



# THE JEPSON GLOBE

A Newsletter from the *Friends of The Jepson Herbarium*

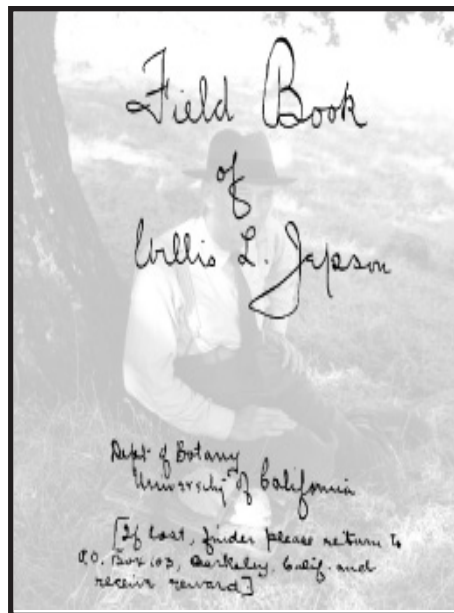
VOLUME 19 NUMBER 1, May 2008

## Curator's Column: California's Amazing Hawaiian Flora

by Bruce G. Baldwin

In the last decade, systematic studies have shown that a surprising diversity of western North American flowering plants gave rise to important elements of Hawaii's native flora. Tarweeds (*Madia* and relatives), sanicles (*Sanicula*), violets (*Viola*), hedge nettles (*Stachys*), and, probably, champions (*Silene*) are among the groups familiar to California botanists that have spawned impressive radiations of Hawaiian plants following ancient, long-distance dispersal from North America. The idea that bird-mediated dispersal of flowering plants could occur across such a vast oceanic barrier (~3,500 km) was rejected by such eminent early 20<sup>th</sup> Century botanists as Carl Skottsberg, as was the notion that highly distinctive Hawaiian genera, such as those of the Hawaiian silversword alliance (*Argyr-oxiphium*, *Dubautia*, and *Wilkesia*) and Hawaiian mints (*Haplostachys*, *Phyllostegia*, and *Stenogyne*), could have evolved since the rise of the modern high islands of the Hawaiian chain. Instead, endemic Hawaiian genera were once widely perceived as relicts that came to be restricted to the islands by subsidence and submergence of ancient continental connections between the islands (and those of French Polynesia) to Asia, Australia, and even South America (via Antarctica). Although

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## Willis Linn Jepson's Field Books Now Online!

by Richard L. Moe

The University and Jepson Herbaria house, in addition to 2.2 million plant specimens, a great deal of archival material related to the collections. This material includes notebooks, lists, photographs, maps, letters, and manuscripts. Most botanical collectors maintain an account of the specimens that they have collected in a field book. Some field books are hardly more than simple lists of numbers and names. Others are elaborate diaries that include detailed itineraries, descriptions of surroundings, accounts of places and people, and memoranda.

Continued on page 4.

## Evolutionary Diversification of the California Clarkias

by Kathleen Kay

I am just completing a one-year National Parks Ecological Research Postdoctoral Fellowship under the direction of Jepson Curator and Integrative Biology Professor Bruce Baldwin. This fellowship program was funded by the Andrew W. Mellon Foundation and administered by the National Park Foundation and the Ecological Society of America with the purpose of expanding research into plants in the U.S. National Parks. This program has funded 20 fellows since 2000 studying a broad range of topics, such as the top-down effects of wolves and large herbivores on the aspens of Yellowstone, the ecophysiology of invasive plants in Hawaii Volcanoes, and a survey of mosses and lichens in Acadia.

My study is focused on the evolutionary diversification of the California clarkias, and I worked at various sites in Point Reyes National Seashore and the Golden Gate National Recreation Area, as well as a few sites outside of these parks. This is a group

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### ALSO IN THIS ISSUE

- ◆ New TJM2 treatments online
- ◆ Digitizing Types, New Funding
- ◆ Georeferencing, New Funding

of approximately 40 annual plant species, most of which are endemic to the California Floristic Province. They generally grow on well-drained slopes, have pretty pink flowers, and are one of the last plants to flower as California dries up for the summer months, hence one of their common names, “farewell-to-spring”.

I have been interested in how this group has diversified, both through the development of genetic barriers among species and through adapting to a variety of habitats. Many closely related plant species show differences in the arrangement of their chromosomes, and these differences generally confer strong sterility barriers, but it is not well understood how these different arrangements get established in the first place. I have been using *Clarkia amoena* from the California Coast Range, which has a lot of within-species variation in chromosome arrangement, as a system in which to examine the fitness consequences of rearrangements before they become fixed between divergent species. Across the genus *Clarkia*, species differ in their habitat affinity and their life history strategies – their schedule of growth and flowering. To better understand these differences, I set up a greenhouse study of seventeen species of *Clarkia* from all over California to examine genetically-based differences

in trade-offs between growth and reproduction under both benign and drought conditions and how those trade-offs relate to the climatic conditions where each species lives. This greenhouse project is a collaboration with Kjell Bolmgren, a postdoctoral fellow in Professor David Ackerly’s lab in Integrative Biology.

The Jepson Herbarium has been a rewarding stop along my academic path, providing a friendly and collegial setting full of experts in all aspects of plant biology. I came here after completing my B.S. at UC Davis and my Ph.D. at Michigan State University, and now I’m leaving to start an assistant professorship at UC Santa Cruz, where I will continue studying diversification processes in California plants. 🌱



Greenhouse experiment

**TJM2 treatments posted since December 2008**

<http://ucjeps.berkeley.edu/jeps-onmanual/review/>

- Agavaceae
- Camassia, Hastingsia, Hesperocallis, Leucocrinum*
- Amaryllidaceae
- Amaryllis, Leucojum, Narcissus, Pancratium*
- Anacardiaceae
- Malosma, Pistacia, Rhus, Schinus, Toxicodendron*
- Caprifoliaceae
- Lonicera, Symphoricarpos*
- Caryophyllaceae (entire family)
- Ceratophyllaceae
- Ceratophyllum*
- Cornaceae
- Cornus*
- Ephedraceae
- Ephedra*
- Menyanthaceae
- Menyanthes, Nymphoides*
- Nymphaeaceae
- Nuphar, Nymphaea*
- Ruscaceae
- Maianthemum*
- Santalaceae
- Comandra*
- Scheuchzeriaceae
- Scheuchzeria*



Field site in Point Reyes



*Clarkia amoena* from Point Reyes



# New Funding for the Consortium of California Herbaria

## Global Biodiversity Information Facility

In December 2007, the Consortium of California Herbaria received funding to georeference approximately 49,000 records from collections in California and database approximately 8,800 specimens of non-native plant taxa that are housed in the herbarium of the California Department of Food and Agriculture. The project titled "GBIF data content development from the Consortium of California Herbaria: Advancing the international effort to monitor and control non-native taxa" began this spring. Records from all Consortium partners will be georeferenced at the Jepson Herbarium (northern California counties) and Rancho Santa Ana Botanic Garden (southern California counties).

The goal of the project is to document the presence and proliferation of non-native species in California and aid international tracking of invasive alien species. The resulting data will be made available to GBIF and included in the Consortium of California Herbaria (CCH) which is currently serving approximately 960,000 specimen records from seventeen institutions (<http://ucjeps.berkeley.edu/consortium>). Ultimately, these data will aid our understanding of the number and distribution of non-native taxa in California and how those taxa relate to others worldwide. 🌐

## Andrew W. Mellon Foundation

The Andrew W. Mellon Foundation has generously funded the effort to database and image type specimens of vascular plants and cryptogamic groups collected from around the world. The University and Jepson Herbaria will digitize type specimens from herbaria in northern California (except the California Academy of Sciences) and Rancho Santa Anna Botanic Garden will digitize types from herbaria in southern California.

The first phase of funding provided to UC/JEPS will support digitization of 7,500 Latin American types held in the collection. The data will become part of LAPI, the Latin American Plant Initiative, an international partnership of herbaria working to create a coordinated database of information and images of the plants of Latin America. <http://www.huh.harvard.edu/collections/lapi.html>

The second phase of funding will support imaging of ~18,350 type specimens from UC/JEPS, DAV, and CHSC and databasing of ~12,850 type specimens from North America (excluding California) and the rest of the world (excluding South America). 🌐



New staff member Kelly Agnew, Bioinformatics Specialist, shown with a herb scanner, a customized scanning device developed at Kew Gardens. Notably, specimens are not inverted when scanned (above).

Isotype of *Abarema commutata* (Fabaceae), collected by Bassett Maguire, Celia K. Maguire, and G. Wilson-Browne on Sept. 4 1961. Plants of the southern Pakaraima Mountains, British Guiana (now Guyana).



Willis Jepson, who kept field books from 1895 to 1940, recorded botanical, biographic, geographic, and historical observations in fairly great detail. Jepson used uniform octavo volumes (filling more than 60), mostly of about 200 lined pages. The pages are handwritten in ink in a fairly legible hand.

The labels on the specimens that Jepson prepared were transcribed from the field books. The books, however, have information pertinent to specimens that the labels lack — information about associated species, about elevation, about geology, and so on. We decided to scan Jepson's field books and make them available on the Web as digital images primarily because of their utility in determining collection localities. Once you look at the field books, however, it is apparent that they will be equally useful in documenting the biological changes in the California of the last of the 19th Century and the first third of the 20th, and in recording

contemporary political geography and social history.

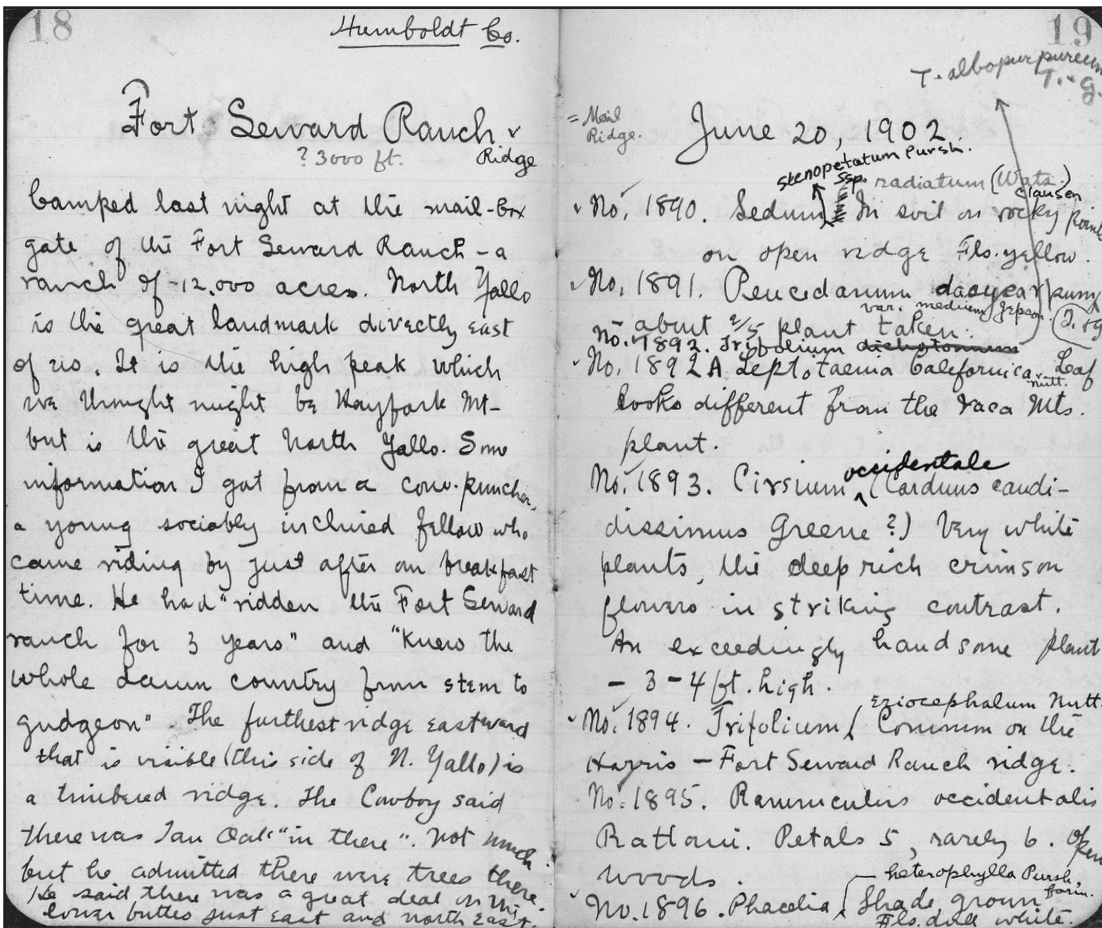
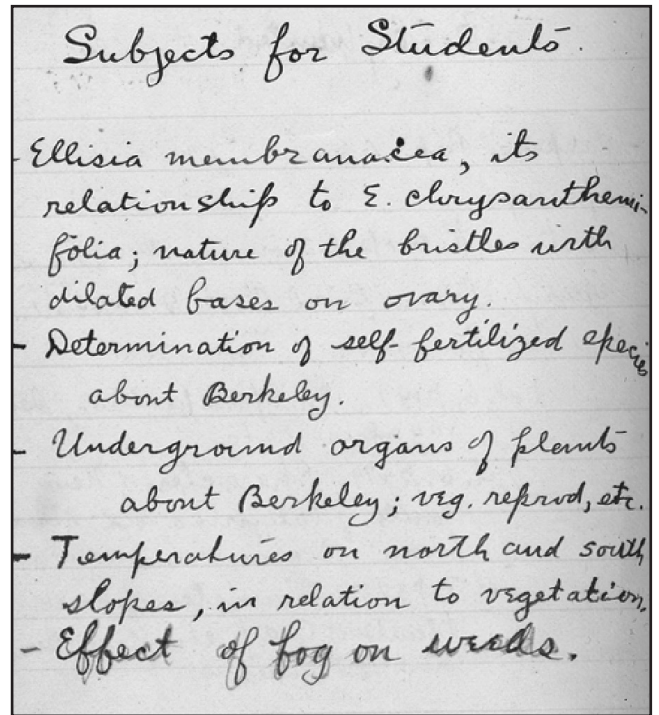
In general, the field books document collecting trips, but Jepson did not have a strict routine for his accounts. Usually the accounts begin with a brief description of the itinerary followed by an itemization of the plants seen and collected. At various places in the accounts, Jepson intersperses botanical, geographical, or weather details, and comments on people met along the way. The books were written in the field, and augmented later (sometimes many years later).

Jepson's collection numbers are mostly chronological and sequen-

tial, with one number for each specimen. Check marks by numbers (added by a curator subsequent to Jepson) indicate that a corresponding specimen can be found in the Jepson Herbarium.

Information at the beginning of a run of numbers applies by default to all of the numbers.

Because nearly all of the Jepson specimens have been databased (see <http://ucjeps.berkeley.edu/consortium/>), it is relatively easy to link a database entry to a corresponding field book entry (and vice-versa). This also allows the specimen database to serve as a rough index (binomials and geographic names) to the field books. When, as sometimes happens, there are discrepancies in the database (e.g., incorrect collection numbers, dates, counties, or elevations), the original can be consulted and the database (and sometimes, the labels) corrected.



Jepson began collecting less than 50 years after the Gold Rush and 25 years after Brewer's State Geological Survey. But by Jepson's time California had a well-established network of roads and a stagecoach system and primary and secondary railroad lines. At first Jepson traveled by rail, stage, and boat to reach distant parts of the state. When he reached the limits of "public transportation," he hired pack trains with mules for trails and horse drawn wagons/carts for back roads.

Eventually, Jepson bought automobiles and drove everywhere (sometimes very slowly). Already by 1900 Jepson was remarking on how little of the first-growth forest was left. In subsequent years he commented sadly on the disappearance of towns he had once visited as stage stops, as well as towns that had appeared on plains where he had formerly botanized. He provides brief accounts of the Hetch-Hetchy valley before the O'Shaughnessy Dam was built and of Big Meadows before Lake Almanor filled.


Jepson brought his field books along on his sabbatical trips to Europe and Palestine and on these trips his accounts are much less botanical, but still full of keen observation.

Sept. 20, 1900.

Mrs. G. J. Blake who has just returned "from the East" tells me of visiting in the Ojai Valley with her daughter Mrs. Thacher. The last three years have been dry, particularly the last two. It is said that never before were such dry years known. In spite of imperfect records this statement is borne out by the fact that many of the finest and oldest oaks in the Ojai died in the summer of 1900 (or possibly 1899). These oaks, *Quercus lobata*, were large trees. From Mrs. Blake's description of the size I should say they were 350 years old.

#### How you can help.

We would like to increase the accessibility of Jepson's field books. Because the field books are handwritten, the contents cannot be indexed by the Web search engines. If users are willing to transcribe the pages, however, little by little a great deal of information will be made widely available and searchable. We have built some simple tools with which you can associate a transcription with a page, or accumulate key-words. We invite you to help make Jepson's observations available to the world. See [http://ucjeps.berkeley.edu/images/fieldbooks/jepson\\_fieldbooks.html](http://ucjeps.berkeley.edu/images/fieldbooks/jepson_fieldbooks.html) or contact Richard Moe ([rlmoe@berkeley.edu](mailto:rlmoe@berkeley.edu))

*Special thanks to Edith Summers for preparing the scans.* 

## THE JEPSON HERBARIUM PROJECTS & RESOURCES

### The Jepson Flora Project

Second Edition of *The Jepson Manual*  
Online Interchange for California Florisites

*Jepson Desert Manual*

Online Horticultural Database

Electronic Publication of Jepson's

*A Flora of California*

Ecological Flora of California

### Publications & Research Projects

*Constancea*: University of California

electronic publications in botany

*Flora of Mount Diablo*

Building the Tree of Life — A National Resource for Phyloinformatics and Computational Phylogenetics

Deep Green Plant Phylogenetics: Novel Analytical Methods for Scaling Data from Genomics to Morphology

Systematics and Evolution of California tarweeds and relatives (tribe Madieae, Compositae)

Unravelling the dynamics of mating-system evolution in tribe Collinsieae

Niche conservatism, functional trait evolution, and the diversification of the California vernal pool flora

Flora of the East Bay

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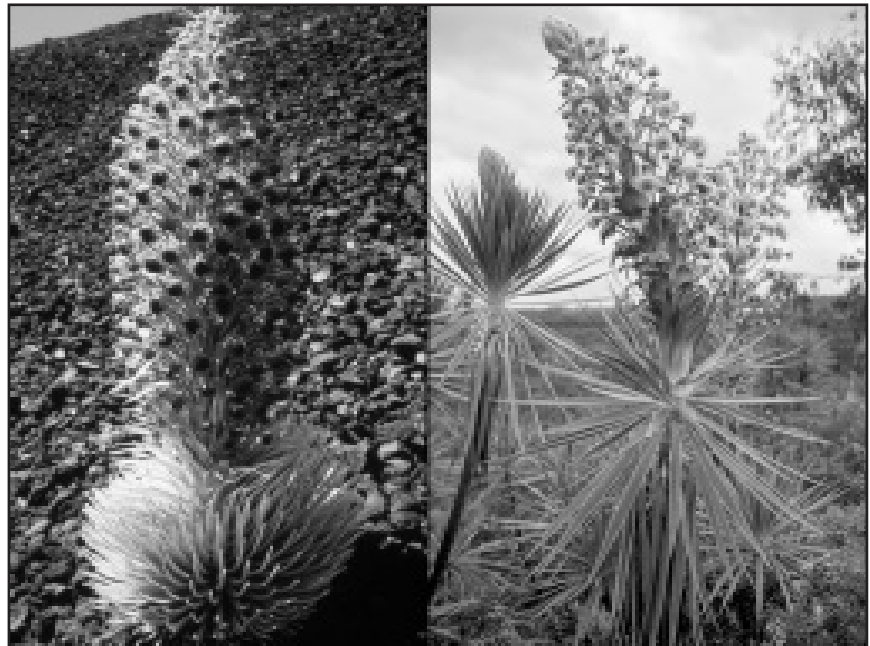
that hypothesis may now be viewed as preposterous, the idea that upland plants without means of dispersal in ocean currents could travel immense distances across open ocean was considered even more implausible by some leading botanists, as was the idea that plants on islands might undergo exceptionally rapid diversification and radical changes in form (including evolution of woodiness). Beginning in the 1950s, Sherwin Carlquist began changing minds about long-distance dispersal and adaptive radiation of island plants, with his extensive studies of island floras, wood evolution, and propagule characteristics. Today, much evidence indicates that even dispersal between continents has been important in assembly of floras worldwide.

The California Floristic Province (CFP), as an “island” of Mediterranean climate, is generally viewed as a phytogeographic “sink” (that is, a region that plants rarely escape) rather than a source area for plant dispersal to other parts of the world. Although a limited number of ancient dispersal events (probably bird mediated) from the CFP to climatically similar areas of central Chile have been long inferred for some of our flowering plant groups (e.g., *Gilia*, *Lasthenia*, *Madia*, *Sanicula*), successful dispersal from California to the Hawaiian Islands is more difficult to envision from an ecological standpoint, with the major differences in climate between (temperate) California and (tropical) Hawaii. Establishment of California plants in Hawaii is not as problematical as latitudinal considerations alone would suggest, however; the high-elevation volcanoes that dominate young islands of the Hawaiian chain provide large areas with climatic conditions that approximate some Californian environments, as noted earlier by Carlquist. The dispersal distance between California and Hawaii, although unpunctuated by any potential habitat for terrestrial plants, is a much shorter distance than the distance between California and central Chile, and both

ancient and modern bird traffic from North America to Hawaii is evident. Also, Californian plants that arrived early in the history of the modern, high Hawaiian Islands probably encountered conditions highly favorable for evolutionary diversification, with abundant ecological opportunities and a lack of other plants that might compete for resources – the perfect conditions to promote adaptive radiation, i.e., rapid ecological diversification, often associated with major changes in morphology.

My Fall 2007 sabbatical at the National Tropical Botanical Garden (NTBG) in Kauai was largely oriented around continued studies of the most definitively Californian of Hawaiian endemics, the silversword alliance, an outstanding example of adaptive radiation that has held my fascination since the mid-1980s. Those descendants of our humble Californian tarweeds, although best known to tourists as spectacular occupants of the semi-barren alpine slopes of East Maui, where the famous Haleakala silversword (*Argyroxiphium sandwicense* subsp. *macrocephalum*) occurs, are most diverse on the oldest modern high-island, Kauai. On Kauai, the silversword alliance includes

trees, vines, rosette plants, cushion plants, and a variety of shrubby forms, and occupies a wide range of habitats including bogs, wet forests, and dry slopes. Some of these species are so restricted in distribution as to have gone unrecognized until recently, such as *Dubautia kalalauensis*, which Gerry Carr and I described as new to science in 2005 and which occurs within a stone’s throw of the main highway in Koke’e State Park. Unfortunately, these evolutionary marvels are in great danger of extinction, along with much of the Hawaiian flora, primarily because of invasive plants and animals that are unraveling Hawaii’s ecosystems. Part of my sabbatical at NTBG was focused on trying to learn more about the decline of the silversword alliance in the mesic and wet forests of Kauai, where recruitment of young plants has been lacking in recent years. Their disappearance from the Hawaiian environment would be a tragic loss for Hawaii’s biodiversity and for California’s flora, which gave rise to these magnificent plants. I am deeply grateful to my generous hosts and collaborators at NTBG for making this research possible. 🌿



Haleakala silversword (*Argyroxiphium sandwicense* subsp. *macrocephalum*), East Maui, photo by D.W. Kyhos (left); iliau (*Wilkesia gymnoxiphium*), western Kauai, photo by G.D. Carr (right).

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June 14, 2008

Diane M. Erwin and John M. Miller

***Climate Change in Yosemite: Patterns of Environmental Change***

September 10 – 14, 2008

Connie Millar, Jessica Lundquist, and David Graber

***Insect Diversity and Coevolution***

October 18, 2008

David Hembry

***Lithocarpus densiflorus: An Environmental History of Tanoak***

November 23, 2008

Frederica Bowcutt

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