# THE JEPSON GLOBE

A Newsletter from the *Friends of The Jepson Herbarium*

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## Curator's Column: Adaptive Radiation Revisited

*By Bruce G. Baldwin*

The origin of endemic Hawaiian silverswords from California tarweeds (subtribe Madiinae; Compositae/Asteraceae) has interested me since graduate school, when it became possible to confirm and extend Sherwin Carlquist's hypothesis of a tarweed ancestry of the diverse assemblage of Hawaiian plants known commonly as the silversword alliance. Over the years, collaborative studies with other silversword researchers helped to establish that the Hawaiian silversword alliance likely descended from a hybrid ancestor with a duplicated genome (i.e., an allopolyploid) that was bird-dispersed to the oldest modern high Hawaiian island, Kaua`i. That mainland tarweed ancestor (which was a member of the clade that presently includes *Carlquistia*, *Anisocarpus*, and close relatives) gave rise to a Hawaiian lineage of such extreme ecological diversity that it is widely regarded as a classic example of adaptive radiation (i.e., diversification marked by major ecological shifts). Taxa of the silversword alliance include trees, shrubs, rosette plants, mat-plants, cushion-plants, and lianas and occur across much of the broad spectrum of environmental settings found in the Hawaiian Islands, from dry, desert-like habitats to some of the wettest places on earth. Some of these plants are so divergent in morphology that they were originally classified as members of dif-

*(Curator's Column continued on page 8)*

Susan in a Great Lakes coastal wetland near the Straits of Mackinac, holding a collection of *Salix*. Photo credit: Seth Kauppinen.

## Susan Fawcett New Research Botanist

Susan Fawcett returned to the University and Jepson Herbaria in September as a Research Botanist. She recently completed her doctoral studies at the University of Vermont, as a member of the Barrington/Sundue lab, where she worked on the fern family Thelypteridaceae. Her research involved a major international collaborative effort to sequence genomic data for over 600 species, most of which are vouchered in the University Herbarium. With Berkeley fern curator Alan Smith, she co-authored a monographic revision of all genera of the family, now in press at the Botanical Research Institute of Texas Press.

Dr. Fawcett grew up in the northern

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## The Connection Between the First Head of the Herbaria, PCR, and the COVID-19 Pandemic

*By Richard L. Moe and Staci Markos*

Yellowstone National Park is full of wonder and beauty; tourists come to see waterfalls, geysers, bison, wolves, and the richly colored thermal pools. In addition to the visitor experience, thousands of scientific studies have been conducted in the park and, in 1898, the first formal research permit was issued to William Setchell for the study of Yellowstone's microorganisms. Early in his career, Setchell, Chair of the Department of Botany at UC Berkeley (1895-1934), was interested in freshwater blue-green algae (or Cyanobacteria) and the upper temperature limits of life. He conducted a thorough study of "hot springs" in California and Yellowstone National Park where he made several hundred collections from Mammoth Hot Springs, the Norris, Lower, Middle, and Upper Geyser Basins, and West Thumb Geyser Basin. In 1903, the results of Setchell's study were pub-

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ALSO IN THIS ISSUE

## Studying Lupines, it Takes a Lifetime!

Teresa Sholars has studied lupines for over 30 years. It all began while she was a graduate student at UC Berkeley and Jim Hickman invited her to contribute a treatment for the *Jepson Manual* (published in 1993). Teresa wrote the treatment for the perennial species of *Lupinus* and, since then, she has continued her study of this fascinating (and difficult!) genus. She has contributed taxonomic treatments to TJM (1993), TJM2 (2012), the *Jepson eFlora* (2020), the *Flora of North America* (in press), and *Legumes of Arizona: an Illustrated Flora and Reference* (in press). She has actively assisted the California Native Plant Society and countless other agencies by providing expert advice on the rarity and distribution of lupine taxa (as well as the flora and vegetation of the Mendocino Coast). She has taught numerous workshops on the genus and, to share her love and enthusiasm for all things lupine, she began a collaboration with Stuart Wilson to write a popular book about lupines. In her new taxonomic revision in the *Jepson eFlora*, Teresa added two taxa, newly recorded from California.

Teresa in the field with *Lupinus elmeri* on South Fork Mountain, Trinity County (July 2004). Photo by Clare Golec.

(1) *Lupinus magnificus* var. *hesperius*, a rare taxon from Inyo County that occurs on the east slope of the Sierra, near Lone Pine. The leaves are densely woolly with stiff hairs, the flowers are smaller than in other varieties of *L. magnificus* and the keel of each flower is straight, not curved.

(2) *Lupinus lepidus* var. *aridus*, an uncommon taxon in California (found in a few locations in the Great Basin Province) that occurs on bluffs, barrens, and sandy or gravelly hillsides in sagebrush scrub or pinyon/juniper woodland. There are two California specimens housed in the herbarium at BLM Eagle Lake field office and more collections of this taxon are needed.

Another important change in the revised treatment is the circumscription of shrub *Lupinus excubitus*, which has been narrowed to plants occurring in the Mojave Desert and the adjacent southern Sierra Nevada. All other members of *L. excubitus* (TJM2) are now circumscribed under *Lupinus albifrons*.

Teresa is always happy to receive feedback and questions about her treatments and is especially interested in new populations that have not yet been documented. She can be reached at: tsholars@mcn.org

## The Long Lasting Value of Endowment Funds

Help ensure a bright future for the University and Jepson Herbaria by designating part of your estate, life insurance policy, or IRA to Herbaria Futures, an endowment fund that provides critical support to the collections and Herbaria programs.

Making a planned gift doesn't have to be complicated – you don't need a will or trust to include the Herbaria in your long-term plans. Beneficiary designations are a great way to direct your gift to the Herbaria.

Over the last 20 years, the funding sources for the Herbaria have changed significantly and as we continue to navigate the challenges, one thing has become clear – building the endowment funds is critical to ensure that the Herbaria remain at the leading edge of floristic studies, data management, public outreach, and curation and care of botanical collections.

For more information, please contact Staci Markos (smarkos@berkeley.edu)

A beautiful, sunny day at Point Lobos State National Reserve. Photo by Staci Markos.

## Thank you to all of our Donors for Supporting the *Jepson eFlora*!

## *Jepson eFlora* Revision 8

Revision 8 involves treatments that have changed taxonomically (e.g., taxa added or deleted) since Revision 7 of the *Jepson eFlora*. A summary of the changes incorporated in the *eFlora* is presented below and online *(https://ucjeps.berkeley.edu/eflora/supplement_summary.html#rev8)*.

AGAVACEAE:

*Chlorogalum*: Three taxa moved to new genus *Hooveria*, the rest retained in *Chlorogalum*

*Chlorogalum parviflorum* changed to *Hooveria parviflora*

*Chlorogalum purpureum* changed to *Hooveria purpurea*

*Chlorogalum purpureum* var. *purpureum* changed to *Hooveria purpurea* var. *purpurea*

*Chlorogalum purpureum* var. *reductum* changed to *Hooveria purpurea* var. *reducta*

ASTERACEAE:

*Crepis pulchra* added, as naturalized

*Eucephalus* transferred to *Doellingeria*, leaving no species of *Eucephalus*

*Eucephalus breweri* changed to *Doellingeria breweri*

*Eucephalus engelmannii* changed to *Doellingeria engelmannii*

*Eucephalus glabratus* changed to *Doellingeria glabrata*

*Eucephalus ledophyllus* var. *covillei* changed to *Doellingeria ledophylla* var. *covillei*

*Eucephalus tomentellus* changed to *Doellingeria tomentella*

*Eucephalus vialis* removed, not in California

*Helianthus exilis* rejected, a synonym of *Helianthus bolanderi*

FABACEAE:

*Lupinus excubitus* var. *austromontanus* changed to *Lupinus albifrons* var. *austromontanus*

*Lupinus excubitus* var. *hallii* changed to *Lupinus albifrons* var. *hallii*

*Lupinus excubitus* var. *johnstonii* changed to *Lupinus albifrons* var. *johnstonii*

*Lupinus excubitus* var. *medius* changed to *Lupinus albifrons* var. *medius*

*Lupinus lepidus* var. *aridus* added, as native

*Lupinus variicolor* changed to *Lupinus littoralis* var. *variicolor*

*Lupinus magnificus* var. *hesperius* added, as native

*Lupinus holmgrenianus* changed to *Lupinus polyphyllus* var. *humicola*

*Lupinus latifolius* var. *barbatus* rejected, a synomym of *Lupinus latifolius* var. *viridifolius*

*Lupinus latifolius* var. *columbianus* moved to *Lupinus latifolius* var. *latifolius*

*Lupinus saxosus* changed to *Lupinus polyphyllus* var. *saxosus*

PLANTAGINACEAE:

*Antirrhinum multiflorum*, an illegitimate name, replaced by *Antirrhinum thompsonii*

*Mohavea* transferred to *Antirrhinum*, leaving no species of *Mohavea*

*Mohavea confertiflora* changed to *Antirrhinum confertiflorum*

*Mohavea breviflora* changed to *Antirrhinum mohavea*

RHAMNACEAE:

*Ceanothus foliosus* var. *viejasensis* newly described, added, as native

*Ceanothus pendletonensis* newly described, added, as native

*Ceanothus thyrsiflorus* var. *obispoensis* newly described, added, as native

*Ceanothus pendletonensis.*
Photo by Jon Rebman.

*Antirrhinum confertiflorum.*
Photo by Susan Fawcett.

*Hooveria purpurea* var. *reducta.*
Photo by Dave Keil.

# The California Botanist Certification Program

*By David L. Magney*
*Program Manager, Special Projects*
*California Native Plant Society*

In 2015, the California Native Plant Society (CNPS) formally established a certification program for California botanists. The goal of the certification program is to help ensure that the most qualified people conduct California's environmental reviews and that decision-makers have the information they need to make sound land-use decisions.

The California Environmental Quality Act (CEQA) requires that a thorough review process is conducted for every development project in the state and that process includes basic baseline surveys for biodiversity. Formal reviews are most typically conducted by environmental consultants who prepare biological resources impact assessments that are intended to inform the public and decision makers, typically county boards of supervisors and city councils, about the impacts a proposed project will have on the environment. Those decisions have real effects on the California flora and a proper assessment of natural resources is fundamental to a thorough environmental review. The California Botanist Certification program provides a mechanism to recognize botanists who are qualified to conduct baseline surveys and impact assessments on botanical resources.

The program is led by eight individuals, the Board of Certification (BOC), who represent federal and state agencies, environmental consultants, and conservation organizations. The BOC has developed a code of ethics for professional botanists, levels of certification, testing criteria and questions, a procedures manual, and an outline of certification renewal procedures. They also established an advisory committee that includes botanists from around the state.

There are two levels of certification, one for consulting botanists (who likely write CEQA assessment reports) and one for field botanists (who likely conduct plant surveys). Four separate exams capture the range of skills and knowledge that certified botanists need to demonstrate their knowledge. Field Botanists must pass exams 1-3 and Consulting Botanists need to pass exams 1-4.

1) Identify 500 common and characteristic native and naturalized California plants by sight.

2) Demonstrate a basic understanding of botanical terminology and navigate dichotomous identification keys using *The Jepson Manual.*

3) Have an in-depth knowledge of the California flora and natural vegetation, understand how to perform botanical surveys and conduct sampling, and be familiar with online tools to determine which species are rare or likely to be present on a project site.

4) The topics of the fourth exam cover environmental regulations, report content, assessment methods, elements of mitigation measures and monitoring, and habitat restoration planning.

The certifications are designed for experienced and highly qualified botanists and although it is not a formal requirement, the expectation is that at least five years of experience is needed before a botanist has enough knowledge and practical experience to pass the exams.

Part of maintaining/renewing certification requires earning Professional Development Credits (PDCs), i.e. continuing education. The certification is valid for five years, and renewed upon satisfaction of earning 50 PDCs by the end of the five years.

If you are interested in becoming a certified botanist or maintaining your certification, the Jepson Herbarium can help! There are over 50 Jepson Videos for taxa that are included on the site-ID list and most Jepson Workshops offer professional development credits.

For more information about the program, see the CNPS website or contact David Magney (dmagney@cnps.org).

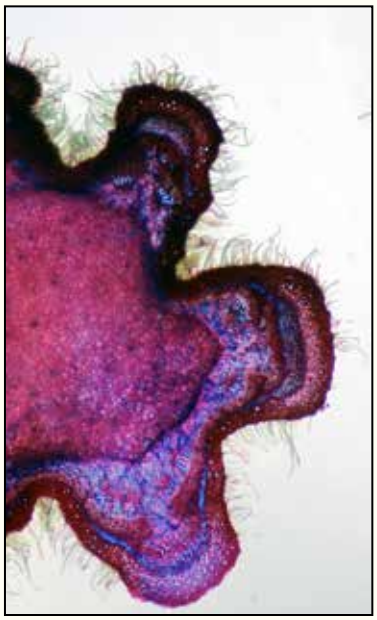
## Preparing for the Certification Exam? The Jepson Videos are a Great Study Aid!

Right: This video discusses four genera in the Themidaceae and shows the distinguishing features of each one (*Brodiaea, Dichelostemma, Dipterostemon, and Triteleia*). Photo by Staci Markos.

Left: If you are in coastal or montane woodlands and detect a sweet floral aroma, it might be the genus *Rhododendron*! Watch this video and learn about the three *Rhododendron* species that occur in California. Photo by Julie Kierstead (*Rhododendron occidentale* at The Cedars, Sonoma County.)

## News from our Alumni

Dr. Joyce G. Chery, an alumna (Ph.D. 2019) of Integrative Biology, is a new faculty member in the School of Integrative Plant Sciences at Cornell University! While at Berkeley, Joyce studied how the strange woods of Sapindaceae lianas are built, both developmentally and evolutionarily. These plants twist up to the forest canopy without breaking and in doing so, have evolved some of the most unusual and complex woods in nature. Her dissertation involved bioinformatics, molecular systematics and phylogenetics, taxonomy, anatomy, morphology, and comparative phylogenetic methods. She was an active member of the University and Jepson Herbaria community and was co-advised by Profs. Carl J. Rothfels and Chelsea D. Specht (Cornell University). As a graduate student, Joyce was an NSF Graduate Research Fellow, Berkeley Chancellor's Fellow, Smithsonian Predoc Fellow, and a Dissertation Year Fellow.



Early plant development is altered to create a star-shaped stem with vascular bundles exclusively in the lobes. This unusual primary plant bauplan serves as a developmental and evolutionary precursor to variant secondary growth.

Alumna Dr. Joyce G. Chery. Photo credit: Elsina Chery.

To examine aspects of their growth, Joyce made field collections of *Paullinia* species at the Smithsonian Tropical Research Institute in Barro Colorado Island, Panama, and rehydrated stem sections from herbarium vouchers for study. Through her anatomical work, she identified five patterns of stem growth, ranging from circular to lobed, to star-shaped cross-sections. She determined that all forms of variant wood growth trace back to the same modification during early plant development that disrupts the distribution of sugar- and water-conducting tissues. As a consequence, the asymmetrical shapes of liana stems likely help lianas to anchor themselves to trees, thus allowing woody vines to twist and turn as they grow.

Joyce's work may help answer another question – why the numbers of lianas are increasing in tropical forests relative to trees. Their overabundance can reduce a forest's ability to store carbon, which is becoming increasingly important as global levels of atmospheric carbon rise.

Joyce's research group at Cornell will focus on the question: "How do plants move?" In the spirit of her training in Integrative Biology at Berkeley, she aims to take a cross-disciplinary approach, utilizing anatomy, developmental biology, molecular and cell biology, and evolutionary biology, to link fine scale mechanisms to large scale macroevolutionary patterns to address this fundamental question.

Brent Mishler and two Herbaria alumni, Kirsten Fisher and Jenna Ekwealor, were lead instructors of a virtual Jepson Workshop "Wonders of a dryland moss: *Syntrichia* from genomes to ecosystems," hosted in partnership with the collaborative research project "Desiccation and Diversity in Dryland Mosses," with funding provided by the US National Science Foundation. In order to make the workshop available more broadly, recordings of all eight 15-minute presentations have been uploaded to YouTube. See introductory page and links to videos here. <https://3dmoss.berkeley.edu/community-outreach/public-workshops/wonders-of-a-dryland-moss/>

*Syntrichia caninervis*, growing at 2,270 meters in the Sheep Mountains (Desert National Wildlife Refuge, NV). Photo by Kirsten Fisher.

*(Continued from page 1)*

lished in the journal Science. Setchell's work set the stage for a deeper understanding of the blue-green algae and archaea that live in thermal waters.

Decades later, in 1964, Thomas Brock, a microbiologist and university professor, was visiting Yellowstone and by chance heard a ranger giving a talk near a thermal pool filled with vibrant color, which was attributed to blue-green algae and other microorganisms. This captured Brock's interest and for 10 years, he conducted field and laboratory research on thermophilic microorganisms in Yellowstone National Park. At that time, the diverse world of extremophiles, organisms that thrive in extreme environments, was not well understood. Brock's discoveries changed scientific thinking about a fundamental condition of life: the range of temperatures in which organisms can exist. He and an undergraduate student, Hudson Freeze, collected, isolated, and cultured an organism thriving at 70 °C (160 °F) which they named *Thermus aquaticus*. The understanding that *T. aquaticus* could tolerate high heat prompted an entirely new field of research and 20 years later, the polymerase chain reaction (PCR) made it possible to speed up replication of DNA in the test tube. The key ingredient to PCR is Taq polymerase, an enzyme in *T. aquaticus*. PCR has revolutionized science and there are many modern-day applications of the technique. For example, PCR tests are one method that is used to test for SARS-CoV-2.

Morning Glory Pool, Yellowstone National Park.

There isn't a direct connection between Setchell's work and the development of PCR but each step along the circuitous path to discovery underscores the value of basic research. The Herbaria remain committed to the development of scientific knowledge and understanding the natural world that surrounds us. It's impossible to know what will be developed from the research being done today but one thing is certain: the data and resources developed and shared by the University and Jepson Herbaria have been and will continue to be an important public source of information for investigators around the world.

*Special thanks to Jen Whipple for her review of this article.*

All photos by Staci Markos.

Mammoth Hot Springs, Yellowstone National Park.

Grand Prismatic Spring, Yellowstone National Park.

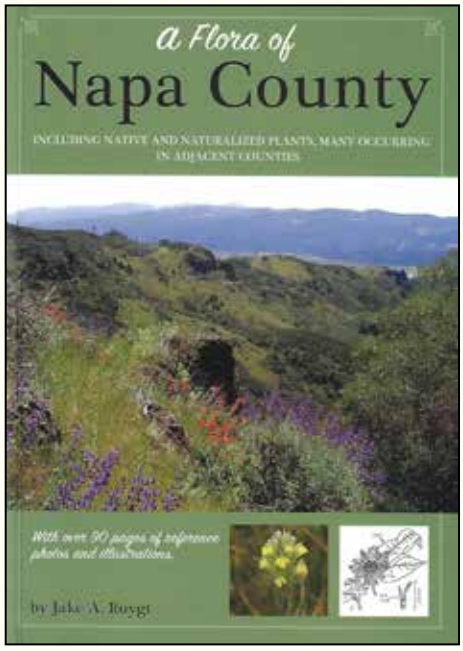
## In Challenging Times, Friends Make all the Difference!

Amidst a global pandemic, it's heartwarming to see two longtime colleagues maintaining their tradition of eating lunch together (socially distant and masked, of course). For over 50 years, John Strother (left) and Alan Smith (right) have shared their lunch hour, taking a sack lunch outside for a moment of fresh air. Friendships have helped sustain many of us through these difficult times and we are grateful to all of our *Friends* and colleagues for their support, collaboration, and shared sense of community.

# UC JEPS Specimens used for New Book on Napa County Flora

Jake Ruygt recently completed his book, *A Flora of Napa County*, which was published by the California Native Plant Society and released in December 2020. Jake has studied the flora of Napa County for over 40 years and the book is based on his field observations, herbarium research, and historical studies of many botanists, including Willis Linn Jepson. The flora, 510 pages in length with 92 plates, includes species descriptions, color photographs, and detailed botanical illustrations for nearly 1,700 native and naturalized taxa. The high levels of species diversity in Napa County stem from the diversity of habitat conditions that occur across a relatively short distance (Napa County covers about 788.5 square miles). Geology, rainfall patterns, and elevational gradients also play an important role in supporting the county's rich flora. With his book, Jake hopes to help foster a greater appreciation for natural resources that leads to lasting conservation of the exceptional biodiversity within Napa County.

While working on the book, Jake was a frequent visitor to the University and Jepson Herbaria, and he made countless visits beginning at a time when navigating the herbarium required climbing many flights of stairs covering at least seven floors. Here, he had the opportunity to meet staff including Dr. Larry Heckard and Dr. James Hickman as they prepared a revision of the *Jepson Manual* in the 1980s. Examination of voucher specimens was required to investigate taxonomic changes, confirm identifications, and learn about historic occurrences of populations and species that are no longer extant in the county.




In a recent note, Jake wrote: *The UC/Jepson Herbaria is a tremendous resource and I suspect there is yet much information to be discovered among the folders. I would like to extend my deepest gratitude to all those who helped me along my path to completing this book.*

Thank you, Jake, for your amazing work and dedication to California botany!

All photos by Jake Ruygt.

*Sidalcea hickmanii* subsp. *napensis*. This taxon was discovered by Jake during his work and described by Steven R. Hill in 2008. Holotype, Jake Ruygt 2959, 15 May 1992 (JEPS 110725).


*Trichostema ruygtii*. Collected by Jake in 2004 and described by Harlan Lewis in 2006 based on Jake's collection. Holotype, Jake Ruygt 3089, 21 Aug 2004 (JEPS 108655).

*(Curator's Column, continued from page 1)*

ferent major taxonomic groups (tribes) of the sunflower family. Yet, they are all so closely related to one another that hybrids of at least marginal fertility can be produced by crossing any pair of species in the alliance, as shown by Gerry Carr and Don Kyhos in the 1980s.

Studies of adaptive radiations in islands have improved understanding of how so much ecological diversity may arise quickly. Ecological release from the selective constraints imposed by interference with other organisms, such as competing plants and herbivores, may allow for survival of plants with trait combinations that ordinarily would be selected against in their ancestral environment. This ecological release in the presence of a wide diversity of under-occupied habitats may allow for some plants (and animals) to "explore" ecological space much more freely than in mainland settings. For lineages with sufficient genetic variation to be able to respond to such opportunities, such as the silversword alliance – with its hybrid polyploid ancestry and strongly outcrossing reproductive system – the potential for adaptive radiation may be high, especially with their ecological priority as early arrivals in the modern high islands.

*Anisocarpus scabridus,* a perennial herb of semi-barren metamorphic scree, mainly in the high North Coast Ranges; a close relative of the Hawaiian silversword alliance. Photo by Bruce G. Baldwin.

*Carlquistia muirii,* a perennial herb of exposed granitics, mainly in the southern high Sierra Nevada; another close relative of the Hawaiian silversword alliance. Photo by Bruce G. Baldwin.

But just how freely has adaptive radiation occurred in these Hawaiian descendants of California tarweeds? Ecophysiological studies have shown that some major trait differences in the silversword alliance appear to have arisen without significant phylogenetic constraint, in keeping with the general view of adaptive radiation as being largely free of such limitations. I recently concluded a collaborative study with Will Freyman (UC/JEPS) and Ken Wood (National Tropical BotanicalGarden,Kaua`i) indicating that the silversword alliance radiation has been much more biased in directionality than we previously imagined. Based in part on a better resolved and sampled phylogenetic analysis of the silverswords and their Californian relatives, it now appears that the mainland tarweed ancestor of the silversword alliance was dry-adapted and that dispersal events between islands that led to the evolution of new species of the silversword alliance involved dry-adapted members of the alliance. Lineages that adapted to wetter habitats evidently evolved repeatedly but those transitions appear to have been largely unidirectional, without evolutionary reversals back to dry habitats. Evolutionary transitions to bog habitats appear to have been irreversible or nearly so, as well. In other words, once established on an island, members of the silversword alliance may have been much more successful at invading wet habitats than the mainland tarweeds, but lineages that transitioned to wet habitats may have done so at the cost of forever leaving behind their xeric-adapted heritage. Why we see no compelling evidence of reversals is still an open question – it could be that re-evolving dry-adapted traits may be evolutionarily challenging as a result of niche pre-emption by close relatives already present in dry habitats or because of intrinsic obstacles to re-evolving successful adaptations to dry environments once they have been lost. We are currently pursuing additional studies of the California tarweeds and Hawaiian silversword alliance that we hope will shed further light on these and other questions about their diversity and diversification.

*Dubautia waialealae,* a cushion-plant in the silversword alliance from Wai`ale`ale bog, Kaua`i, one of the wettest places on earth. Photo by Kenneth R. Wood.

## Volunteer to Map Plant Specimens in the Consortium of California Herbaria's "100 Club"

*By Katie Pearson, Project Manager, California Phenology TCN*

Botanists and naturalists across the state are banding together to deepen our knowledge of where California plants have historically occurred. In September 2020, the California Phenology (CAP) Network—an NSF-funded collaboration of 28 herbaria, including UC/JEPS—launched the "100 Club," a team of experts who are trained to "georeference" herbarium specimen records in CCH2 (cch2.org), a new data portal that serves data from California herbaria. Members of the 100 Club have experience with one or more geographical areas, and they use this expertise to translate textual descriptions of specimen locations into latitude and longitude coordinates: dots on a map.

The CAP Network aims to georeference 300,000 herbarium specimens by 2022 and they are well on the way to achieving that goal; however, producing accurate georeferences is often challenging. This is where the expertise of local experts comes into play.

"Anyone can read a label and put a dot on the map, but in order for that dot to be accurate, you need people who know an area well. There is no replacement for local knowledge about a place,"says Jenn Yost, professor at California Polytechnic State University and lead PI of the CAP Network. "Many of our labels refer to place names not found on any map, but if it's your backyard, you'll know right where it is."

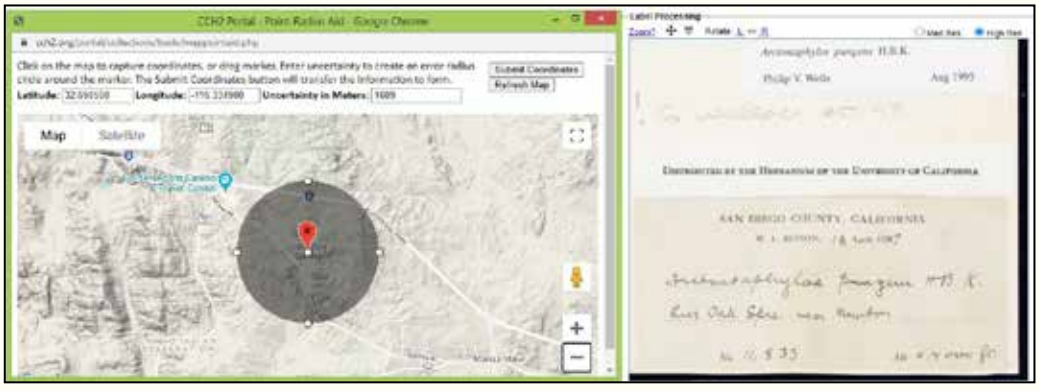
To date, the 100 Club includes 26 active members representing many vocations and locations, from self-taught botanists, to ecological consultants, to professional botanists and taxonomists, each with expertise ranging from Baja California to the Pacific Northwest. Similarly, specimens in CCH2 originate from across the state and even the globe, underscoring the importance of a diversity of experienced georeferencers. Together, the 100 Club has georeferenced over 7,400 specimen records in only a few months, yet the process has been anything but tedious.

"For me, georeferencing is a multidimensional experience," explains Chris Hauser, manager of the Panoche Valley Preserve and avid 100 Club Member. "When I'm georeferencing an herbarium specimen, it's as if I'm above tree line at 10,000 feet in the mountains with Dean Taylor or walking through a dark coast redwood forest with Jeff Norman. I can almost hear the wind in the trees, smell the vegetation, and feel the soil under my feet."

Georeferencing herbarium specimens can be an adventure into the past as members explore historical collecting locations—parks, forests, mountains, valleys, and preserves—some of which no longer exist in their natural state. Georeferencers also become familiar with historical and recent collectors, their collecting patterns, and their label styles. Each specimen is like a time capsule, embodying the tireless efforts of passionate people and their botanical escapades.

The CAP Network invites everyone with some naturalist experience to join the historical exploration by becoming part of the 100 Club. Each member completes the CAP Network's online georeferencing training course (https://www.capturingcaliforniasflowers.org/georeferencingcourse.html) and receives live, virtual training via Zoom. As members begin to work in the CCH2 portal, they are fully supported through additional training and communication. To sign up, fill out the interest form here: tinyurl.com/37c3m5xb.

Thanks to the dedicated efforts of this group of naturalists, more herbarium specimens are georeferenced each day, helping us build a more comprehensive understanding of where and when plants have occurred across California and beyond. These data are critical in the face of a changing climate and the potential effects of those changes on California's precious plant diversity.




The label from a specimen of *Arctostaphylos pungens* collected by W. L. Jepson in 1927 and an example georeference for the specimen.

# Memorial & Honorific Gifts

***In honor of Lew Feldman***
Ramona Davis

***In honor of All Herbaria Personnel***
Edith Horwood & Don Selcer

***In honor of Ken Himes***
Dan Gluesenkamp

***Forest Service Botany staff in honor of***
Lisa Hoover and *Lupinus constancei*

***In memory of Barbara Joe Hoshizaki***
Takashi Hoshizaki

***In memory of Lissie Kern***
Adam Singer

***In honor of Dylan Neubauer***
Ray Collett Trust

***In memory of Rod Park***
Mary Beth Burnside

***In memory of Jonathan Robbins***
Brett Hall

***In memory of PC Silva***
John West

***In honor of Alan R Smith***
Beth Alexander
Patricia Gordon
Tom Lemieux
Leslie Leve

***In memory of Benito Tan***
David Hutton & Valerie Ventre-Hutton

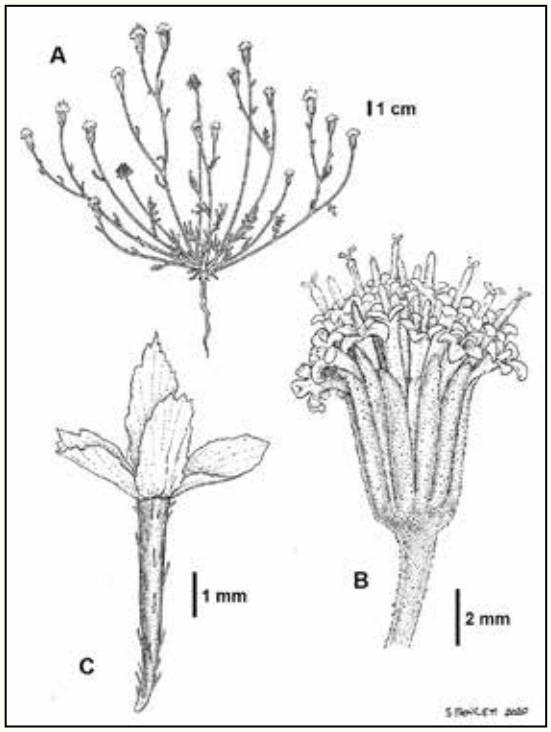
***In honor of Margriet Wetherwax***
Alison Colwell

*(Continued from page 1)*

lower peninsula of Michigan, where she is now faculty at the University of Michigan Biological Station, teaching botany and botanical illustration. As an undergraduate student, she attended the University of Michigan, where she worked in the Museum of Natural History and studied in the School of Art and Design, specializing in scientific illustration. She earned a Masters Degree in Biology from Northern Michigan University in Marquette, where she studied the flora and ecology of a neotropical savanna on the island of Utila, off the Caribbean coast of Honduras.

Dr. Fawcett is a National Geographic Explorer and has conducted fieldwork in Mexico, Honduras, Nicaragua, Venezuela, Peru, Puerto Rico, Jamaica, the Dominican Republic, Hawaii, and Fiji. She is no stranger to California botany, however, and spent a season as a field technician for Dr. Susan Harrison at UC Davis, documenting plant response to drought on serpentine and non-serpentine soils. She has collaborated with UC Berkeley Herbaria researchers, including Drs. John Game and Alan Smith, recently describing a new species and documenting new fern and lycophyte records from Fiji.

In addition to her primary research interests in taxonomy, phylogenetics, and floristics, Dr. Fawcett works professionally as a botanical illustrator. She has contributed illustrations for work by University and Jepson Herbaria researchers Drs. Matt Guilliams, Genevieve Walden, Barbara Ertter, and Bruce Baldwin. Dr. Fawcett has a history in the Herbaria, initially volunteering as a plant mounter in 2013 after completing her Masters Degree, and assisting Dr. Alan Smith with fern curation and identification. She later joined the staff to help with digitization grant-funded projects, including one on the flora of the Baja California peninsula, and another on bryophytes, working at the grant-partner institution, the California Academy of Sciences.




*Chaenactis kyhosii* illustration by Susan Fawcett.

She is happy to be back in Berkeley, in time for spring wildflower season, and to continue her research on the Thelypteridaceae, with access to the world-class fern collection at the University Herbarium, surrounded by friends and colleagues. To learn more about Dr. Fawcett's research and publications, visit her page: researchgate.net/profile/Susan_Fawcett2

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## Jepson Herbarium Resources & Projects related to the California flora

The Jepson Herbarium includes approximately 400,000 plant specimens from California.

**Director:** Brent D. Mishler
California Phylodiversity Project
Systematics and ecology of *Syntrichia*

**Jepson Curator:** Bruce G. Baldwin
*Jepson eFlora*
Systematics and evolution of California tarweeds and relatives (tribe Madieae, Compositae), *Chaenactis* (Chaenactidieae, Compositae), and *Collinsia* (Plantaginaceae).

**Curator of Ferns and Lycophytes:**
Carl Rothfels
Divergence and hybridization in Californian ferns and lycophytes (especially *Notholaena*, *Cystopteris*, *Isoëtes*).

**Tucker Curator of Lichenology:**
Klara Scharnagl
Ecology and evolution of symbiosis in California lichen communities

**Asst. Director for Development & Outreach, and Globe editor:**
Staci Markos

**Biodiversity Informatics Manager:**
Jason Alexander

**Collections Staff:**
Kim Kersh and Ana Penny

**Archivist and Librarian:**
Amy Kasameyer

**Public Programs:** Staci Markos, Roxanne Andersen

**Membership, workshop enrollment, and *Globe* design:** Roxanne Andersen

**Staff Research Associate:** Bridget Wessa

**Jepson Videos:** Staci Markos, Amy Kasameyer

**Trustees:**
Vice Chancellor Emeritus Beth Burnside; Professor Emeritus Russell Jones; Professor Emeritus John Taylor and Professor Brent D. Mishler (ex officio)

***Constancea***: UC Publications in Botany (online)

***See our website for a full list of Herbaria projects, resources, and people.***

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## New Jepson Videos on YouTube

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*Cercis*

We've organized the Jepson Videos into playlists! Viewers can now find videos in a particular family, region, or habitat. For example, check out our playlist for desert species.

*Sarcodes*

*Dendromecon*

*Marah*

*Aquilegia*