodiaea pallida	Robert F. Hoover	1938
Brodiaea elegans	Robert F. Hoover	1939
Brodiaea terrestris subsp. *kernensis* (published as *Brodiaea coronaria* var. *kernensis*)	Robert F. Hoover	1939
Brodiaea elegans var. *australis* (name applied to plants intermediate between *B. elegans* and *B. terrestris* subsp. *kernensis*)	Robert F. Hoover	1957
Brodiaea kinkiensis	Theodore F. Niehaus	1966
Brodiaea elegans subsp. *hooveri*	Theodore F. Niehaus	1970
Brodiaea sierrae	Robert E. Preston	2006
Brodiaea santarosae	Tom Chester, Wayne Armstrong, and Kay Madore	2007
Brodiaea matsonii	Robert E. Preston	2010

Source: Compiled by the author from the original publications.

Richard Anthony Salisbury (1761–1829) beat his rival Smith to print with the name *Hookera*. Salisbury's rush to publish his descriptions resulted in nearly two centuries of confusion over the names of brodiaeas. Courtesy of the Linnean Society of London.

In 1886, James Britten published an account of the *Hookera* vs. *Brodiaea* controversy. Because *Hookera* had been published in 1808 but Smith's *Brodiaea* description was not published until 1811, Britten argued that, under the rule of priority, *Hookera* had priority over *Brodiaea*. Britten criticized Smith's conduct as "unjustifiable" and vigorously defended Salisbury, quoting Salisbury's complaints as evidence of the hurts he had suffered. He also suggested that the unpopular Salisbury had been the victim of a conspiracy to ignore and suppress his botanical work and names. Britten's defense of Salisbury seems a bit overblown, for he had a political ax to grind, being a strong proponent of the rule of priority. Over the subsequent decades all of the brodiaeas were named or renamed as species of *Hookera*.

Both *Hookera* and *Brodiaea* were used in floras and new species descriptions well into the 20th century, resulting in a proliferation of competing names. The rule of nomenclatural priority was not universally accepted, however. One of the main points of disagreement dealt with the practical aspects of replacing well-known names to accept older, little-known names. A compromise was reached in which names could be exempted from the rule of priority if they had been used for so long that reverting to an earlier name would cause considerable confusion. Ultimately, the debate over which genus name to use was settled in Smith's favor. Because the name *Brodiaea* had been in accepted use for so long, it was proposed as a *nomina conservanda* (conserved name) and accepted as such by the International Botanical Congress at Vienna in 1905.

WAS SALISBURY WRONGED?

Britten may have been correct about a conspiracy to suppress *Hookera*, given Salisbury's level of notoriety. Salisbury was outspoken in his criticism of other botanists, and he appeared to take delight in provoking the sensibilities of his more prim and proper colleagues. His social standing may also have played against him. Salisbury, whose given surname was Markham, claimed to have accepted the surname of "a very old maiden lady" in exchange for an annuity, whereas his botanical colleagues were generally members of the moneyed classes. The hostility towards Salisbury was so strong that it sometimes rubbed off on Salisbury's colleagues. However, the circumstantial evidence is fairly convincing that Salisbury, rather than Smith, really was the villain of this story.

Smith's treatments of *Hookeria* and *Brodiaea*, completed on the heels of Salisbury's description of *Hookera*, may at first glance seem to be an attempt to discredit Salisbury's publication. However, it seems highly unlikely that Smith would have rushed to describe a new moss genus, *Hookeria*, with ten species, and the genus *Brodiaea*, with two species, during a single weekend, just to discredit Salisbury. Smith was known to be a slow and careful worker, even being criticized for his long delays in getting publications to press. It is also likely that Smith had not yet seen Salisbury's treatment.

Smith worked on his descriptions from his home in Norwich, which is about 100 miles northeast of London, and it would have taken at least a couple of days for the March 1 issue of *Paradisus Londinensis* to be delivered, even with the best mail service (presuming that Smith was even a subscriber!). Samuel F. Gray reported that he had not received his copy with the treatment of *Hookera* until April. Although Smith had vowed to ignore anything written by Salisbury, and he remained "utterly silent" about Salisbury's treatment of *Hookera* during the presentation to the Linnean Society, he may simply have been unaware of Salisbury's publication.

It seems far more likely that Salisbury knew of Smith's pending descriptions and rushed his own names into print to upstage Smith.

Not only had Smith revealed the existence of Menzies' undescribed species in his *Introduction to Botany*, but he was also working on a new moss genus, which he hinted at in the *Flora Britannica*. If Salisbury's publication of *Hookera* was a potshot at Smith, it accomplished dual goals. By describing Menzies' two species under the name *Hookera*, Salisbury preempted Smith's description of the new species and also usurped the name that Smith was proposing to use for his new moss genus.

This was not the first time that Salisbury had tampered with Smith's taxonomy. Earlier he had renamed two species of the genus *Menziesia*, named by Smith in honor of Menzies, for no apparent reason other than spite, stating that "Nothing can sound more uncouthly than *Menziesia smithii*. . . . " Shortly after this episode, Salisbury faced similar accusations of intellectual theft when he published a monograph on the Proteaceae, after hearing Robert Brown read his own paper on the Proteaceae at a series of Linnean Society meetings. Salisbury seems to have been exceedingly concerned about his botanical legacy and perhaps was willing to compromise ethical boundaries for the sake of posterity.

Salisbury made several errors in his descriptions that also indicate that it was he, not Smith, who rushed to publication. First, Salisbury stated that the species had been collected in California, whereas Menzies' notes clearly state that, although he had wintered in California, his collections had been made in New Georgia, which was the mainland area that is now the northwest coast of Washington and the southwest coast of British Columbia, well north of the Spanish colony. As Smith was in possession of Menzies' field notes and drawings, Salisbury may have simply assumed that Menzies' collections were from California.

TOP: **Garland brodiaea (*Brodiaea coronaria*), collected by Menzies in the Pacific Northwest, was the first Brodiaea species to be named. All photos by the author unless otherwise noted.** • BOTTOM: **Ookow (*Dichelostemma congestum*) was originally named *Hookera pulchella* by Salisbury, whose mistake in the description led to the name *Dichelostemma pulchellum* being erroneously applied to blue dicks (*Dichelostemma capitatum*).**

Although he had seen Menzies' specimens, Salisbury based his description of *Brodiaea coronaria* on fresh material collected from the garden at his home in Mill Hill, Middlesex, England. Salisbury had obtained corms from a Mrs. Haliburton of Nova Scotia, which were originally part of a cargo seized by privateers from a Spanish ship (I told you there were pirates in this story!). If the ship had been bound from California, perhaps Salisbury assumed that Menzies had collected his specimens from there, as well.

In his description of the genus *Hookera*, Salisbury also named *Hookera pulchella*, which is now treated as a synonym of *Dichelostemma congestum*. He provided a diagnosis for the species, but he did not publish a full description until later that year, after he observed plants in bloom. Salisbury committed a fundamental error in his description of *H. pulchella*, which is evident from his illustration of the flower. The figure shows six stamens inserted at two different levels, which is characteristic of some *Triteleia* species, but not *Brodiaea*. In addition, Salisbury noted that the anthers "fall off," which is also characteristic of *Triteleia* but not *Brodiaea* or *Dichelostemma*.

According to Chris Pires, who examined Menzies' specimens during a post-doctoral position in England, the herbarium sheet containing Menzies' collection of *Hookera pulchella*—which is also the type specimen for *Brodiaea congesta*—consists of a mixed collection of *D. congestum* and *T. grandiflora*. Salisbury's confusion over the application of the name *Dichelostemma pulchellum* cascaded down through the years, because many people mistakenly assumed that Salisbury was describing blue dicks (*D. capitatum*), the widespread species later collected by Theodor Hartweg in California.

Sierra foothills brodiaea *(Brodiaea sierrae)*, described in 2006, occurs on basic and ultramafic substrates in Butte, Yuba, and Nevada Counties.

Dichelostemma capitatum does have six stamens, although they are all at the same level on the corolla and the anthers are not deciduous.

A TANGLE OF NAMES

A little more than 200 years have passed since Salisbury and Smith's quarrel was fodder for the *Monthly Botanical Report*, and although the dispute over the priority of *Hookera* vs. *Brodiaea* has been settled, the taxonomy of *Brodiaea* species has still not been fully resolved. Uncertainty about which species belong in the genus *Brodiaea* and confusion over the correct names for several species has led to a tangle of names that is still being unraveled.

Nearly 100 species have been described that at one time or another were placed within the genus *Brodiaea*. Most are plants from California and the western United States, but some South American species were also formerly included within *Brodiaea*. All of these species are small geophytes that share a set of common features: flowers in an umbel, corms rather than bulbs, and the lack of an onion-like smell. As more and more of these species were described, however, the differences between them led to a host of genera being proposed within which to place them, including *Dichelostemma, Triteleia, Suebertia, Calliprora, Hesperoscordum, Brevoortia, Stropholirion*, and others. Most major treatments of the lily family during the 1800s recognized the genus *Brodiaea*, but they differed widely with regards to which species should be included in the various genera. This wide diversity of opinion left many people wondering, "What is a 'brodiaea'?"

One of the main difficulties of working with brodiaeas (as with other liliaceous species) is that a careful examination of the floral morphology, including the shape and relative size of the stamens and staminodes, may be needed to distinguish between some species. However, as Smith and later botanists have noted, herbarium specimens are of limited utility for detailed comparative studies because many of the diagnostic floral features are obliterated when specimens are pressed and dried. Moreover, collecting across the range of brodiaea species can be logistically complicated, making comparisons of

fresh material difficult. Progress towards resolving the *Brodiaea* taxonomy was not effectively made until botanists were present in California to do the field work and make the side-by-side comparison of fresh flowers from different species.

In 1886, Edward Lee Greene published a comprehensive review of the taxonomy of brodiaeas in the *Bulletin of the California Academy of Sciences*, with the intent of resolving the confusion. His solution was a compromise that recognized three genera, *Hookera*, *Brodiaea*, and *Triteleia*. Like Britton, Greene was an advocate of the rule of priority and agreed with the proposal to resurrect *Hookera*, but he introduced a novel interpretation of the genus *Brodiaea*. He argued that Salisbury's *Hookera grandiflora* was the correct name for that species because it had been published first, and therefore *Hookera* should be the correct genus name. Furthermore, he argued, Salisbury's *Hookera pulchella* belonged to a different genus, and because Smith's *Brodiaea congestum* was the first published name for that species, *Brodiaea* should be the correct name for that genus, rather than *Dichelostemma*. Greene appears to have been on the right track with respect to the circumscription of the genera, but his paper had little immediate effect towards resolving the taxonomic confusion, and the establishment of *Brodiaea* as a conserved name left Greene's nomenclature in disarray.

Harvest brodiaea (*Brodiaea elegans*) was mistakenly called *B. coronaria* by many California botanists prior to Robert Hoover's 1939 monograph of *Brodiaea*.

Willis Jepson's treatment of *Brodiaea* in *A Flora of California* paralleled E.L. Greene's treatment, although he recognized a single genus with three subgenera, *Hookera*, *Dichelostemma*, and *Triteleia*. Unfortunately, Jepson's treatment is the best example of the confusion over the species' names. Because the first species were described in England or in the eastern United States, the earliest botanists in California did not have access to reference specimens or illustrated floras. They depended on the original descriptions or later secondary treatments to try and put names on the brodiaeas they were encountering for the first time in the field.

Understandably, their "best guess" was sometimes wrong, with the result that later botanists compounded the mistakes. Jepson, like Greene and other California botanists before him, mistakenly applied the name *Brodiaea coronaria* to harvest brodiaea, the large-flowered, common, most widespread species. There were, in addition, many *Brodiaea* populations in the Great Valley and adjacent foothills with small to medium-sized flowers that Jepson was unable to put a satisfactory name on, and he resorted to lumping them all under the name *Brodiaea synandra*. We now know that this is actually a group of six to eight different species.

Jepson's error was further compounded by the fact that the name *Hookera synandra* was originally given to a large-flowered North Coast Range species by Amos Heller, who was unaware that Greene had earlier described the same species as *Hookera leptandra*. Jepson was familiar with *Hookera leptandra* but believed it to be the same species as *Brodiaea californica*. Jepson had not seen the type specimen of *Hookera synandra*, and he based his use of the name on a misinterpretation of Heller's written description.

***Brodiaea matsonii*, described in 2011, was named for its discoverer, the late Gary Matson.**

It wasn't until the late 1930s that Robert

Hoover developed the modern concept of the genus *Brodiaea*. Hoover completed his graduate studies at UC Berkeley, and Willis Jepson, his major professor, assigned him to work on groups of plants that Jepson himself was unable to resolve. Between 1934 and 1939, Hoover traveled extensively up and down the state collecting specimens for his research on endemism in the Central Valley, including specimens of most of the California brodiaea species. Hoover came to essentially the same conclusion that E.L. Greene had reached earlier, recognizing three closely related genera, *Brodiaea, Dichelostemma,* and *Triteleia*. He published monographs of all three genera, and he concluded that the South American species were unrelated to the North American ones.

Hoover was a careful observer, and he was able to resolve most of the confusion over the species names. He determined that harvest brodiaea, the species previous California botanists had mistakenly called *Brodiaea coronaria*, was not the same as the species Menzies had collected in the Pacific Northwest, but an undescribed species to which he gave the new name *Brodiaea elegans*. He also recognized and described three other new *Brodiaea* species and a new variety. Unfortunately, Hoover's treatment of the genera was largely ignored, and the *Illustrated Flora of the Pacific States*, *A California Flora*, *Vascular Plants of the Pacific Northwest*, and many local floras continued to follow the older treatment. Consequently, the common name "brodiaea" is still widely used for many species that are no longer included within the genus.

In the 1960s, further graduate research at UC Berkeley by Glen Keator (on *Dichelostemma*) and Theodore Niehaus (on *Brodiaea*) concluded that Hoover had been correct in his assessment. Their work became the basis of Keator's treatments of *Brodiaea*, *Dichelostemma*, and *Triteleia* in the first edition of *The Jepson Manual*. More recently, Chris Pires, currently at the University of Missouri, Columbia, has investigated relationships among brodiaeas and their relatives using molecular and phylogenetic techniques. His results have further confirmed Hoover's conclusions and have given us a clearer picture of how the genera are related. For example, *Brodiaea* and *Dichelostemma* species share many features in common and are closely related genetically, whereas *Triteleia* species lack many of those features and are only distantly related to *Brodiaea*.

A WORK IN PROGRESS

Currently, 21 species and subspecies are recognized in the genus *Brodiaea*. But that's not the end of this story, as there is still a ways to go before the monographic work started by Hoover and Niehaus is completed. From recent study of *Brodiaea,* several colleagues and I have found that some of the more poorly known species actually consist of two or more morphologically similar taxa that have separate geographic distributions, and that differ in chromosome numbers and habitat preferences.

Three new *Brodiaea* species have been described since the first edition of *The Jepson Manual*, and more new names are in the works. Wayne Armstrong and Tom Chester, who recently described *Brodiaea santarosae* (with Kay Madore), are studying another Southern California taxon that has been confused with *Brodiaea jolonensis*. Dale McNeal has been investigating chromosomal races in *Brodiaea elegans*. Chris Pires' students have been using DNA markers to distinguish morphologically cryptic *Brodiaea* populations that may have multiple independent origins via hybridization. I am currently working to resolve confusion over *Brodiaea coronaria*, the first brodiaea to be described, and the one that has continued to perplex botanists for over 200 years. We hope to bring you the sequels to this story in the not too distant future.

REFERENCES

Armstrong, W.P., T. Chester, and K. Madore. 2009. The Santa Rosa Basalt Brodiaea: a new species "hidden in plain sight". *Fremontia* 37(2): 20–27.

Britten, J. 1886. *Hookera* vs. *Brodiaea*: with some remarks on nomenclature. *Journal of Botany* 24: 49–53.

Gray, S.F. 1808. Monthly botanical report. *The Monthly Magazine* 25(1): 90–92; 25(4): 380–382; 26(2): 197–198; 26(5): 501–505.

Greene, E.L. 1886. Some genera which have been confused under the name *Brodiaea*. *Bulletin of the California Academy of Sciences* 2: 125–144.

Keator, G. 1987. Differentiating California's brodiaeas. *Fremontia* 14(4): 20–24.

Mabberly, D.J. 1985. *Jupiter Botanicus: Robert Brown of the British Museum*. J. Cramer, Braunschweig, Germany.

Menzies, A. 1923. *Menzies' Journal of Vancouver's Voyage, April to October, 1792*. Edited, with Botanical and Ethnological Notes, by C.F. Newcombe, M.D., and a Biographical Note by J. Forsyth. William H. Cullin, Victoria, B.C.

Preston, R.E. 2006. A reconsideration of *Brodiaea minor* (Benth.) S. Watson and *Brodiaea purdyi* Eastwood (Themidaceae), with the resurrection of *Brodiaea nana* Hoover. *Madroño* 53(1): 46-54.

Salisbury, R.A. 1808. *The Paradisus Londinensis*. William Hooker, London, England.

Smith, J.E. 1810. Characters of a new liliaceous genus called *Brodiaea*. *Transactions of the Linnean Society* 10: 1–5.

White, P. 1999. The purchase of knowledge: James Edward Smith and the Linnean collections. *Endeavor* 23(3): 126–129.

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In 1794, Archibald Menzies was the first botanist to collect specimens of coast redwood near the mouth of the canyon of the San Lorenzo river, less than a league above the Mission Santa Cruz. Photograph by Gary D. Lowe.

ENDLICHER'S SEQUENCE: THE NAMING OF THE GENUS *SEQUOIA*

by Gary D. Lowe

Austrian botanist Stephen Frierdrich Ladislaus Endlicher established the genus *Sequoia* in 1847. Endlicher's failure to record why he named the new genus *Sequoia* resulted in a significant body of literature speculative of his reasons. The genus *Sequoia* included two species for 85 years. In 1939 one of these, the giant sequoia of the Sierra Nevada, was separated into the genus *Sequoiadendron*, and the coast redwood was retained in the genus *Sequoia*. The history of the origin of the generic name *Sequoia* is a history shared by both of these two native California plants.

EUROPEANS' FIRST ENCOUNTER WITH CALIFORNIA'S GIANT TREES

Documentary mention of the coast redwood (*Sequoia sempervirens* [D. Don] Endl.) first appeared in Fray Juan Crespi's account of the overland expedition of Don Gaspar de Portola from San Diego to Monterey in his diary entry dated October 10, 1769. In September 1791, the first naturalist to encounter the coast redwood, also near Monterey, was Thaddeus Haenke, a member of the Spanish expedition of 1789–1794 headed by Alessandro Malaspina. This encounter resulted in seeds of the undescribed tree finding their way back to Spain.

Concurrently, the British expedition in the further quest for the Northwest Passage from 1790 to 1795, under George Vancouver, included Archibald Menzies as ship's surgeon and naturalist. Menzies collected specimens from near present day Santa Cruz. However, Menzies' specimens were not described until 1824 by Scottish botanist David Don, working in London, and published in Aylmer Bourke Lambert's *A Description of the Genus* Pinus (Lambert was then vice-president of the Linnaen Society and Don was the Society's librarian). Don gave the coast redwood the Linnaean binomial name of *Taxodium sempervirens* (Beidleman 2006; Jepson 1910).

ENDLICHER'S RECLASSIFICATION OF *TAXODIUM SEMPERVIRENS*

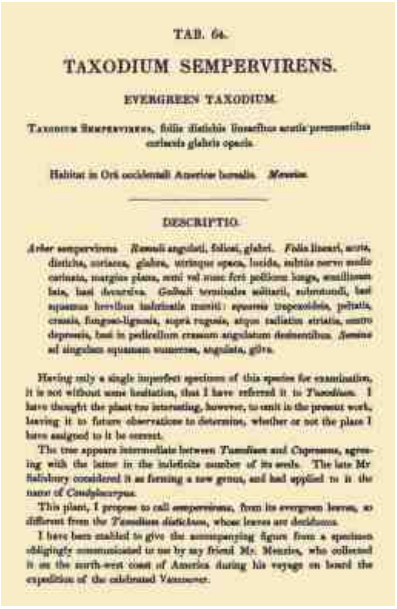
In 1836 Endlicher was made curator of the botanical department of the Austrian Royal Natural History Museum. In 1840, he was named professor of botany at Austria's University of Vienna and director of the university's botanical garden. He published his monograph *Synopsis Coniferarum*, dated May 14, 1847. Though French was the most important language of science in the 17th through early 19th centuries, Latin still held dominance in Austria. So this volume, along with his other botanical works, was published in that language. In preparing *Synopsis Coniferarum* he undertook the reorganizing and reclassifying of the conifers and frequently included names, references, and passages in the language in which they were originally published or annotated on herbarium sheets: Latin, of course, but also Greek, English, Chinese, and Japanese, all languages with which he was familiar.

Endlicher had begun studying what he deemed "useful" languages in 1826, as part of his early theological education, especially Chinese, presumably in hopes of a missionary assignment. His final efforts along this line were published in 1844 as *Foundations of Chinese Grammar*, thereby formally establishing himself as a linguist (Rompel 1909). Stephen Endlicher died on March 28, 1849, less than two years after completing *Synopsis Coniferarum.*

In *Synopsis Coniferarum*, Endlicher incorporated 290 species among 31 genera as part of his reorganizations and reclassifications. He followed his own understanding of how plants should be described and named, as did all of the botanists of the time. By 1847, systematic botany was well along in breaking away from Linnaeus's artificial system of classification, and two *natural* systems of plant classification had risen to prominence: those of Jussieu and De Candolle.

Among the 31 genera described in *Synopsis Coniferarum*, Endlicher included, as his own, four genera and 28 species. His four genera are *Widdringtonia*, *Libocedrus*, *Glyptostrobus*, and *Sequoia*. He established

The Linnaean Society headquarters/library at 32 Soho Square, London, from 1822 through 1857, where David Don worked with Archibald Menzies' specimen, a small sprig, the only material of coast redwood available. Image courtesy of the Natural History Museum, London.



TAB. 64.

TAXODIUM SEMPERVIRENS.

EVERGREEN TAXODIUM.

Taxodium Sempervirens, foliis distichis linearibus acutis persistentibus carinatis glabris opacis.

Habitat in Orâ occidentali America borealis. *Menzies.*

DESCRIPTIO.

Arbor sempervirens. Ramuli angulati, foliosi, glabri. *Folia* linearia, acuta, distincta, coriacea, glabra, utrinque opaca, lucida, subtùs nervo medio carinata, margine plana, semi vel sesse ferè pollicaria longa, semilineam lata, basi decurrentia. *Gemmæ* terminales solitariæ, subrotundæ, basi squamis brevibus imbricatis munitæ: squamis tripartitis, peltatis, crassis, fungoso-lignosis, supra rugosis, atque radiatim striatis, centro depressis, basi in pedicellum crassum angulatum desinentibus. *Semina* ad singulam squamam numerosa, angulata, glabra.

Having only a single imperfect specimen of this species for examination, it is not without some hesitation, that I have referred it to *Taxodium*. I have thought the plant too interesting, however, to omit in the present work, leaving it to future observations to determine, whether or not the place I have assigned to it be correct.

The tree appears intermediate between *Taxodium* and *Cupressus*, agreeing with the latter in the indefinite number of its seeds. The late Mr Salisbury considered it as forming a new genus, and had applied to it the name of *Condylocarpus*.

This plant, I propose to call *sempervirens*, from its evergreen leaves, so different from the *Taxodium distichum*, whose leaves are deciduous.

I have been enabled to give the accompanying figure from a specimen obligingly communicated to me by my friend Mr. Menzies, who collected it on the north-west coast of America during his voyage on board the expedition of the celebrated Vancouver.

David Don's final description of *Taxodium sempervirens* in the 1833 edition of Lambert's *Description of the Genus* Pinus. He raises the possibility of the coast redwood forming a new genus and suggests a new name for it: *Condylocarpous*. Image courtesy of the Gray Herbarium, Harvard University.

the genus *Sequoia* by reclassifying *Taxodium sempervirens*. Endlicher generally did not explain why he chose the names he selected for any of the new genera and species listed in *Synopsis Coniferarum*. There was no convention requiring this at the time. Though custom and tradition had occasionally included recording such naming honors, rules to be followed were not available until 1867. That was the year Alphonse De Candolle published *Laws of Botanical Nomenclature*.

ENCOUNTER WITH A SECOND GIANT TREE IN CALIFORNIA

In 1833 a tree of the "Red-wood species" was mentioned in Zenas Leonard's account of the overland expedition of the Joseph Rutherford Walker party during their arduous crossing of the Sierra Nevada. This account was serially published in a Pennsylvania newspaper and then in book form in 1839 (Curry and Kruska 1991), but did not see a wide circulation or raise any interest.

The next published mention of Leonard's "Red-wood species" in the Sierra Nevada did not appear until the spring of 1853 in the newspapers of the gold rush mining camps, from encounters in Calaveras County. The international population shift known as the California Gold Rush that had enabled the discovery of this tree also facilitated its being immediately and explosively brought to the attention of the world. Shortly thereafter it would popularly be known as the Mammoth Tree or Big Tree and botanically known as *Sequoia gigantea* from 1854 through 1939, and today as *Sequoiadendron giganteum*. (The history of the controversy over the naming of the giant sequoia is a subject unto itself, summarized by Saint John and Krause 1954.) Other historic matters aside, English botanist William Lobb delivered specimens of this tree to London—at that time the horticultural/botanical capital of the world—where John Lindley published the first botanical description of this tree as a new genus on December 24, 1853 in *The Gardener's Chronicle and Agricultural Gazette*.

In 1854 reports of the sheer magnificence of the Mammoth Tree was establishing it firmly in the American conscience. The similarity of this inland species to the coastal species, combined with the simple fact that only one (William Lobb) of the botanists working in the early 1850s had actually seen mature living trees of both species, inevitably led to confusion. In May 1854, in sorting out some of the confusion, Harvard Professor Asa Gray stated, in referring to the 1847 generic name change of the coastal species, ". . . the Redwood of California, namely the *Taxodium sempervirens* of Don, of late very properly distinguished as a separate genus under the unmeaning and not euphonious name of Sequoia." Gray obviously accepted the basis for the name change, but thought the word senseless and not pleasing to the ear. Thus began the attempt to sort out the history of the origin of the generic name *Sequoia*. In June 1854, French botanist Joseph Decaisne corrected John Lindley's assignment of the Mammoth Tree to a new genus, and placed the species in the genus *Sequoia*, consequently merging the social history of the two trees.

John Lindley, the original taxonomic describer of the Mammoth Tree, had entered the service of the Horticultural Society of London in 1823 as Secretary of the Garden at Cheswick. In 1827, Lindley also took on a professorship at London University. The following year, someone was needed at Cheswick Garden to perform those duties that Lindley no longer had time for, and the Society hired George Gordon as one of its gardeners, a prestigious position. Gordon stayed on at Cheswick until 1858, the year before the Society had to close Cheswick Garden (Fletcher 1969). That same year, Gordon issued the first edition of his monograph *The Pinetum*. In the 1858 edition, Gordon—to the extent that he could ascertain—gives the derivation of the

***Sequoia sempervirens*, the coast redwood, was first illustrated in the second edition of Lambert's *Description of the Genus* Pinus in 1828. Image courtesy of Biodiversity Heritage Library and the Missouri Botanical Garden.**

names of the genera that he lists. He records the naming of Endlicher's four genera of 1847, as follows:

Widdringtonia.—The African Cypress.—"Named in compliment to Capitan Widdrington (formerly Cook) who traveled in Spain." (Widdrington, born Cook, wrote extensively concerning Spain in the late 1830-1840s and probably provided Endlicher his study materials.)

Libocedrus.—The Incense Cedar.—"derived from 'Libanos,' incense and 'Cedrus,' the Cedar.

Glyptostrobus.—The Embossed Cypress.—"derived from 'Glypho,' embossed, and 'strobus,' a cone; scales of the cone embossed on the face."

Sequoia.—The California Redwood.—"Name, not explained."

Thus, in naming his genera, Endlicher, to Gordon's reckoning, named one for a colleague, one from a property, and one for a form, leaving one unknown, or, in Gray's initial assessment, meaningless—Sequoia. None of Endlicher's five species and one genus occurring in China were named after a Chinese linguist, as would have been consistent with his earlier interests.

HISTORICAL DERIVATION OF THE NAME SEQUOIA

Endlicher did not explain his choice of a name for his genus *Sequoia*, and died before he could subsequently do so. Therefore, any explanation of the name Sequoia entails examining the history of how others perceived the derivation of the word. Before reevaluating what Endlicher may have had in mind in choosing the name Sequoia, it is first necessary to thoroughly understand the accepted history of the word. In presenting this history, the original spelling of names as used by the various authors is retained, since the confusion resulting from the variability of the spelling is also an essential part of the history.

Portrait of Stephen Endlicher, who established the genus *Sequoia* in 1847. From Haberlandt 1899 (correspondence between Franz Unger and Stephan Endlicher).

Popularization of Endlicher's possible derivation of the name Sequoia began in 1868 with publication of *The Yosemite Book* by the Geological Survey of California, authored by Josiah Dwight Whitney, California state geologist and professor in the Mining School at Harvard. In his chapter on "The Big Trees," Whitney states, "The genus was named in honor of Sequoia* or Sequoyah, a Cherokee Indian of mixed blood, better known by his English name of George Guess . . . known to the world by his invention of an alphabet and written language for his tribe." For the asterisked "Sequoia,*" Whitney footnoted:

> This is the way the name was spelt in an article published in the 'Country Gentleman' which attracted Endlicher's attention, and led him to adopt this name for the genus. It is also more generally spelt 'Sequoyah,' which is the English way of writing it, while the other is what it would naturally and properly be in Latin.

Furthermore, to his summary of George Guess/Sequoyah's career, Whitney added the footnote, "For the above particulars of Sequoyah's history . . . we are indebted to Professor Brewer."

William H. Brewer, principal assistant in charge of the botanical department in the California State Geological Survey (1860–1864) and professor of agriculture in the Sheffield Scientific School at Yale (1864–1903), would have been familiar with the scientific literature when Whitney was preparing *The Yosemite Book*. Later, revised editions (renamed *The Yosemite Guide-Book*)—the ones that most people had access to—appeared in 1869 and 1870. It was undoubtedly due to Brewer's editorial assistance that Whitney's reference to Endlicher having been "attracted" to the name Sequoia in an issue of the *Country Gentleman* was removed from these later editions and replaced with "Endlicher, who named the genus, was not only a learned botanist, but was eminent in ethnological research, and was undoubtedly well acquainted with Sequoia's career." The first issue of *The Country Gentleman* was published on November 4, 1852 (Mott 1938), three-and-a-half years after Endlicher's death!

There were no specialized scientific journals in the United States in the middle of the nineteenth century. One of the few broad-based magazines that provided an outlet for both casual observations and some research was *The Gardener's Monthly, Devoted to Horticulture, Arboriculture, Botany & Rural Affairs*. This journal was owned, edited, and published by Thomas Meehan in Philadelphia. Characteristic of the times, contributors generally signed their submittals, either by their name, their initials, or under a penname. While this journal did not serve as the publication of choice for the mainstream botanists Torrey and Gray, or even Brewer, it did publish accounts by others.

One of the names advocated in 1854 for the giant sequoia had been *Washingtonia*. In the March 1860

Giant sequoias in the North Grove, Calaveras Big Trees State Park, September 2011. English botanist William Lobb was familiar with all but one of the mixed conifer forest species at the headwaters of San Antonio creek in Calaveras County. There he noticed a splendid, unidentified cedar-like tree—what we now call the giant sequoia. He collected herbarium specimens, live saplings, and thousands of seeds in late July or August of 1853, and personally escorted them to London. Photograph by Gary D. Lowe.

issue of *The Gardener's Monthly* an article appeared with the title "Sequoia versus Washingtonia" signed simply "L." Of course "L." is not to be confused with Linnaeus. This article and its title show that the genus name *Sequoia* was culturally more associated with the giant sequoia than with the coast redwood.

L.'s main thrust in his article was supporting a tribute to the Cherokee "See-quah-yah" (L.'s spelling) as the origin of the genus name *Sequoia*. He stated that, "Surely if the genus were not named in his honor, it should be now." To this article, editor Meehan appended a note that included the statement that Endlicher, "as he was no less noted for his philological knowledge than his botanical, it is not at all unlikely that he knew Sequoia's history, and that L. has hit on the secret." And then, he added, "Our intelligent correspondent, himself having family relationship with the Cherokees, renders the history the more reliable."

The following May, Meehan published a clarification that L. "does not assume, as implied in our note, to have been the first to suggest that the name Sequoia was derived from See-quah-yah," but that he (Mr. L) 'failed to detect any clue to any other origin' in the libraries, and among the botanists of Philadelphia or New York." Author "L." and editor Meehan did not have any evidence to support the conclusion that Endlicher derived the name of the genus *Sequoia* from that of the Cherokee linguist Sequoyah.

Meehan's note published in May 1860 also made reference to an earlier statement of the origin of the name Sequoia:

> . . . the strong presumptive evidence drawn from the extensive philological attainments of the late distinguished Endlicher, warrant us in believing that the suspicion first awakened in the columns of the *Country Gentleman*, a few years since is correct.

This is the article that Whitney had originally referenced, which had appeared in the column "The Fireside" of *The Country Gentleman* for January 24, 1856.

The *Country Gentleman* article bore the title, "The American Cadmus: The *Sequoia gigantea*—The Great American Tree and the Great American Genius for Whom it is Named." The article was anonymous, attributed "to an esteemed correspondent in Maryland." In the article the association of the name of the genus *Sequoia* with the originator of the written Cherokee language is expressed with a noticeable measure of uncertainty:

> Pray, Messrs. Editors, where does the name come from? Is it an intentional thing, or is it an accident, that the American tree should bear the name of an American who deserves any such honor. . . . The honor must be intentional; but if not, the accident is most gratifying.

The article then closed with the following statement: "If the huge monuments erected by Nature—the *Sequoia gigantea*, are dedicated to his name, it is a thing well done." It appears that the historical basis for the name of the genus *Sequoia* has heretofore been due to the fact that an anonymous writer merely wanted it that way.

ACCEPTED DERIVATION OF THE NAME SEQUOIA PERSISTS

The documentary sources of the origin of the name Sequoia presented above has shown that derivation of the name from that of the Cherokee

Moss growing on the side of a redwood trunk at Prairie Creek Redwoods State Park, Humboldt County. Photograph by Chris Johnson.

linguist Sequoyah was merely the desire of three authors (Anonymous 1856, "L." 1860, and Meehan 1860). Consequently, it becomes necessary to explore why an unsubstantiated conclusion has persisted into the present century.

In 1890, 30 years after Thomas Meehan published the article by "L." in *The Gardener's Monthly*, the topic of the origin of the name Sequoia was still a contentious subject, particularly among California botanists, dendrologists, and foresters, and particularly for John Gill Lemmon.

Lemmon came to California in 1869, still recovering from the effects of imprisonment during the Civil War. While recovering he took up botanizing. In 1874 he had his first paid assignment working with plants (Beidleman 2006). By 1876 he was a contributing correspondent to the *Pacific Rural Press* in a series titled "Botanical Excursions." In 1879 he contributed a six-part article titled "The Cone-bearers, or Evergreen Trees of California." Portions of this article eventually became part of his *Handbook of West-American Cone-Bearers* (Lemmon 1892), that followed Lemmon's own system of classification for the conifers.

In the 1879 article, Lemmon expressed the opinion that the name of the genus *Sequoia* was "said to be derived from Sequoya, the celebrated Cherokee Indian; but this is no doubt an afterthought and unworthy to be kept up." He then methodically set about finding out more. In 1888, following the death of Albert Kellogg, Lemmon received the assignment of "botanist for the California State Board of Forestry." As part of his duties to this state Board, Lemmon conducted an opinion poll concerning the origin of the name Sequoia by collecting published statements and by sending out letters of inquiry to the "principal dendrologists of the East and Europe." His report was published in 1890 in the forestry board's Third Biennial Report.

In his report concerning the "Origin of the Name Sequoia," Lemmon included one published statement and the five letters he received in response to his inquiry. Two of these letters clearly did not even pretend to answer the question that Lemmon had posed.

From a statement published by George Engelmann in 1873 in a St. Louis, Missouri journal, Lemmon concluded that Engelmann "evidently believed in the origin of the name as derived from the Cherokee, Sequoyah." The letter from Joseph D. Hooker stated, "My impression is very strong that Dr. Gray accepted the view of Sequoia being named in honor of the American who invented the alphabet for his tribe language." Thomas Meehan, in his letter, revealed the identity of "L." as being J.H. Lippincott, with whom he had close personal ties. Meehan wrote Lemmon that Lippincott was "a very learned and careful critic," who "was personally acquainted with De Candole, and possibly with some of the immediate associates of Endlicher." Alphonse De Candolle wrote that the "supposed origin of the word Sequoia is entirely fanciful, having no basis." De Candolle closed his letter by stating "After all, it matters little, a name is a name."

Lemmon placed considerable emphasis on Meehan's statement that Lippincott "was personally acquainted with De Candole, and possibly with some of the immediate associates of Endlicher." With regards to De Candolle, Lemmon merely stated that he "is eighty-four years of age, and was contemporary with Endlicher, so is enabled to know as much about the origin of the word as any one."

From his review of the opinions of his contemporaries, Lemmon concluded, "So the name is still a myth." However, the strong weight of opinion of most others who have investigated the derivation was that the name was derived from the name of the Cherokee linguist. Lemmon's report on the naming of the genus

***Sequoiadendron giganteum* was first botanically illustrated as *Wellingtonia gigantea* in W.J. Hooker's April 1, 1854 issue of *Curtis's Botanical Magazine* (Vol. 10, 3rd Series, Vol. 80). The history of the naming of this tree is a story unto itself.**

Sequoia ended by acceding that "we will be consoled by the last closing words of De Candolle, philosophical, terse, and clearly restating the scientific requisites of a good name," words that De Candolle had included in the *Laws of Botanical Nomenclature:* "The essential things are: first, that it be the expression of a natural genus; second, that it has not yet been employed before; and third, that the genus had not previously received another name."

The historical understanding of the origin of the name Sequoia has persisted into the present century based on learned opinion, not fact.

HISTORICAL EVIDENCE OF A LATIN DERIVATION

Another possible derivation of the name Sequoia that has historically been offered is that the name Sequoia came directly from the Latin for "sequence," with no connection to the Cherokee linguist Sequoyah. Two possible explanations have appeared in the literature.

In the 1858 edition of *The Pinetum,* George Gordon had indicated that he could find no explanation for the name Sequoia. In the 1862 *Supplement to Gordon's Pinteum*, and again in the second edition of *The Pinetum*, in 1875, Gordon added an etymology for the genus *Sequoia*. He wrote: "The name *Sequoia* is prob-

ably derived from 'Sequence,' separated, or following in order of succession, after *Taxodium*; from which Genus Professor Endlicher separated it." While this sounds plausible, it somewhat forces a sequential relationship, and fails to mention that Endlicher had also named *Glyptostrobus*, which was also "separated, or following in order of succession, after *Taxodium*." Lemmon (1890) quoted Gordon's possible sequence but did not explore it any further. Instead, he reiterated his preference first published in 1879.

In the aforementioned 1879 article, Lemmon emphatically stated, "The generic name *Sequoia* was given by Endlicher because this genus is a lone follower ('sequi,' to follow) of vast colossal forests." No authority was provided for this statement in 1879. In the 1890 report Lemmon added:

> In 1877 Hooker and Gray made a journey to the Pacific Coast and in conversation with them, I asked which was the true origin of Sequoia? Dr. Gray quickly replied that . . . undoubtedly Endlicher derived his name from sequi or sequor, alluding to the well known fact that our Redwoods are followers or remnants of several colossal extinct species.

However, both the letters from Thomas Meehan and J.D. Hooker questioned this as Gray's interpretation, suggesting that Lemmon had misunderstood Gray.

In 1872, Gray had published the statement that "I, for one, cannot doubt that the present existing species are the lineal successors of those that garnished the earth in the old time before man." Gray (1872) had based his interpretation on paleobotanical publications that appeared after 1854 by Heer, Lesquereux, and Newberry. Studies of these fossil floras were, of course, unavailable to Endlicher in 1847. Though Endlicher could know nothing of his genus following in sequence after "vast colossal forests," what about following in sequence after "several colossal extinct (fossil) species?"

Ralph W. Chaney (1951) revised the assignment of fossil sequoias following the discovery of the genus *Metasequoia* in Szechuan Province, China. Chaney noted that the last 50 pages of Endlicher's *Synopsis Coniferarum* are devoted to fossil conifers, and that Endlicher did not identify any of his fossil conifers as members of the genus *Sequoia*. Concerning one fossil form (*Taxites*

UNDERSTANDING THE CLASSIFICATION OF SPECIES

All societies have given a name to each kind of living thing and have observed that living things fall naturally into groups, which in turn form parts of larger groups. The act of arranging or classifying living things into their several groups and naming them accordingly, colloquially referred to as pigeonholing, is known as taxonomy. Our name for a kind of living thing is from the Latin speci and is called "species," e.g., *Sequoia sempervirens*, in the genus *Sequoia*. The full name includes the name of the genus because many living things may be given the same specific name; there are several evergreen plants that have been named *sempervirens*. Thus, classification is an exercise in organizing a comparison of a single species to all other species, or in Asa Gray's (1872) terms, determining "their place in the ranks."

Each level in the ranks is given a name. For example, the highest level is named "kingdom," thus the "Vegetable or Plant Kingdom." Lower levels of classification have sequentially been named Subkingdom, Division, Class, Subclass, Order, Family (Endlicher's level of Suborder), Genus, and Species. Early plant, animal, and mineral systematics, or classification systems, were based on the selection of a *single* arbitrary characteristic as an aid to classification, much like identification keys in modern popular guides, where flowers are arranged by color or trees by leaf features. Linnaeus's system was considered artificial because it was based on a single characteristic, the reproductive organs of plants. This limitation resulted in about a quarter of the British genera containing species at variance with the characteristics of the *Classes and Orders,* the classification system developed by the father of systematics, Swedish botanist Carl Linnaeus.

To many, the use of multiple characteristics seemed more natural. Thus, natural systems of classification were developed that considered as many plant characteristics as possible, organized either from simple to complex forms (followers of Jussieu) or from complex to simple forms (followers of A.P. De Candolle). Each of these two schools of thought had many adherents, each with their own natural system of classification within the overall context. Lindley (1853) summarized 29 natural systems of plant classification that had been published by that date. Each of these natural systems was independent of the others. A researcher classified (i.e., organized) a genera and/or its species as to where he felt it should be placed among the several higher ranks, to suit his latest findings and opinions. Thus a species can be assigned to a genus by one investigator and then be reassigned to a completely different, or new genus, by a later researcher. All species are subject to later revisions since the process of classification is at once very subjective and very precise.

Filtered light sometimes creates a magical feeling in redwood groves, as here in Muir Woods National Monument, Marin County. Photograph by Stephen Joseph, www.stephenjosephphoto.com.

langsdorfii Brongn.), Chaney stated that, "Endlicher failed to recognize the resemblance of these leafy shoots to those of *Sequoia sempervirens* which he had described for the first time on a preceding page." This further discredits Lemmon's idea that the generic name *Sequoia* was given by Endlicher because the genus is a follower or remnant of vast colossal forests, which would have been composed of extinct (i.e., fossil) species. This understanding came long after Endlicher's time.

SUMMARY OF HISTORIC DERIVATION THEORY

In summary, the foregoing has shown that the name of the genus *Sequoia* as a tribute to the Cherokee linguist Sequoyah is an unsubstantiated opinion, and that its derivation from the Latin because the species followed from a sequence of fossil forms, or paleoforests, also does not withstand scrutiny. Lemmon expressed his preference for a sequence and then conceded to the learned opinion of his correspondents. The historic record supports Lemmon's conclusion—the origin of the name of the genus *Sequoia* is an American myth.

ENDLICHER'S SEQUENCE

Clearly, Endlicher had to have had something in mind when he named the genus *Sequoia*. Careful examination of his writings indicates that the name Sequoia indeed *was* derived from the Latin for sequence, although this documentation has inexplicably not been thoroughly examined previously.

Endlicher published his description of the genus *Sequoia* twice. It first appears in his monograph on the conifers (*Synopsis Coniferarum*) that bears the printed date May 14, 1847 (Endlicher 1847a). It then appears again in the fourth supplement to his larger work (published sequentially between 1836 and 1850) on all the genera of plants (*Generum Plantarum*). The supplement (*Gen. Pl. Suppl. IV*) bears the printed date December 1847 (Endlicher 1847b). He inadvertently enhanced later confusion on the subject by referencing his second publication of the description as an unpublished manuscript in his monograph.

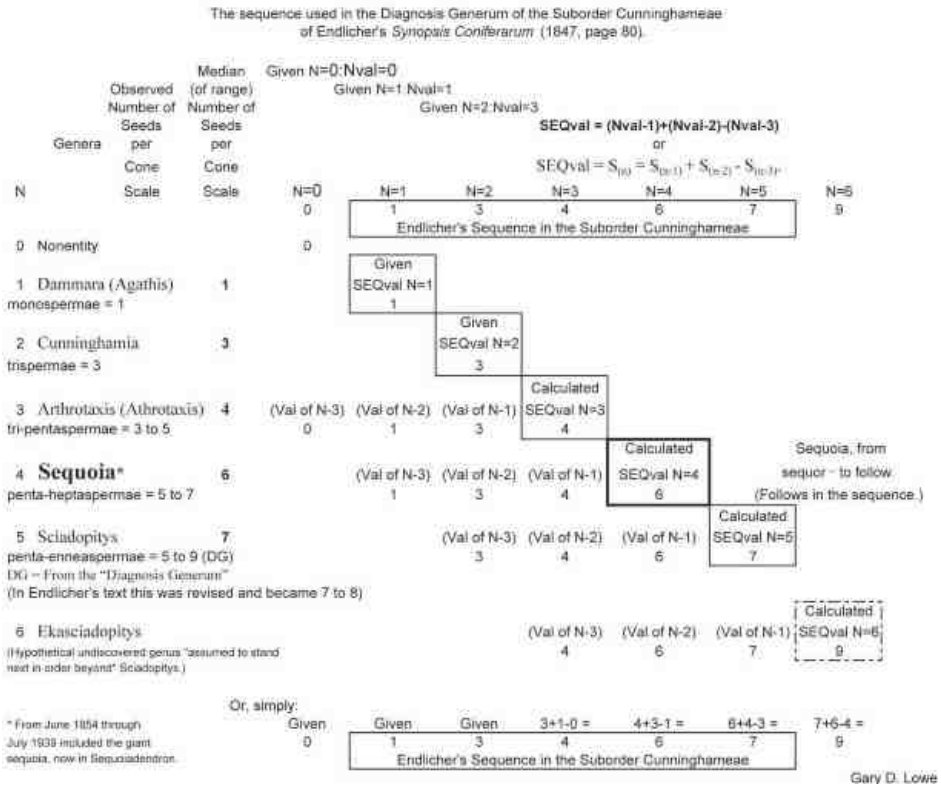
Endlicher's unstated explanation for the name he chose, *Sequoia*, for the generic reassignment of Don's *Taxodium sempervirens* is couched in the science of his day. His explanation is most readily apparent, through proximity, in *Generum Plantarum*. The explanation can be found on page 5, two pages ahead of the description of the genus *Sequoia*. The explanation is also present in *Synopsis Coniferarum* on page 80, at a considerable separation of 118 pages ahead of the description of the genus *Sequoia*.

Plant classification is considerably different now compared to what it was in the middle of the nineteenth century. In dealing with the conifers (Endlicher's Class Coniferae), he chose morphological features common to larger groupings of plants to define his categories. Endlicher divided his conifers into five Orders, not all of which need concern us. His Orders were divided into suborders, which were populated with the genera. Assigning a specific plant within this hierarchy is what Asa Gray (1872) called determining "their place in the ranks."

In studying the California tree that David Don had named *Taxodium sempervirens*, Endlicher decided that it was more like those he had placed in his pine-like Order Abietineae than like those in his cypress-like Order Cupressineae, where he had assigned the swamp cypress of the southeastern United States (*Taxodium distichum*). This reassignment stripped Don's California tree of its generic affiliation, necessitating that it be reassigned.

Endlicher had divided his Order Abietineae into three Sub-Orders.

TABLE 1. ENLICHER'S SEQUENCE EXPLAINED.



TOP: **Title page of *The Country Gentleman* (January 24, 1856) where an anonymous resident of Maryland published his opinion as to the origin of the genus name *Sequoia*.** • BOTTOM: **Title page of *The Gardener's Monthly* (March 1860) where "L." published his opinion as to the origin of the genus name *Sequoia*. Image courtesy of Biodiversity Heritage Library and the University of Massachusetts, Amherst Libraries.**

When Endlicher reached this level of his classification system, he provided a table showing the diagnostic features of the suborders and of the genera assigned to the Suborders. The table was headed, in Latin, "Diagnosis Generum." Endlicher assigned Don's California tree to the Suborder Cunninghamieae.

As listed in Endlicher's Diagnosis Generum, exclusive of the genus *Sequoia*, Endlicher's Suborder Cunninghamieae comprised four previously established and acceptable genera—*Dammara*, with 1 seed per cone scale; *Cunninghamia*, with 3 seeds; *Arthrotaxis*, with 3 to 5 seeds; and *Sciadopitys*, with 5 to 9 seeds. These four genera have median numbers of seeds per cone scale of 1, 3, 4, and 7 (see page 33). In 1830, Alexander Braun had previously found this sequence of numbers in the arrangement of the leaves and cones of conifers. In his investigation Braun had also found the arrangement of plant parts to follow in the sequence 1, 1, 2, 3, 5, and 8 (Braun 1831). Braun had discovered that the growth patterns of plants frequently occur in one of two recursive numerical sequences. Over four decades later, these two recursive sequences were respectively named the Lucas sequence and the Fibonacci sequence.

A close friend and colleague of Endlicher's was fellow Austrian, Franz Unger. In 1832 Endlicher and Unger were exchanging letters discussing floral diagrams using Braun's mathematical methods in the context of plant systematics (Haberlandt 1899). He retained these mathematical concepts of plant systematics when working on *Synopsis Coniferarum*. When he recognized Don's California tree as a new genus with 5 to 7 seeds per cone scale he had to place it somewhere in the hierarchy of his classification system. He opened a gap in the sequence of genera in his Suborder Cunninghamieae, between *Arthrotaxis*, with 3 to 5 seeds, and *Sciadopitys*, with 5 to 9 seeds, to allow placement of the new genus with 5 to 7 seeds per cone scale. With the addition of the new genus, the arrangement of the genera in his Suborder Cunninghamieae no longer followed the sequence 1, 3, 4, and 7 in the median number of seeds per cone scale. Instead, a new recursive sequence was formed—1, 3, 4, 6, and 7, Endlicher's sequence.

Endlicher named the genus for the operation that he had conducted. The new genus fell in sequence with the other four genera in his suborder. For Stephan Endlicher to have developed his systematics of the conifers at least partially on anatomically based mathematical patterns is in complete holding with the science of his times in the Austrian Empire.

ENDLICHER'S SEQUENCE ESCAPES NOTICE

Endlicher's sequence has lain hidden for the last 160 years. Botanists and others in America had little or no access to either of Endlicher's publications, and would hardly have sought out Endlicher's second publication since he had indicated that it was unpublished. The availability of reference works was always a problem in mid-nineteenth century America. In 1851, American botanist John Torrey wrote to an associate that "in this place (Princeton) I labor under many disadvantages—chiefly from the want of books." In 1853 Louis Agassiz, world-renowned geologist and zoologist, wrote that certain German works "are hardly to be seen in any American library." In 1855 he again lamented that "No one has felt more keenly the want of

TABLE 2. ENDLICHER'S SEQUENCE IN HIS SUBORDER CUNNINGHAMEAE: THE NUMBER OF SEEDS PER CONE SCALE.

Dammara		*Cunninghamia*		*Arthrotaxis*		*Sequoia*		*Sciadopitys*
Monospermae		trispermae		tri-pentaspermae		penta-heptaspermae		penta-enneaspermae
1	:	**3**	:	**3-5**	:	**5-7**	:	**5-9(DG) / 7-8 (Txt)**

Dammara is now known as *Agathis*. DG = From the "Diagnosis Generum." Txt = From the description in Endlicher's text. In later manuals (e.g., Bailey 1949), the number of seeds per cone scale of *Sciadopitys* is 7-9.

an extensive scientific library than I have since I have been in the United States" (Bruce 1987).

Those who concerned themselves most with the derivation of the name Sequoia were not necessarily mainstream scientists and would have had limited access to the libraries that were available. No one needs to be reminded that science and technology were immeasurably different in the third quarter of the nineteenth century compared to the present. When a researcher needed a reference, he had to first locate a copy. Once a reference work was located, the researcher either had to transcribe the text, or hire the services of a copyist. Making a manuscript copy of Endlicher's description of Sequoia would inevitably separate it from the whole of Endlicher's *Synopsis Coniferarum*. Consequently, Endlicher's sequence was probably not available to be studied by those interested in the origin of the name Sequoia.

Furthermore, a uniform system of plant classification was not yet available. Each plant systematist had his own hierarchy of the ranks of plants. By July 21, 1853, six months before the description of the giant sequoia was published, Lindley had restudied the genera of Endlicher's *Synopsis Coniferarum*. Lindley disagreed with Endlicher and rearranged the conifers. Lindley thought that *Sequoia sempervirens* was more cypress-like and less pine-like than Endlicher had indicated, and so reassigned the genus *Sequoia* to the Cupresseae, thus breaking Endlicher's sequence of five genera arranged by the number of seeds per cone scale. Lindley also did away with Endlicher's classification level (his suborders) that held the other four genera of the sequence (including Endlicher's suborder Cunninghamieae). Lindley placed these four genera together with all of the other pine-like species in the Abieteae. This last revision totally eliminated Endlicher's sequence from the major classification system in use at the time the description of the giant sequoia was published on December 24, 1853. The giant sequoia subsequently inspired numerous speculations as to the origin of the name Sequoia.

REFERENCES

Anonymous. 1856. The American Cadmus. The Sequoia Gigantea—The Great American Tree and the Great American Genius for Whom it is Named. *The Country Gentleman* 7(4): 65.

Bailey, L.H. 1949. *Manual of Cultivated Plants*. The Macmillan Company, Toronto Canada.

Beidleman, R.G. 2006. *California's Frontier Naturalists*. University of California Press, Berkeley, CA.

Braun, A., 1830. Vergleichen Untersuchung über die Ordnung der Schuppen an den Tannenzapfen als einleitung zur Unterscuung der blattstellung überhaupt: Nova Acta Physico-Medica, Academiae Caesareae Leopoldino-Carolinae Naturae Curiosorum, Vol. 25, 1831 (submitted 16 Jul. 1830).

Bruce, R.V. 1987. *The Launching of Modern American Science: 1846-1876*. Alfred A Knopf, New York, NY.

Currey, L.W., and D.G. Kruska. 1992. *Bibliography of Yosemite, the Central and the Southern High Sierra, and the Big Trees:1839-1900*. Dawson's Book Shop, Los Angeles and William P. Wreden, Palo Alto, California.

Endlicher, S. 1847a. *Synopsis Coniferarum*. Apud Scheitlin & Zollikofer, Sangalli, Österreich.

——. 1847b. *Generum Plantarum Supplementum Quartum*. Apud Fridericum Beck, Universitatis Bibliopolam, Vondobonae, Österreich.

Fletcher, H.R. 1969. *The Story of the Royal Horticultural Society, 1804-1968*. Oxford University Press, London.

Gordon, G. 1858. *The Pinetum*. Henry G. Bohn, London.

——. 1862. *A Supplement to Gordon's Pinetum*. Henry G. Bohn, London.

——. 1875. *The Pinetum*. 2d ed. Henry G. Bohn, London.

Gray, A. 1854. On the Age of the large tree recently felled in California. *American Journal of Science* Series 2, 17(51): 440-443.

——. 1872. Sequoia and its history. *The American Naturalist* 6(10): 577-596.

Haberlandt, B., 1899, Briefwechsel zwischen Franz Unger und Stephan Endlicher, Verlag von Gebrüder Borntraeger, Berlin.

Jepson, W.J. 1910. The Silva of California. *Memoirs of the University of California* 2: 480.

Lemmon, J.G. 1879. The Cone-Bearers, or Evergreen Trees of California.—No. 5; Cypress, Arbor-Vitae, Redwood, and Big Tree. *The Pacific Rural Press* 17(7): 107.

——. 1890. Redwoods. *Report of the Botanist of the California State Board of Forestry, Third Biennial Report of California State Board of Forestry for the Years 1889-1890*. State Office, Sacramento: 157-168 and 208-10.

Lindley, J. 1853, 3d ed. *The Vegetable Kingdom; or, The Structure, Classification, and Uses of Plants, Illustrated Upon the Natural System*. Bradbury & Evans, London.

"L." (Lippincott, J.H.). 1860. Sequoia versus Washingtonia. *The Gardener's Monthly, Devoted to Horticulture, Arboriculture, Botany & Rural Affairs* 2(3): 75-77.

Meehan, T. 1860. Sequoia. *The Gardener's Monthly, Devoted to Horticulture, Arboriculture, Botany & Rural Affairs* 2(5): 148.

——. 1879. Derivation of Sequoia. *The Gardener's Monthly and Horticulturist* 21(6): 189.

Mott, F.L. 1938. *A History of American Magazines, 1850-1865*. The Balknap Press of Harvard University, Cambridge, MA.

Rompel, J. 1909, 421. Stephan Ladislaus Endlicher. *The Catholic Encyclopedia*. Robert Appleton Company, New York, NY.

Saint John, H. and R.W. Krauss. 1954. The Taxonomic Position and the Scientific Name of the Big Tree Known as *Sequoia gigantea*. *Pacific Science* 8(3): 341-358.

Whitney, J.D. 1868. *The Yosemite Book*. Geological Survey of California. Published by Authority of the Legislature. Julius Bein, New York, NY.

——. 1869, 1870. *The Yosemite Guide-Book*. Geological Survey of California. Published by Authority of the Legislature. University Press, Cambridge, MA.

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Sloping fen in Sundew Meadow, Shasta-Trinity National Forest. Photograph by Danielle Roach.

FENS: A REMARKABLE HABITAT IN THE SIERRA NEVADA

by Deborah Stout

Some of the most uncommon and unusual meadow habitats across the western United States are "bogs" and "fens," which are known for their soppy wet organic soils often covered by spongy blankets of moss. What distinguish bogs and fens from other meadow habitats are their thick layers of organic matter or peat. Peat is partially decomposed plant matter (best known by the dried peat found at your local garden center) that forms in wetlands and remains saturated for most of the year.

Over the past few years, the US Forest Service has been collaborating with the CNPS Vegetation Program, Colorado State University, University of California at Davis, and other partners to describe fen vegetation throughout the Sierra Nevada. This collective research has fostered a better understanding of how and why fens develop, what vegetation types characterize them, and the impacts and risks to fen habitats. Read on to learn more about this rare and unusual habitat.

FENS VS. BOGS

Fens are a rare habitat type in California. Many people are more familiar with the term "bog," but bogs and fens are two types of peatland that are differentiated by their primary water sources. Bogs develop in temperate climates where rainfall is responsible for soil saturation. In California's Mediterranean

climate, peatlands form where groundwater (not rainfall) is the primary source of water saturation, and therefore our peatlands are technically fens.

HOW FENS DEVELOP

In saturated soils gases diffuse very slowly, which results in low-oxygen conditions that severely hinder bacterial decomposition of dead plant matter. These conditions over thousands of years allow organic matter to accumulate until it becomes the primary substrate or layer upon which plants grow, and some specialized plants grow entirely within the peat layer without access to mineral soil. In addition to the presence of saturated low-oxygen soils, there are other ecological conditions that play a role in the formation of peatlands. Peatlands typically are associated with low soil temperatures, which also slow microbial decomposition of plant matter. Because peatlands are characterized by organic soils (histosols), they only develop in areas where there is no regular deposition of inorganic sediments, such as decomposing granite and other materials that eventually break down into soil components like sands, silts, and clays.

FEN LANDFORMS

Fens can develop in seemingly unusual places including on hillslopes, although this may seem counterintuitive to their requirement for saturated soils. Only a few specific landforms allow surface discharges of groundwater at a rate slow enough to cause perennial saturation and the subsequent accumulation of peat. In the Sierra Nevada these conditions occur in four settings: slopes, basins, spring mounds, and lava bed discontinuities.

Sloping fens are the most common type in the Sierra Nevada and form at the base of hills where groundwater surfaces. This occurs where the water table intersects the land surface, resulting in groundwater discharging directly to the land surface. *Basin fens* originated as lakes or ponds and formed as the pond was filled with partially decomposed plant remains. *Spring mounds* are localized areas where groundwater rises to the soil surface; they often support small fens. The fourth type of fen, *lava bed discontinuities,* is found where lava beds overlie each other, such as in Lassen National Forest in the southern Cascade Range. When lava is deposited over an older lava bed, the surface of the older bed is melted and forms an impermeable barrier when it cools. The overlying lava cracks as it cools, allowing surface water to percolate down until it hits the impermeable barrier. The water is then forced to move horizontally, where it emerges as springs in the soil's surface.

Watershed geology influences the development of fens in more subtle ways as well. The chemistry of groundwater varies from alkaline to acidic (high to low pH) depending on the type of bedrock that underlies a watershed. In areas with granitic bedrock, fens are typically acidic and nutrient-poor. These fens contain curious carnivorous plants such as sundew (*Drosera rotundifolia*) and California pitcher plant (*Darlingtonia californica*), which obtain from their prey nutrients that

TOP TO BOTTOM: **Some of the showier denizens of fens: Bees on Parish's yampah (*Perideridea parishii*); a bumble bee perches atop a sneezeweed (*Helenium bigelovii*); Sierra gentian (*Gentianopsis holopetala*); and the brilliant but rare, showy raillardella (*Raillardella pringlei*). Photographs by CNPS staff.**

are not available in the soil or available in insufficient amounts. Some woody plants, such as lodgepole pine (*Pinus contorta* ssp. *muricata*), Labrador tea (*Rhododendron columbianum*), and alpine laurel (*Kalmia microphylla*) can also grow in these fens. In other areas where dolomite, limestone, marble, and volcanic bedrock occur, the fens are alkaline and nutrient-rich.

DIVERSITY OF PLANTS/ VEGETATION

The complexity of geology and climate found in California—not only at a watershed level but also within individual watersheds—has resulted in a diversity of vegetation associated with fens. Even an individual fen can support a surprisingly broad range of plant species, including non-vascular mosses, annual and perennial herbs, and even woody shrubs and trees. What they all have in common is their ability to tolerate waterlogged soils, acidified water, and low soil nutrients. One of the best known peat-forming plants is sphagnum moss (*Sphagnum* spp.), which grows in acidic peatlands. CNPS staff has collected three different species of sphagnums and more than 25 other moss species while working in fens. Other mosses common to fens in the Sierra Nevada include *Aulacomnium palustre*, *Bryum pseudotriquetrum, Drepanocladus aduncus,* and *Philonotis fontana.* (Most mosses do not have common names, which is why none appear here.)

Of the many vascular plant species that thrive in fens, sedges, rushes, and spikerushes are particularly common. These include star sedge (*Carex echinata*), short-beaked sedge (*C. simulata*), southern beaked sedge (*C. utriculata*), inflated sedge (*C. vesicaria*), arctic rush (*Juncus arcticus*), and common spikerush (*Eleocharis quinquefolia*). These plants can form discrete monotypic stands (containing only one species) or intermixed stands with no single species dominant.

Fens also sport more showy herbaceous species, which draw a diversity of pollinators. Some of these include Newberry's gentian (*Gentiana newberryi*), Bigelow's sneezeweed (*Helenium bigelovii*), monkeyflowers (*Mimulus* spp.), bog asphodel (*Narthecium californicum*), western yellow pond lily (*Nuphar lutea*), tundra aster (*Oreostemma alpigenum*), purple elephant's head (*Pedicularis groenlandica*), and fragrant bog orchid (*Platanthera leucostachys*).

Unlike several other rare vegetation types in California (e.g., vernal pools, serpentine vegetation, maritime chaparral), the fen vegetation of California is comprised of species which, with only a few exceptions, have very broad ranges. However, since some species are restricted largely to fens, they may be globally widespread yet common nowhere. Other species may be common elsewhere such as in the northern portions of North America, but restricted or even rare in California. Of the species identified in fens throughout the Sierra Nevada, 29 have a California Rare Plant Rank (CRPR) of 1 or 2 (considered rare, threatened, or endangered in California and/or elsewhere).

SYNTHESIS OF FEN INFORMATION

An ecological understanding of fen systems and classification of their associated vegetation is required if these unique wetland habitats are to be conserved. Since 2001, National Forests in the Pacific Southwest Region have initiated fieldwork to identify where fens occur. Upon this baseline of work, CNPS began collaborating with the Forest Service and other partners to enhance and standardize approaches for surveying fens and for characterizing their vegetation and related features.

In 2010 and 2011, CNPS Vegetation Program staff implemented

Ginny Lake, a basin fen on the Nevada side of the Lake Tahoe Basin Management Unit. Photograph by Kendra Sikes.

a newly revised survey protocol for surveying fens and wet meadows in the Sequoia and Shasta-Trinity National Forests, and throughout the Lake Tahoe Basin Management Unit. Revisions to the protocol include additions of measurable disturbance ratings such as grazing, off-highway vehicle use, dewatering (diverting water from all or part of a fen), and other details. These enabled us to compare and rank fen habitats on their quality, uniqueness, biological diversity, and other values.

In addition to a standardized protocol, a secondary goal of this broad collaboration was the development of an assessment report summarizing the current state of knowledge of fens throughout the National Forests of the Sierra Nevada. The draft assessment is based on over 800 fen surveys conducted by researchers, Forest Service botanists, and CNPS staff. The report includes a review of existing literature and unpublished studies, a

summary of USFS efforts to inventory fen resources, an analysis of data compiled from over 800 fen surveys, and identification of data gaps. It also includes a classification and key to fen vegetation types at both the alliance and association levels, greatly expanding our existing knowledge of wetland vegetation in California. The assessment highlights the floristic biodiversity and rarity of fens, provides a framework for future management decisions, and identifies research and monitoring priorities.

Through collaboration and years of hard work conducted in the field, our understanding of fens in California has grown immensely in the past few years. We now know, for example, that approximately 470 meadows throughout California National Forests contain one or more fens, and this number is likely to increase with additional surveying. While all meadows in several forests have been fully inventoried, a few still need additional surveys and, for some, assessments have yet to be initiated.

We have also learned that 175 of the surveyed fens support one or more of the CRPR-ranked rare plant species. Overall plant diversity in fens is impressive as well; approximately 306 different taxa have been identified in fens throughout the Sierra Nevada. Recent efforts to classify fen vegetation have also resulted in the identification of 14 new vegetation alliances (or provisional alliances) since publication of the *Manual of California Vegetation*, 2nd edition, in 2009.

While the assessment of meadows and fens continues throughout the state, the next challenge is protection. Fens are threatened by a number of activities that affect their associated watershed. Impacts reported from recent inventory surveys include road and trail construction, ground and surface water pumping, and livestock grazing activities that increase bare peat or cause significant stream erosion. Water pollution is also known to threaten fen ecosystems. This information can now be used to determine future management strategies that could avoid or mitigate for these impacts.

Sundews (*Drosera rotundifolia)* and sphagnum moss (*Sphagnum* spp.) thrive beneath a canopy of mud sedge (*Carex limosa)*, CNPS Rare Plant Rank 2.2. All are found in fens around Silver Lake, Plumas National Forest. Photograph by Scott Batiuk.

EXPLORING FENS

If you have not yet had the opportunity, we encourage you to explore these amazing and unique habitats. Some of our favorite locations are:

Butterfly Valley, Plumas National Forest, Plumas County – Highlights include large stands of the carnivorous California pitcher plant.

Toad Lake, Shasta-Trinity National Forest – A well-established trail passes through a string of fen meadows on the way to Toad Lake. The trail continues around the lake to the southeastern edge, which has a beautiful and diverse meadow complex and offers a picturesque view.

Grass Lake, Eldorado National Forest – This incredible fen meadow system is designated as a Research Natural Area and supports the largest sphagnum peatlands in California, as well as various uncommon and disjunct plants, three species of carnivorous plants, and four species of orchids.

REFERENCES

Cooper, D.J., and E.C. Wolf. 2006a. *Fens of the Sierra Nevada, California*. Department of Forest, Rangeland and Watershed Stewardship, Colorado State University, Fort Collins, CO. Unpublished report.

Sawyer, J.O., T. Keeler-Wolf, and J.M. Evens. 2009. *A Manual of California Vegetation*. 2d ed. California Native Plant Society, Sacramento, CA.

Sikes, K., et al. 2010. Fen conservation and vegetation assessment in the National Forests of the Sierra Nevada and adjacent mountains, California. Unpublished report.

Weixelman, D.A., and D.J. Cooper. 2009. *Assessing Proper Functioning Condition for Fen Areas in the Sierra Nevada and Southern Cascade Ranges in California, A User Guide*. General Technical Report R5-TP-028. USDA, Forest Service, Pacific Southwest Region, Vallejo, CA.

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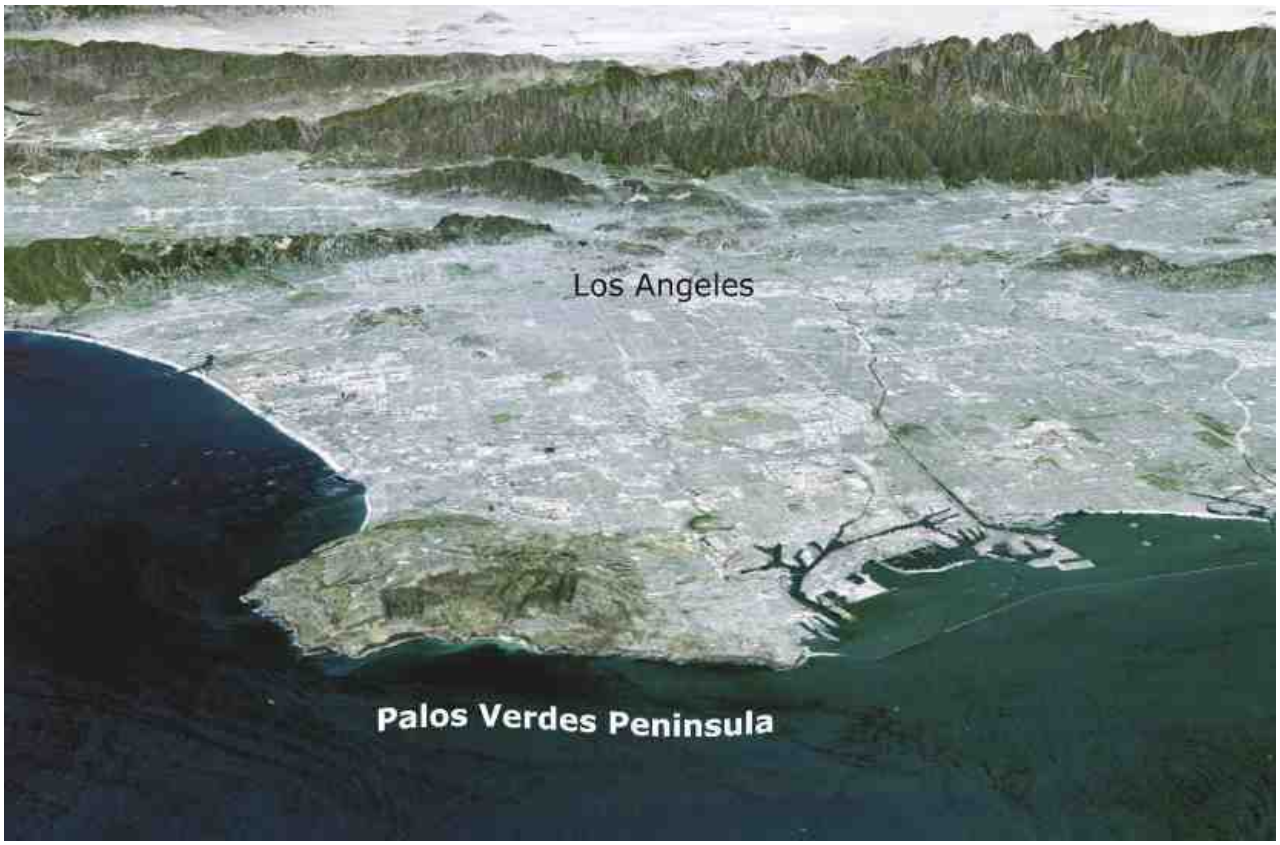

Oblique view of Los Angeles County with Palos Verdes Peninsula in foreground. Image courtesy of NASA/JPL/NIMA, PIA03348, Shuttle Radar Topography Mission, February 2000.

CONSTRUCTING ALL-YEAR FLORISTIC KEYS FOR SMALL AREAS

by Christine M. Rodrigue

A common problem for naturalists conducting fieldwork in their study sites is accurate identification of plant species. Over the years, we become familiar with species of interest to us in a given area. Even so, we often come across species we may never have encountered before or, annoyingly, species we once knew but have since forgotten. This problem is challenging for educators at all levels: They might like to use a site for field trips but find species identification a chore. Docents for park lands and interested laypeople also face the identification challenge.

One way to acquire familiarity with plant species is to consult books and pamphlets about local or regional species (e.g., Gales 1988; Rundel and Gustafson 2005). These can be organized by vegetation formation, life form, or flowers, and they are variable in details and currency. Another, more formal way is to consult a flora or a floristic key for the region.

Floristic keys narrow down a plant species identification through a series of (usually binary) choices about observable traits. Most cover large areas. These can be as large as an entire state, such as California (e.g., Stuart and Sawyer 2001) or regions within a state, such as Southern California (e.g., Collins 1972 and 1974). In regions of great biodiversity, this can entail thousands of species, leading to long chains (sometimes referred to as "trees" due to their continual branching) of binary decisions. These become difficult to keep track of, both for the writer and for the reader. Authors of botanical keys find that it becomes unwieldy to design the keys if flowers are not used early in the process. As a result, most keys cut quickly to flower characteristics (e.g., Collins 1972 and 1974; Dole and Rose 1996).

Unfortunately for key users, however, plants do not obligingly flower all year round. It can be difficult poring over several keys and floras to identify a plant in the field that is no longer in its blooming

Photograph of Palos Verdes Peninsula landscape, including the ongoing Portuguese Bend landslide that activated in 1956. The landslide precluded further development in the affected area, resulting in the conservation of open land and coastal sage scrub (CSS) habitat there. All photographs by Christine M. Rodrigue.

season. What generally happens then is that readers make guesses. They go to the index at the back and look up various guesses, and then go directly to the species' descriptions. This, of course, sabotages the whole point of using a binary decision tree. Adding to the challenge, plants' blooming seasons do not match with one another, so use of a key may only be partially successful. Refreshing one's familiarity with a species in the wild is time consuming for researchers, instructors, docents, and the interested lay public.

This Catch-22 for readers might be resolved by key authors giving up early reliance on flowers. The only way that this becomes feasible is by reducing the number of species in the key. Dole and Rose (1996) approached the problem by restricting their key to cacti, trees, and shrubs. They also provided four separate sections, one each for cacti, trees, shrubs in flower, and shrubs not in flower. They note that the fourth key is difficult to use and imprecise.

Designing an all-season key for a much smaller area might be another way to reduce the number of species involved so that flowers are not critical to identification. This article reports on an attempt to construct such a key for the Palos Verdes Peninsula (~9,000 hectares or 22,230 acres) in Los Angeles County. The Peninsula contains 229 native species, with 125 already in the key. It is complete for succulents, trees, shrubs, and subshrubs (small, many-branched plants that are woody only at the base with soft, herbaceous branching above the base). The herb, fern, and monocot section is about half done.

BUILDING THE KEY

The first step in the process entailed finding an existing checklist for species that should be included in the key. I used a native plant checklist for the Palos Verdes Peninsula that was created by Angelika Brinkmann-Busi.

The second step involved consulting several existing keys and floras and cross-referencing them to identify basic traits for the new key (Calflora 2012; CalPhotos 2012; Collins 1972, 1974; Dole and Rose 1996; Gale 1988; Hickman 1993; Munz 1974; Rundel and Gustafson 2005). These included life form (loosely defined), height of adult plants, branching habits, leaf shape and complexity, leaf margins, leaf arrangement, color and texture of leaves and stems, presence of spines or thorns, as well as detailed information on flowers and propagules.

The third step was field work, keys in hand. I collected small samples of plants in the field and created an informal herbarium of Palos Verdes native and exotic species. This was used for reference dur-

TABLE 1. SPECIES BLOOM TIMES ON THE PALOS VERDES PENINSULA, LOS ANGELES COUNTY.

GENUS	SPECIES	LIFE FORM	SUBTYPE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	URL*
Ribes	*californicum*	Shrub	Small	X	X	X										7107.html
Marah	*macrocarpus*	Vine	Herb	X	X	X	X									5363.html
Dudleya	*lanceolata*	Succulent	Herb	X	X	X	X	X	X						X	2855.html
Crossosoma	*californicum*	Shrub	Large	X	X	X	X	X	X							2433.html
Isomeris	*arborea*	Shrub	Small	X	X	X	X	X	X	X	X	X	X	X	X	4384.html
Eriogonum	*fasciculatum*	Shrub	Small	+	+	+	X	X	X	X	X	X	X	X	+	3243.html
Eriogonum	*parvifolium*	Shrub	Small	+	+	+	+	+	X	X	X	X	X	X	+	3346.html
Eriogonum	*cinereum*	Shrub	Small	+	+	+	+	+	X	X	X	X	X	X	X	3216.html
Salix	*lasiolepis*	Shrub	Large		X	X	X									7277.html
Crassula	*connata*	Succulent	Herb		X	X	X	X								2407.html
Rhus	*integrifolia*	Shrub	Large		X	X	X	X								7090.html
Encelia	*californica*	Shrub	Small		X	X	X	X	X							2963.html
Oligomeris	*linifolia*	Succulent	Herb		X	X	X	X	X	X						5913.html
Lycium	*brevipes*	Succulent	Shrub			X	X									3532.html
Salix	*gooddingii*	Tree				X	X									7272.html
Salix	*laevigata*	Tree				X	X	X								7276.html
Antirrhinum	*kelloggii*	Vine	Herb			X	X	X								401.html
Prunus	*ilicifolia* subsp. *lyonii*	Tree				X	X	X								6896.html
Rhus	*ovata*	Shrub	Large			X	X	X								7091.html
Salix	*exigua*	Shrub	Large			X	X	X								7270.html
Lycium	*californicum*	Succulent	Shrub			X	X	X	X	X						5235.html
Mimulus	*aurantiacus*	Shrub	Small			X	X	X	X	X						5489.html
Rubus	*ursinus*	Shrub	Small			X	X	X	X	X						7206.html
Lupinus	*chamissonis*	Shrub	Small			X	X	X	X	X						5125.html
Lotus	*scoparius*	Shrub	Subshrub			X	X	X	X	X	X					5072.html
Sambucus	*mexicana*	Shrub	Large			X	X	X	X	X	X	X				7320.html
Spergularia	*marina*	Succulent	Herb			X	X	X	X	X	X	X				7713.html
Heliotropium	*curassavicum*	Succulent	Herb			X	X	X	X	X	X	X	X			4060.html
Aphanisma	*blitoides*	Succulent	Herb			`	X	X								421.html
Prunus	*ilicifolia* subsp. *ilicifolia*	Shrub	Large				X	X								6894.html
Toxicodendron	*diversilobum*	Vine	Liana				X	X								8015.html
Dudleya	*virens*	Succulent	Herb				X	X	X							2870.html
Lathyrus	*vestitus*	Vine	Herb				X	X	X							4626.html
Lonicera	*subspicata*	Shrub	Small				X	X	X							5014.html
Lupinus	*longifolius*	Shrub	Small				X	X	X							5174.html
Salvia	*mellifera*	Shrub	Small				X	X	X							7311.html
Symphoricarpos	*mollis*	Shrub	Small				X	X	X							7898.html
Calystegia	*macrostegia*	Vine	Herb				X	X	X	X						1353.html
Cylindropuntia	*prolifera*	Succulent	Cactus				X	X	X	X						9588.html
Keckiella	*cordifolia*	Shrub	Small				X	X	X	X						4522.html
Eriophyllum	*confertiflorum*	Shrub	Subshrub				X	X	X	X	X					3422.html
Salicornia	*subterminalis*	Succulent	Herb				X	X	X	X	X	X				7257.html
Isocoma	*menziesii*	Shrub	Small				X	X	X	X	X	X	X	X	X	4370.html
Sesuvium	*verrucosum*	Succulent	Herb				X	X	X	X	X	X	X	X		7534.html
Calystegia	*peirsonii*	Vine	Herb					X	X							1369.html
Cuscuta	*californica*	Vine	Herb					X	X	X	X					2528.html
Opuntia	*littoralis*	Succulent	Cactus					X	X							5940.html
Opuntia	*oricola*	Succulent	Cactus					X	X							5942.html
Orobanche	*californica*	Succulent	Herb					X	X	X						5965.html
Salvia	*leucophylla*	Shrub	Small					X	X	X						7310.html
Rosa	*californica*	Shrub	Small					X	X	X	X					7179.html
Heteromeles	*arbutifolia*	Shrub	Large						X	X						4140.html
Cucurbita	*foetidissima*	Vine	Herb						X	X	X					2510.html
Artemisia	*douglasiana*	Shrub	Subshrub						X	X	X	X	X			708.html
Frankenia	*salina*	Shrub	Subshrub						X	X	X	X	X			3612.html
Cuscuta	*pentagona*	Vine	Herb							X	X	X				2539.html
Atriplex	*lentiformis*	Shrub	Small							X	X	X	X			986.html
Hazardia	*squarrosa*	Shrub	Small							X	X	X	X			4010.html
Suaeda	*taxifolia*	Succulent	Shrub							X	X	X	X			7879.html
Epilobium	*canum*	Shrub	Subshrub							X	X	X	X	X		2984.html
Brickellia	*californica*	Shrub	Small								X	X	X			1152.html
Ericameria	*ericoides*	Shrub	Small								X	X	X	X		3080.html
Artemisia	*californica*	Shrub	Small			m					X	X	X	X	X	705.html
Baccharis	*emoryi*	Shrub	Large								X	X	X	X	X	1030.html
Baccharis	*pilularis*	Shrub	Small								X	X	X	X	X	1031.html
Ericameria	*palmeri*	Shrub	Subshrub								X	X	X	X	X	3088.html
Number blooming				**8**	**13**	**29**	**43**	**46**	**40**	**33**	**28**	**23**	**19**	**12**	**10**	
Percentage blooming				**12**	**20**	**44**	**65**	**70**	**61**	**50**	**42**	**35**	**29**	**18**	**15**	

Base URL: http://www.csulb.edu/geography/PV/ X = blooming season; + = dried inflorescences retained; m = may do a secondary bloom
Source: C.M. Rodrigue, June 2012, based on Brinkman-Busi, Calflora, *Jepson Manual*, Munz flora, Colllins key, and GDEP and class fieldwork.

CSU, Long Beach biogeography students using all-season key in the field. Note student in back using her smartphone to access the online version of the key.

ing the construction of the key. Field work took place during various research projects on the Peninsula, field trips for a biogeography course, and community field trips offered by the Geosciences Diversity Enhancement Program (GDEP) at California State University, Long Beach.

The fourth step required constructing a sequence of decisions for readers to make in using the new key. I decided to relax the customary practice in botanical keys of only giving two choices for each question, in order to shorten the process of identifying a plant. In my key, each identification question leads to two or more choices. For instance, leaf shape could be linear, lanceolate, oblanceolate, oblong, etc.

The fifth step involved assessing the evolving key, which has now gone through several iterations. Each version was assessed for ease of use in various classes and GDEP projects. Assessment focused both on how readily students and amateurs could make positive identifications, and on problems they reported in using it.

The most recent step has been moving the paper key online, so students could use their smart phones, tablets, and netbooks to access it in the field. The online edition was also emailed to professional botanists working in the Palos Verdes Peninsula and another nearby conservation area. Revisions were then made in response to feedback from both professional and student/amateur users. The most current version of the key is available at http://www.csulb.edu/geography/PV/.

HOW THE KEY WORKS

This process has yielded a workable key, which is most functional in its online version. The first decision encountered by the user is simply to select the life form of the plant in question: succulent, tree, shrub, subshrub, vine, or herb. In this, the new Palos Verdes key follows the common practice of most keys, in that it departs from the binary (the forced two-choice-only question) at this first level.

For trees and shrubs, the key begins by asking whether the leaves are simple or compound, then whether they are alternate or opposite, and then inquires about their shape. In the case of the few native trees on Palos Verdes, just these three levels will lead to a positive identification! Clicking on one of these identification end-points then takes you to a species description that is quite detailed, to ensure confidence in plant identification. This description can include leaf size, texture, color, veining, and margins. Detailed flower descriptions are also provided, so that if the plant is blooming, the flower can be used to confirm the identification at the end of the process, rather than as a starting point and potential dead-end.

The online version of the key also provides links to the Calflora taxon report, the *Jepson Manual* treatment and species map, and the CalPhotos collection of photos of that species. The CalPhotos link is particularly helpful to those using the key online in the field, as it can provide instant affirmation of the species identification.

The most common vegetation on the Palos Verdes Peninsula is California sage scrub, often called coastal sage scrub (even far from the coast) or CSS. This is a low vegetation type, typically 0.5–2.0 meters (1.5–6.0 feet) tall, and dominated by shrubs and subshrubs. Many of these are capable of summer deciduousness, dropping all or some of their leaves if the stresses of California's summer drought reach critical thresholds. As such, CSS is a somewhat unprepossessing vegetation that many settlers in California thought nothing of clearing.

Estimates are that some 85–90% of it has been destroyed by agriculture and urban development. CSS, however, is critical habitat for a number of endangered animal species. These include the California Gnatcatcher *(Polioptila californica)*, the California Cactus Wren *(Campylorhyncus brunneicapillus)*, and the Palos Verdes blue butterfly *(Glaucopsyche lygdamus palosverdesensis)*. Given the nature of the vegetation, the most complex part of the

key was the shrub and subshrub section.

For most of the larger true shrubs, as with trees, the user only has to work through three levels of decision-making before arriving at a positive identification. Large shrubs with ovate leaves, however, were broken down into two more levels.

Subshrubs were more complicated to work through, however, being the visually dominant life form in CSS with nearly 30 species occurring in Palos Verdes. They require as many as six levels of decision-making, but that is still a small number of choices to make, and none of them depend on flowering season. In one group of simple and alternate leafed plants, the buckwheats (*Eriogonum* spp.), the key does inquire about inflorescences. These species are distinctive in that they retain inflorescences all year—including dead and dried ones long after the flowering season has ended. After deciding whether or not a plant retains these structures, the key reverts to leaf shape and then to margins, completing identification within six steps.

Succulents were another complex group. I subdivided it by life form: herbaceous (e.g., pickleweed, *Salicornia subterminalis*), shrubs (e.g., boxthorn, *Lycium californicum*), and cacti (e.g., coastal prickly-pear, *Opuntia littoralis*). The herbaceous and shrub succulents then went on to leaf arrangement and shape, while the cacti were instead broken down by shape and size of stem segments and spines.

Vines also needed to be subdivided by life form: lianas or woody vines (e.g., poison oak, *Toxicodendron diversilobum*) and herbaceous vines (e.g., coyote gourd, *Cucurbita foetidissima;* California morning glory, *Calistegia macrostegia;* and chaparral dodder, *Cuscuta californica*). Past that subdivision, species are differentiated again by leaf size, arrangement, and shape.

Herbaceous plants are far more numerous, with more than 180 native plant species on Palos Verdes. This has necessitated a more elaborate key structure. This section starts with a division between forbs and graminoids and, within forbs, between ferns and angiosperms. These divisions help organize the species into manageable numbers. In each division, the key then reverts to the basic leaf attributes used as starting points in other life forms. This section of the key is still under construction, but the sections on succulents, trees, shrubs and subshrubs, and vines are now complete.

Summer research interns setting up a quadrat to census coastal sage scrub habitat on Palos Verdes Peninsula for the Geoscience Diversity Enhancement Project.

I had always wanted to make the key available to the public, which is why I began to put it online in 2010. This turned out to make the key vastly easier to use, particularly in an age of field work where data is most easily recorded using the latest technology. The botanical key can be accessed by a smart phone, tablet, netbook, notebook, and iPad using 3G or 4G wireless connections. The online format also allows users to link the key with the CalPhotos archive, so users can instantly visually confirm their plant identification decisions. While smartphone access through the browser included with the phone works quite well, I hope to write a software application that allows users to access it even more conveniently.

ASSESSMENT

The evolving key for the Palos Verdes Peninsula has been used by my students for field assignments in several sections of upper-division biogeography. It has also been used as an extra credit field project for students in danger of failing introductory physical geography. The key also served as a resource for several years of summer research projects with high school and community college interns. In each case, the students were successful in identifying several species put to them, both dried specimens in the lab and live plants in the field.

The earlier versions of the key were written in the concise botanical language common to floras and keys and, as such, would require me to be around to help students with definitions. The specialized language reduced its ease of use, and created frustration among the students and

interns, so I rewrote the key. I started including informal definitions within the species description pages every time a botanical term was used. While this increased clarity, it also lengthened the key and created redundancies from one description to the next. However, it also made it easier for students to use the key independently.

The students in my last section of biogeography (fall 2011) were not only able to make identifications on their own online, but also reported enjoying the process more. I have also shared the online key with the Palos Verdes Peninsula Land Conservancy and with the director of a company spearheading restoration of the Los Cerritos Wetlands (Tidal Influence, Long Beach, CA). My goal in doing so was to have professionals look the key over and notify me of any errors. Feedback has been enthusiastic, and I'm confident this will help in the training of interns, docents, and volunteers in these conservation organizations.

TURNING FLORISTIC KEYS UPSIDE DOWN

It is possible to redesign floristic keys that make no reference to flowers and yet still allow users to identify plant species accurately. A key can present a short sequence of manageable choices regarding plant characteristics that are visible all year. As this Palos Verdes botanical key "experiment" has shown, this can even be accomplished during non-flowering seasons without "cheating" (making guesses and then using an index to look up various possibilities).

This approach is feasible for areas under 10,000 hectares, even in a biodiversity hotspot like California. Limiting the geographical area covered by the key reduces the number of native species that need to be included. That said, the process turned out to be more time-consuming than I had anticipated. Even with just 229 species, the time required proved quite daunting. I am still working on the key each summer, now some five years into the process. I hope to have the last category completed in the summer of 2013. While this is something of a labor of love, I sometimes wonder whether I would have started the process, knowing then how much time it would take.

Unfortunately the key does not systematically include exotic species that are rampant throughout California, and on the Palos Verdes Peninsula in particular. Species richness field data indicate that roughly half the species in Palos Verdes are non-native and often visually dominant, and several are quite invasive. No one has put together a non-native species checklist, so it would be far more difficult to work them into a key. However, I am considering an addendum to the key with brief descriptions of the exotics that I happen to recognize.

Even with these problems, the process of constructing a non-flower-dependent key proved feasible for the Palos Verdes Peninsula. It would be less time-consuming for someone working in a less diverse region or in a smaller area. All-year floristic keys make plant identification much easier for non-professionals and educators. The implications for developing similar keys for use in many other areas open up new, exciting possibilities for native plant conservation. Once this occurs, many more people will be able to use these simplified keys and develop their interests in native plant communities as well as support efforts to protect them.

REFERENCES

Brinkmann-Busi, A.1999. Appendix A: Flora of the Palos Verdes Peninsula, a preliminary checklist. In Lipman, A., et al. *Habitat Evaluation and Reintroduction Planning for the Endangered Palos Verdes Blue Butterfly: Final Technical Report to California Department of Fish and Game*. Department of Geography, University of California, Los Angeles, CA.

Calflora. 2012. *The Calflora Database.* Available at http://www.calflora.org/.

CalPhotos. 2012. *The CalPhotos Collection*. Available at: http://www.calflora.org/.

Collins, B.J. 1972. *Key to Coastal and Chaparral Flowering Plants of Southern California.* California State University Foundation, Northridge.

——.1974. *Key to Trees and Wildflowers of the Mountains of Southern California.* California State University Foundation, Northridge.

Dole, J.W., and B.B. Rose.1996. *An Amateur Botanist's Identification Manual for the Shrubs and Trees of the Southern California Coastal Region and Mountains*. Foot-Loose Press, North Hills, CA.

Gales, D.M. 1988. *Handbook of Wildflowers, Weeds, Wildlife, and Weather of the South Bay and Palos Verdes Peninsula Including Tidepool and Seashore Life,* 4th ed. FoldaRoll Company, Palos Verdes Peninsula, CA.

Hickman, J.C., ed. 1993. *The Jepson Manual: Higher Plants of California.* University of California Press, Berkeley, CA. Also available online at http://ucjeps.berkeley.edu/.

Munz, P.A. 1974. *A Flora of Southern California.* University of California Press, Berkeley, CA.

Rodrigue, C.M. 2012. Native plant identification key for the Palos Verdes Peninsula, California. Available at http://www.csulb.edu/geography/PV/.

Rundel, P.W., and R. Gustafson. 2005. *Introduction to the Plant Life of Southern California: Coast to Mountains*. California Natural History Guides. University of California Press, Berkeley, CA.

Stuart, J.D., and J.O. Sawyer. 2001. *Trees and Shrubs of California.* California Natural History Guides. University of California Press, Berkeley, CA.

Whittaker, R.H. 1977. Evolution of species diversity in land communities. *Evolutionary Biology* 10: 1–67.

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LOCATIONS OF *FLORA OF NORTH AMERICA* AUTHORS IN THE US AND CANADA, 2012.

THE *FLORA OF NORTH AMERICA*

by Nancy Morin

We are so lucky that California, with its 8,000 species of plants and many outstanding botanists and botanical institutions, has long been a leader in floristics. Sometimes it seems like California is a country unto itself with little need to look outside its boundaries. Its excellent published flora, *The Jepson Manual: Vascular Plants of California* (now in a new second edition) provides a statewide overview, and local checklists and county floras give regional detail.

There is a great deal to be gained from having a broader view of plants, however, and that view is finally being made available through a massive effort to complete a *Flora of North America* (FNA), which contains information on the more than 20,000 species of native and naturalized vascular plants and bryophytes in the continental US, Canada, Greenland, and the St. Pierre and Miquelon Islands.

The 16 volumes published to date, and website, provide carefully reviewed names, descriptions, distributions, and discussions for more than 11,000 species. They give a botanical context to the species and genera that occur in California, and are especially helpful in understanding the distributions of California Rare Plant Rank 2 species (CRPR, formerly called CNPS List 2) or the relationships within their genera of other rare species.

Many of the authors of *The Jepson Manual* revision are also doing the treatments for the *Flora of North America*, so in large part the relationships and even the descriptions of strictly California plants may be the same or very similar. An example of how the information in FNA can add to our knowledge of California plant groups can be found in the genus *Nasturtium* in Volume 7 of FNA. This volume, published in 2010, is the most recent in the series.

Volume 7 covers 11 families, the largest of which are Brassicaceae (mustard family), with a whopping 97 genera and 744 species, and Salicaceae (willow family), with only 4 genera but 123 species. The section on Brassicaceae was written primarily by Ihsan Al-Shehbaz—a world-wide authority on the family,

and on staff at the Missouri Botanical Garden—and presents the results of his massive overhaul of this enormous and economically important family. Typically it takes many years before the knowledge from such research makes it into floras. Thanks to FNA the knowledge is becoming available sooner.

Gambel's yellowcress, CRPR 1B.1. Courtesy of the Flora of North America Association, Yevonn Wilson-Ramsey, illustrator.

For example, if we look up *Nasturtium* in the index of Volume 7, we find it is the common name of that fancy orange-flowered plant that grows profusely and drapes itself over gardens and creek banks. The introduced species *Tropaeolum majus*, in the family Tropaeolaceae, is also treated in Volume 7. The section on *Tropaeolum* notes that it is naturalized in the FNA area only in California, and is edible, rich in Vitamin C, and has antibacterial properties.

The true genus *Nasturtium*, or watercress, is in the mustard family, Brassicaceae, and has five species (four grow in the FNA area, and one is found only in Morocco). As a result of Dr. Al-Shehbaz's work, most of the species formerly in *Nasturtium* are now in *Rorippa,* yellowcress. Watercress *(Nasturtium officinale)*, a non-native, occurs in California and all the rest of North America (except Greenland and the northernmost provinces in Canada). It was collected as early as 1877 in the San Gabriel Mountains according to herbarium records, and is considered a weed. One-row yellowcress *(N. microphyllum)* also introduced, is found in a smattering of states and provinces.

Our native Gambel's yellowcress *(Nasturtium gambelii)* is of conservation concern (CNPS list 1B.1 and federally endangered), grows only in Central and Southern California, and sometimes hybridizes with *N. officinale*. Florida yellowcress *(Nasturtium floridanum)* is known only from wet places in Florida.

Thus, through the *Flora of North America*, Volume 7, we get a sense of how widely distributed *N. officinale* is, and that it poses a genetic hazard to *N. gambelii*. We also learn that this genus has an unusual geographic pattern, with two relatively widespread species and three very local species—one in California, one in Florida, and one in Morocco.

More than 900 botanists in the US, Canada, and elsewhere are working on the *Flora of North America.* Editors, authors, and reviewers are volunteers and work from their home institutions. Editorial centers at Missouri Botanical Garden, University of Kansas, University of Montreal, the Hunt Institute for Botanical Documentation at Carnegie Mellon University, and California Academy of Sciences host technical editors and botanical illustrators. Nomenclatural and bibliographic reviewers check that the scientific names and literature citations are correct.

California botanists are involved in this project in many ways. Regional reviewers include Gary Wallace at Rancho Santa Ana Botanic Garden, Margriet Wetherwax at UC Berkeley, Jon Rebman at San Diego Natural History Museum, and Fred Hrusa at California Department of Food and Agriculture. John Strother and Alan Smith at UC Berkeley have been part of the project since it started in 1983, and John is still a special editor.

Deb Trock is heading up the editorial center for Volumes 15 and 18 at California Academy of Sciences. For many years Grady Webster at UC Davis coordinated the southwest regional review of manuscripts, a task I took over in 2000. I circulate manuscripts to the reviewers in our area—which includes California, Nevada, and Arizona, and compile their comments, which are then returned to the author for consideration.

Volume 7 is dedicated to Grady, in honor of his many contributions to our understanding of plants and their distributions, especially in the spurge family, Euphorbiaceae. More than 50 California botanists are authors of treatments, and many other authors, editors, and reviewers have California connections. The "business office" (basically a desk in my home) is located in Point Arena.

The *Flora of North America* received its first funding in 1986, and since then 16 volumes have been published by Oxford University Press, USA (affiliated with Oxford University Press, UK). All the ferns and gymnosperms, all the monocots (Poaceae is in two volumes), all the sunflower family (three volumes!), and most of the "lower" (more primitive) dicots have been published. These cover 182 families, 1,741 genera, and 11,000 species. Work is progressing well on the remaining 14 volumes, with more than 60% of the remaining treatments now in the editing and review process.

Additional information on the project, the published volumes, and volumes in preparation, as well as the content from *all* published volumes can be found on the Web at www.fna.org and is free to all. FNA treatments are also available through JSTOR, an online information resource that also provides images of herbarium specimens and digital files of related literature. JSTOR is a subscription service, but the specimen images and FNA files are available without charge at http://plants.jstor.org.

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California fan palms (*Washingtonia filifera)* in a desert wash at Mountain Palm Canyon, Anza Borrego Desert State Park. This photo can be viewed online in a comprehensive EoE section on California. All photographs by the author.

THE ENCYCLOPEDIA OF EARTH INVITES CNPS PARTICIPATION

by C. Michael Hogan

Imagine an Internet resource that is free to everyone and contains thousands of peer reviewed articles covering all aspects of environmental science, each containing links to many other Web pages. Imagine that this website is viewed by almost one million visitors each month, and that the content grows by the hour.

The Encyclopedia of Earth (EoE) provides just such an environmental science website, one that contains a wealth of information on California vegetation. This relatively new world-

wide network of hundreds of professional scientists brings together content on ecology, hydrology, climate, earth sciences, geography, and even socioeconomic issues. There are entries on individual species, ecoregions, and ecological theory that address local to regional scale issues.

VALUE TO CNPS

So far five members of CNPS have qualified and published as au-

This photo, taken during wildflower season at the St. Helena Palisades, accompanies an EoE entry titled "Flora of Napa County, California." Lead author is Jake Ruygt, longtime rare plant chair for the Napa Valley Chapter of CNPS.

thors or editors of the EoE. Their articles cover such topics as California endemics, regional vegetative systems, and historical ecology in California. Some of the CNPS authors have also written articles that cover national or even international ecological issues.

For example, Jake Ruygt, rare plant and conservation chair for the Napa Valley Chapter of CNPS, has already contributed an article on the flora of Napa County, one on the historical distribution of oaks in Sonoma County, two on the *Arctostaphylos* and *Quercus* genera, and an article on the Cactaceae family. Other CNPS members who have contributed individual species articles include Ann Howald, Roger Raiche, Sarah Gordon, and C. Michael Hogan, all members of the Milo Baker Chapter (Sonoma County).

Since the California Floristic Province has intrinsic interest internationally, the audience for this California oriented content is quite large. Publication of articles with the EoE by CNPS members with scientific backgrounds results in increased publicity for CNPS and its programs, and may result in attracting new members to the organization. EoE entries also serve as an additional means of communication among CNPS members, in a manner similar to that of *Fremontia* and the *CNPS Bulletin,* and the *CNPS e-Newsletter*.

ARTICLE CONTENT AND PROTOCOLS

Each EoE article is reviewed by one or more technical consultants, but overall quality is overseen by an all-scientist board of directors, two of whom are California-based. Besides setting content quality and format standards, the Board directs special projects, such as major pushes for content expansion in certain areas. Current priorities include a drive to cover each of the over 700 world ecoregions, and an initial push to address the ecology and hydrology of major river basins of the world.

Homepage of the Encyclopedia of Earth: www.eoearth.org.

We are also trying to create high-quality genus level articles for plant taxa in North America, Asia, Africa, Europe, and South America.

Qualifications for acceptance as an author are based more on knowledge and expertise than simply academic credentials. While a majority of the EoE authors are university faculty members, there are also many from the private sector and from government. The EoE welcomes articles that are focused not only on individual species, but on plant communities. Articles may also be written by two or more authors.

Examples of content which CNPS members might provide include articles stressing the need for more thoughtful solar array siting in sensitive desert habitat; regional articles on areas containing a high percentage of endemic plants; methods of protecting rare species, or those of limited distribution; and discussions about the eradication or control of invasive plant species in California.

INSTITUTIONAL CONTENT PARTNERS

Another powerful aspect of the Encyclopedia of Earth is the strength of its content partners. EoE has formalized content partnerships with over two dozen agencies, allowing the use of most of the content available from such entities as

Witches butter (*Tremella mesenterica*), a widespread decomposer parasitizing on rotting oak limb at Bouverie Preserve, Sonoma County. An EoE entry sites its importance for nutrient recycling and soil manufacture within hardwood forests.

the US Environmental Protection Agency, US Geological Survey, Central Intelligence Agency, National Oceanic and Atmospheric Administration, National Aeronautics and Space Administration, and the National Science Foundation. In most cases EoE has the right for our authors to add content to an existing work by one of the content partners, after it has been reviewed by senior EoE technical authors and editors.

A key content partner is the World Wildlife Fund (WWF), whose data on over 750 ecoregions worldwide forms a backbone of article content depicting plant communities throughout the world. Other EoE content enriches the WWF data, which can be searched by country, river basin, national park, and other delineating boundaries. The value of these article interrelationships is magnified by the rich hyperlinking to other EoE articles. Approximately 20 "clickable" links are provided within the text of an average EoE article, connecting the reader to EoE articles on related content of specific species, ecoregions, geographic features, and ecological theory.

TECHNICAL DETAILS AND THE EOE COMMUNITY

The EoE website encourages contributors to submit other media content along with the technical written content of their articles. This typically includes such items as slide show photograph galleries, videos, news articles, curriculum modules, and announcements of symposia or other events. The presence of photos, graphs, videos, and other images within the text makes the information come alive, and lures the reader into the subject matter.

The EoE platform has an advanced online editing function that allows authors to enter all article content, including text, graphics, and metadata, and to add special effects such as bolding, italics, and image captions. Furthermore the author can assign the article to over 150 topic areas, allowing readers to search and find the content in a hierarchical browsing mode, as well as using the internal EoE search engine.

One of the most valuable features of becoming an EoE author is the ability to interact with members of one's field all over the world. These interactions also extend to interdisciplinary discourse, since the core of the EoE philosophy is to integrate high-level content from related environmental disciplines.

Within the EoE community of scholars are opportunities to find colleagues to coauthor a new paper, or simply to interact with a topic editor (a technical reviewer) to assist in evaluating and moving one's article to publication. In preparing manuscripts for EoE, I have personally interacted with experts from Egypt, England, Iran, Germany, Canada, Spain, Namibia, and Scotland (as well as from the USA).

CNPS members are strongly encouraged to contribute articles to EoE. Inquiries should be sent to C. Michael Hogan at Luminatech@yahoo.com.

Author's Note: The Encyclopedia of Life (http://eol.org/) is a kindred website and content partner of the Encyclopedia of Earth. However, the emphasis of the Encyclopedia of Life is purely biology and is organized by taxa to include detailed information on over one million organisms. Conversely, the Encyclopedia of Earth addresses all areas of the environmental sciences including climate, earth science, physical science, and environmental chemistry. It also addresses more complex assemblies of data, such as descriptions of complete ecoregions, interactions of carbon storage with climate, etc. There are several key people active in both sites in order to facilitate considerable information sharing between them.

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NEW CNPS FELLOW: JIM BISHOP

by Marjorie McNairn and Joan Stewart

Jim said once that while on a Mount Lassen Chapter field trip, someone asked him to be the nominee for chapter president, although he had not previously been active in the chapter, nor a member of the executive board. He agreed, and jumped right in for a two-year stint as president from January 1996 to December 1997. Two years later he was again elected as president for another two-year term.

This story about Jim is a good example of his willingness to get involved, to shoulder responsibility, and to continue to help when needed. As president, he was always organized, and conducted the chapter business with enthusiasm and energy. As a chapter member he has stimulated others to apply their skills and interests to chapter activities.

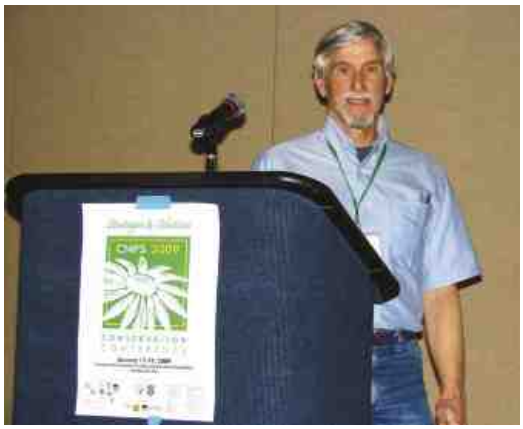
Jim Bishop in the embrace of an ancient and enduring bristlecone pine. Photograph by Catie Bishop.

When he was not acting as Mount Lassen Chapter president, Jim took on the role of program chair, a position he has held since 1998. He has participated in recruiting speakers for many interesting and high quality educational programs. In addition, he has at times presented programs himself, which have been well researched and professionally delivered. One of his talks described the ongoing international alpine monitoring project known as "GLORIA" and the first US site in the Sierra Nevada and White Mountains, in which he and Catie Bishop have participated (see *Fremontia,* 38.4/39.1). A related program was on adaptations of plants to high elevation conditions. Other presentations were on the fens of Plumas National Forest, bristlecone pines, plant colors, and desert ecology.

While president of the Mount Lassen Chapter, Jim was introduced to, and became active in the State CNPS Executive Board. After his presidency he continued as the chapter delegate for a few years, also became vice president for administration, organized Council meetings, and was among those involved in reorganizing the State CNPS Executive Board into the CNPS Chapter Council and the CNPS Board of Directors. Many times Jim has urged members of the Mount Lassen Chapter to attend state Chapter Council meetings. He is always eager to educate our members about CNPS activities at the state level, and in recruiting new people for state positions.

He first served as Chapter Council vice-chair from 2004–2005, and then as its chair from 2006–2007. This was a period of difficult strategic planning that built on work dating back to the late 1980s, and continues to this day. It was not an easy time for CNPS. Jim often assumed the role of peacemaker during heated discussions.

He served for two years on the state Governance/Elections Committee, and spent six years chairing the Program Policy Committee. Among his accomplishments are helping to revise the state Administrative Handbook. He was also part of the group that developed a Chap-



Giving a presentation at the 2009 CNPS Conservation Conference. Photograph by Catie Bishop.

Jim examining a deep cut into the peat of a fen in the Bucks Lake Wilderness. Photograph by Michelle Coppoletta.

ter Council Manual, which was continually being revised during 2002–2006.

Jim continues to lead the important, difficult work of reviewing and developing our formally drafted CNPS policies, which provide us with the statements we quote, distribute, and support on issues important to the mission of CNPS. His leadership took us through a challenging, and sometimes divisive effort to craft our policy on the use of herbicides in 2008, a final policy in 2010 on native plants and fire safety, and in 2011 he helped finalize the CNPS native plant advocacy policy. Those who have participated in policy discussions know how tedious the process can be, and how much time can be spent debating phraseology. Toward the end of that process, and in typical Jim Bishop style, he wrote to all Chapter Council members:

> To be optimally effective on all the things that demand CC's [Chapter Council's] attention, please keep in mind that we do reach the point of diminishing returns on detailed word-crafting adjustment. If the policy enables, and does not preclude, what you want to do, and if it does not compel us to do something wrong, it is probably ready to use.

Jim then signed the message, identifying himself as "your humble Program Policy Committee chairperson and policy development facilitator."

Those of us who have worked with statewide CNPS programs are well aware of the contributions Jim has made, and of his accomplishments. He has skillfully conducted meetings, reviewed documents, and presented valuable information. And he has shared his "fellowship" in the best sense of the word. Jim sometimes miraculously moved us on to action, or to conclusions that recognized diversity of opinion, yet produced a compromise result we could all support, with language such as, "It seems that…", "Perhaps we can agree that…", "Is this what we want to do now?", or "Perhaps something we can all support would be…"

Jim Bishop has an outstanding record of service to the California Native Plant Society both at the local and state level. He is truly worthy of the title CNPS Fellow.

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MYRTLE WOLF: 1913–2012

by Roger Raiche

The native plant community lost a long time enthusiast and supporter on March 2, 2012, when Myrtle Wolf died at the age of 98 in her Berkeley home after a long illness. Myrtle touched so many lives with her passion and love of horticulture and native plants that she will be sadly missed.

Myrtle always loved plants, often recalling childhood memories of picking wildflowers while her father disked the peach orchards in fields near Winters in Yolo County. The family moved to Berkeley when she was a teenager, and she never left. At UC Berkeley, she received a master's degree in botany and her teaching credentials in the mid 1930s. She even collaborated with Dr. Herbert Mason in writing a book to introduce elementary school children to plants that was called *Botany For Beginners*. Myrtle spent 36 years teaching life sciences and serving as a counselor in the Oakland School District.

After retirement she dedicated much of her time to causes she loved, especially horticulture and native plants. She referred to this phase as the "dessert of her life." Through her long friendship with many of

the founders of *Pacific Horticulture* magazine, Myrtle found herself volunteering whenever help was needed with the struggling new journal. She assisted her good friend Olive Waters with many tasks, from clerical to promotion and publicity events. She gave generously to make sure the magazine was financially stable. And she wrote a glowing tribute upon the passing of Marjorie Schmidt, another close friend and fellow lover of California's native flora.

She had strong ties to the two local botanical gardens—UC Botanical Garden at Berkeley (UCBG) and the East Bay Regional Parks Botanical Garden (EBRPBG) in Tilden Park—as well as to the young California Native Plant Society. Myrtle first fell in love with the UC Botanical Garden (UCBG) as a graduate student while at Berkeley, an affection that continued for the rest of her life, and which she later repaid many times over with her volunteer activities and financial support. She was part of the first class of docents, served on the board of the new Friends of the Botanical Garden, and was also active in the plant sales that helped provide revenue for the Garden. She was willing to do almost anything, as she recalled in a story she loved to relate about the late Wayne Roderick, who was in charge of the California Collection there. When she asked if she could help, he simply handed her a bucket and said, "Start weeding!"

The UCBG honored Myrtle with a Myrtle Wolf Day in October 1990, when dozens of friends, family, and supporters showed up to thank her. In 2000, UCBG named its horticultural library in her honor. The Garden newsletter stated,

> The devoted affection which Myrtle holds for the Garden is held in turn for her by all associated with the Garden—staff, academics, and volunteers alike. Never could the naming of a building at the University of California Botanical Garden be more appropriate than this opportunity to honor a human "living treasure" of the Garden, one of our most beloved friends and staunchest supporters.

Myrtle Wolf spent most of her retirement years volunteering, and she especially loved propagating plants. This group at the East Bay Regional Parks Botanical Garden in Tilden Park (circa 1980) helped the garden remain open without an admission fee after Proposition 13 caused massive cutbacks in its budget. Left-to-right: Phoebe Watts, Charlie Danielsen, Myrtle Wolf, Lillian Henningson, Wayne Roderick, Jane Owen, Pat Jowise, and Ruth Fiske.

At the Tilden Park native plant garden she was instrumental in helping it remain open after Proposition 13 caused the park district to drastically cut the garden's budget and initiate an admission fee. The effect was to cut the number of visitors by half. A group of friends of Wayne Roderick, then Garden Director at EBRPBG, decided to start propagating plants for an annual spring sale at the Garden in lieu of charging an entry fee. Myrtle was one of the earliest and most active plant sale volunteers, as she loved propagating plants, was very good at it, and loved to share her expertise. She frequently claimed she could "root broomsticks," which was not far from the truth. According to current garden director, Stephen Edwards, this eager group was instrumental in "cre-

Two of the most influential women that shaped the East Bay Chapter for many decades, the late Jenny Flemming (CNPS Fellow, 1985) and Myrtle Wolf (CNPS Fellow, 1987) at a CNPS picnic in Tilden Park in June 1989. Note Myrtle's CNPS tee shirt, designed by artist Hisao Yokota, with the picture of a plant named in her honor, a selection of the Pajaro manzanita (*Arctostaphylos pajaroensis* 'Myrtle Wolf').

Myrtle loved to attend field trips and to see native plants in the wild. Here she is resting, during a local trip to Brines Reservoir in 1986.

ating a great annual plant sale that would one day become the best native plant sale in the state and a critical source of funding for the garden."

Myrtle was associated with the early California Native Plant Society which eventually transitioned to the East Bay Chapter of CNPS, where she served on the board of directors for many years. She was friends with so many of the personalities that shaped CNPS over its first 40 years, even though she took a more behind-the-scenes position of influence. She was an ardent supporter of native plants, teaching people—especially children—about them, how to protect them, and how to use them in gardens. She was also active in the propagation and sale of native plants at the chapter's annual sale. When folks at the sales had questions, they were often told to "ask Myrtle." Due to her decades of support for native plants, Myrtle was honored by being named a CNPS Fellow in 1987.

In the late 1980s, when the Jepson Herbarium decided to put out a new version of *The Jepson Manual: Vascular Plants of California,* Myrtle was there with her support, both financial and personal. She was a great help to Susan D'Alcamo who was in charge of fundraising for the project, and facilitated the effort of CNPS in starting the Friends of the Jepson Herbarium, a support group for this huge project.

She was also instrumental in the decision for the new manual to include horticultural information about every native plant mentioned, and played a key role in setting up the Horticultural Council chaired by Warren Roberts (Supervisor of the UC Botanical Garden at Davis. She also encouraged her old friend, Emily Reid, then 80, to come out of retirement to provide illustrations for the new manual. Emily ended up doing over half (93) of the illustrations, most of which have been re-used in the most recent update of *The Jepson Manual* (2nd edition, 2012).

Myrtle was a very loving and giving person who made her friends into an extended family. She was one of those exceptional human beings that made all who knew her feel privileged to have been part of her life.

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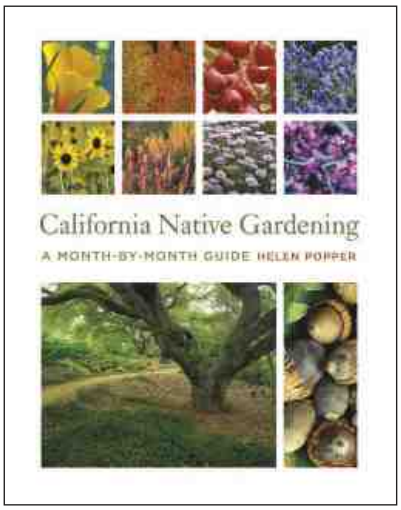
BOOK REVIEWS

California Native Gardening , A Month-By-Month Guide by Helen Popper. 2012. University of California Press, Berkeley, CA. 224 pages. ISBN# 978-0-520-26534-9, cloth; ISBN# 978-0-520-26535-6, paperback. Order online through CNPS.

If you have ever wished that an experienced native plant gardener would take you under her wing and share her gardening wisdom with you, your wish has come true. For in the pages of *California Native Gardening,* Helen Popper, long time native plant gardener, presents information gleaned from her years of gardening, and from CNPS members of the Santa Clara Valley Chapter's native gardening interest group.

Written in a conversational style, the book presents a year of gardening advice that follows the seasonal rhythms of the garden. In it one will find instructions on how to succeed in growing native plants, and insights on how to recognize seasonal rhythms and garden by them. Anyone who is already gardening with natives or is thinking about it in the cismontane region of California—that part of California west of the Sierra Nevada Crest that shares the weather pattern of dry summers and wet winters—will find this a valuable book. Although the title suggests that it is solely a gardening guide, its beautiful photography and descriptive writing make it a great choice for anyone interested in California native flora.



January may start the new year on your inside calendar, but in the native plant garden October begins the new year, for according to Popper, that is "when cismontane California leaves the dry season behind and prepares for its own green 'spring.'" The chapter for October and each subsequent one follows a simple yet effective formula. Each is designed to keep our gardening on track and to keep us ever observant of our surroundings.

First, we are greeted by a stunning garden photograph showing the beauty of the season. Then we are treated to a delightful descriptive summary depicting the rhythm of the month. For instance, May is described as being "Act II of the spring garden show," when the annual flowers wane and perennial blooms come onto the scene. August brings "a slow time. In the garden, it is a season of quiet, of scent, of sun-ripened berries, of small tasks, and rest. It is a season to enjoy."

With the rhythm dancing in our mind, we are ushered into a section that lists the tasks for the month in checklist format. This is followed by a detailed discussion of each activity that incorporates sage advice gathered from gardeners with years of gardening experience.

Specific steps are given for certain activities such as planting. We are told precisely how to unpot, prepare the roots, dig the hole, and so forth. For other tasks, we are advised to consult the rhythm of the season for guidance. January's rhythm, for example, usually includes some rainy days. When it does not, we are directed to "Fake the rain.... give it to them from the garden hose."

At the end of each chapter we are presented with a "What's in Bloom" section, in which the beauty of the garden is described, combined with a bit of gardening inspiration. September eloquently closes the gardening year with, "In the lowering light of the afternoon, it is the glint of gold that bridges the seasons." The promise of the new gardening year is on the horizon.

Following the 12 monthly chapters is a final one on landscape design. It is filled with observations on how natives can fit into conventional garden designs. The book concludes with three additional sections: a list of suggested timings for vegetative propagation of certain species, a collection of places to see native plantings, including botanic gardens and university arboreta, and a list of other native gardening books for further reference.

There are many things that make this book unique. However, there are three that I believe make it outstanding. The first is the book's month-to-month format that showcases the garden's rhythm. The second is Helen Popper's skill in sharing with us the "how to" advice garnered by many long-time gardeners, and allowing us to see the beauty of the garden through their eyes. The third is how the book is intentionally written as an *invitation* to learn the rhythm of the garden. Popper's formula is simple: come into the garden, keep your eyes and ears open, and the rhythm will unfold naturally. As it does, you will begin to garden with it and discover how it can enrich your life.

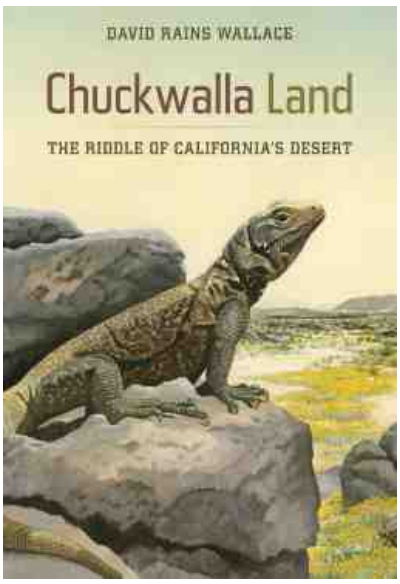
—Abbie Blair

Chuckwalla Land: The Riddle of California's Desert by David Rains Wallace. 2011. University of California Press, Berkeley, CA. 280 pp. $35.00, hardcover. ISBN#: 978-0520256163.

Passing through Arcata, California in the spring of 1983, I stopped by the Tin Can Mailman bookstore and walked out with a newly published book titled, *The Klamath Knot* by David Rains Wallace. As I left town and drove my VW east on a stormy Highway 299, the local radio station claimed it was the 80th consecutive day of precipitation on the northern coast of California, in what was a record wet year throughout the state. As a nascent young botanist just hired by Inyo National Forest, and with a few weeks to burn before my summer employment began, I set out for Death Valley to study the ongoing epic bloom. It was there in a remote desert camp that I read *The Klamath Knot*.

Ironically, it was also the spring of 1983 when Wallace first became curious about the California deserts. That spring he made trips to Red Rock Canyon and described the formations there as "grotesque and unexpectedly enchanting." He went to the Cima Cinder Cones and found them far more alive and diverse than Darwin's portrayal of young volcanic substrates. He visited the Providence Mountains of the eastern Mojave Desert and was struck by the species diversity. It was not just the show of annuals from that banner year of winter rain that got his attention, but rather the seemingly endless number of cacti and shrubs. He later learned that the mid-elevations of the eastern Mojave Desert are known to contain some of the highest shrub diversity in all of California.

Prior to his 1983 jaunts into the desert, Wallace's impression was comparable to today's popular opinion of deserts as monotonous expanses of "vacant land." He was, at best, indifferent to the species-rich ecologically



wondrous landscape. In *Chuckwalla Land: The Riddle of the California Desert*, he explains his revamped intellectual and philosophical appreciation of the desert. He does so by using vivid accounts of field trips, where he compares and contrasts his observations to the concepts and theories of scientists, perhaps hoping to better comprehend the desert's intricate natural processes and enigmatic life forms.

But this is not just another poetic field guide, and it's certainly not a book about the podgy chuckwalla lizard. Instead, Wallace makes a bold transformation from desert newbie in the early 1980s to tackling the very challenging and complex questions surrounding the origin of the desert flora and fauna. With a John McPhee-like approach to inquiry, Wallace presents 31 short narratives which chronicle the various hypotheses scientists have used to explain the evolution of life and landforms in the California deserts. And throughout the book he deftly blends into the discussion the varying popular attitudes toward the desert over time.

Early in the book he references mythology and the observations of early explorers of the US West such as Garcés and Fremont. He reviews the writings of naturalists such as Austin, Muir, Van Dyke, Jaeger, and Krutch, and presents the work of scientists Merriam, Clements, Janzen, Shreve, and I.M. Johnston. He even draws relevance from the scripts of Hollywood B-movies filmed in the desert. Turning to Charles Darwin, Wallace learns that Darwin found deserts uninteresting from an evolutionary standpoint, referring to them as an "evolutionary backwater," while more contemporary scientists saw them as an evolutionary frontier where aridity encourages selection.

Wallace dedicates a number of chapters to the often conflicting views of paleobotanist Daniel Axelrod, botanist G. Ledyard Stebbins (one of the founding members of the California Native Plant Society), and Jerry Rzedowski, a Mexican botanist. UC Davis botanist Michael Barbour said of his colleague Axelrod, "During an era when most scientists became more specialized, Axelrod retained an ecosystem-level focus and curiosity. He asked, and answered, large questions."

Axelrod's Madro-Tertiary Geoflora concept challenged the idea that desert climates and floras were old. He alleged that most California desert taxa had evolved during the past five million years as descendents of plants that had lived in the woodlands that preceded the area that is now desert. Those who sided with Axelrod identified recently derived lineages as evidence of rapid speciation, and the unique morphological and physiologi-

cal adaptations to be evidence of recent origin.

Rzedowski and others theorized that the flora developed from ancient invaders moving up from the south. Recent studies show the Sierra Nevada to be older and higher in elevation than Axelrod had assumed, casting a shadow (no pun intended) of doubt on the young flora concept.

At times Wallace seems determined to settle the controversy posed by the vaguely understood origins of California's desert. But the answers don't come easy, if they come at all. It was after reading the book's epilogue that I realized Wallace does not seem bothered by the origin riddle. In fact, it is the author's ease with this uncertainty that I found most transcendent about the book. This is not a book of answers, but rather one about the ebbs and flows of scientific inquiry.

Chuckwalla Land is highly recommended for students in college-level desert ecology courses, or those curious about our desert's geological and evolutionary past. The book is loaded with interesting personalities, observations, and unique factoids that were new for me, so readers with a general interest in desert natural history will not be disappointed. One minor objection that botanists will have is that the terms "bushes" and "shrubs" are used interchangeably throughout. And while the book is not a plea for conservation, Wallace nudges readers about the wisdom of the looming catastrophic change being imposed upon the desert by renewable energy development.

Wallace writes about the time he once consulted Stebbins about the origin of the Angiosperms, Stebbins replied "If you can make this 'can of worms' authentic, up to date, and interesting to the non-biologist, it will be a major achievement." Indeed that is what Wallace has done with *Chuckwalla Land*; he presents the arguments about the origin of the desert as well as any text on the subject. Those who read *Chuckwalla Land* will be inspired to visit the desert to observe the pupfish, ocotillo, packrats, fan palms, lizards, and the clonal rings of creosote bush, and see them in a new and different way. And that is a major achievement.

—Jim Andre

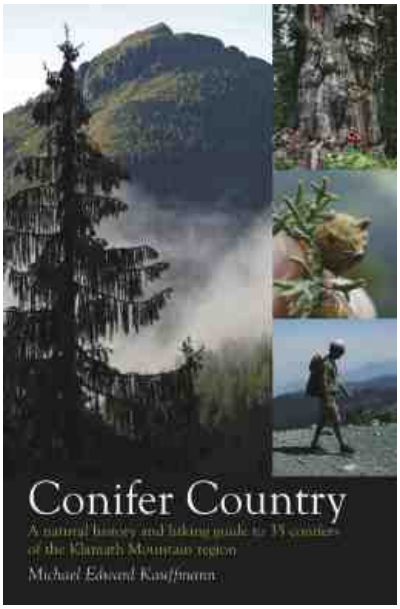
Conifer Country: A Natural History and Hiking Guide to 35 Conifers of the Klamath Mountain Region by Michael Edward Kauffmann. 2012. 206 pages. Backcountry Press, Kneeland, CA. $22.95, soft cover. ISBN# 978-0-578-09416-8. Order online through CNPS.

Conifer Country by Michael Kauffmann is the perfect guide to the conifers in the Klamath Mountain region. It is a fresh and personal journey into one of the richest lands on earth. Few places in the world offer the diversity in conifer genera and species as the Klamath Region will. Few regions on the planet are as rich in geologic diversity and offer the range of elevation gradients, aspects, habitat diversity, and climatic profile.

We can think of the Island of New Caledonia in the Australasian region of the South Pacific where 43 or more endemic conifers occur, many restricted to serpentine soils. As *Conifer Country* describes, the Klamath Mountains also host extensive serpentine areas, and venturing a little east and west and north from the Klamath Range easily brings the numbers of conifers close to or surpasses those of New Caledonia. While the Klamath Mountains cannot boast as many endemics, there certainly are some spectacular ones, like Brewer's spruce *(Picea breweriana)*, for example, as well as many other rare and disjunct stands and occurrences.

Who is this book written for? On the back cover the author explains:

> It is for plant lovers, hikers, and backpackers—for the novice and expert botanist alike, it is for people who want to get into the field, explore wild places, and understand why the Klamath Mountain region nurtures unique plant diversity.



In a world bombarded by smart phone applications and virtual realities, *Conifer Country* challenges us to get back in touch with our ancestral adventuring roots. Michael Kauffmann entices us to go out to find these majestic and wonderful conifer stands. Though he cautions us to prepare for rugged wilderness terrain in lands devoid of cell phone towers and acknowledges that fitness and wilderness skills are essential, he provides detailed maps of over 25 hikes and a wealth of conifer education. The guide covers taxonomy, biogeography, paleontology, human use, Native American perspectives, fire ecology, local

history, and much more. It includes color plates to aid in identification with generously interesting species descriptions. Best of all, the book is grounded in Kauffmann's direct experience exploring the Klamath Region.

Kaufmann starts out by giving special thanks to a handful of individuals including the late Dr. John O. Sawyer, and expresses a tremendous appreciation for Sawyer's mentoring and friendship during his personal discovery of this magical landscape. Many of us first met Michael Kauffmann during the 2009 CNPS Conservation Conference in Sacramento. In planning the Northern California Regional Session for the 2009 conference, we eagerly sought someone who could speak knowledgeably on the topic of northwestern California conifers. When Dr. Sawyer was asked who might present on this important topic, he immediately recommended the author, Michael Kaufmann.

For those who don't know Michael, he lives with his wife and their new baby near Arcata. He teaches science at Fortuna Middle School, lectures at California State University, Humboldt, and is also a member of CNPS.

—Brett Hall

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SUBMISSION INSTRUCTIONS

CNPS members and others are invited to submit articles for publication in *Fremontia.* If interested, please first send a short summary or outline of what you'd like to cover in your article to *Fremontia* editor, Bob Hass, at bhass@cnps.org. Instructions for contributors can be found on the CNPS website, www.cnps.org, under Publications/Fremontia.

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(*continued on inside back cover*)

FROM THE EDITOR

The California Native Plant Society (CNPS) is all about collaboration. We believe in working with others to solve problems and protect our native habitat. This fact, in itself, provides a compelling reason to become a member of CNPS, and is one reason many long-time members remain more committed than ever to the organization.

Collaboration takes many forms, can be found at all "levels" of governance, and occurs in vastly different arenas. Here are but a few examples to prove the point.

Many CNPS members and their chapters have participated in the public comment process when county general plans come up for review and renewal. Other conservation organizations are often involved in these very important public policy deliberations. Representatives from CNPS and like-minded groups frequently converse informally to share notes and strategize, leading to a better conservation result.

Similar opportunities present themselves with regional issues. For example, the CNPS Sacramento Chapter participates in Habitat 2020, a coalition of organizations collaborating to protect wildlife and native plants.

At the state level, CNPS has played a central role in shaping the Desert Renewable Energy Conservation Plan, in partnership with state and federal agencies and advocacy groups. The initiative is to protect desert wildlife and sensitive plant species, while expediting renewable energy production.

CNPS has worked with a broad coalition to identify areas containing the most sensitive native habitat so they will be left undeveloped, and to develop plant priority lists. Thus, the Plan includes more species than would otherwise be the case. Collaboration can be an effective tool whereby groups with shared interests leverage resources for a common purpose.

—Bob Hass