**Director’s Column:**
**Herbaria Data Go Mainstream**
*By Brent D. Mishler*

The University and Jepson Herbaria (UC/JEPS) has long been a leader in the nationwide effort to make data from herbarium specimens available online, an effort that is rapidly gathering steam here and globally. The increased attention being paid to collections digitization across the United States and around the world stems from several related crises impacting natural biodiversity. Habitat loss through development, pollution of the environment, and human-caused climate change have all greatly impacted native plants and animals. To conserve biodiversity in a rapidly changing environment, it is ever more essential to know the precise makeup of taxonomic groups (including internal variation) and their past and current geographic ranges. Tools for ready identification, understanding variation within and among species, and mapping predicted distribution changes are needed more than ever. National efforts such as the US Virtual Herbarium (http://www.usvirtualherbarium.org/), and international efforts such as GBIF (http://www.gbif.org/), depend on local initiatives to generate and curate high-quality data.

Digitization efforts at UC/JEPS began with the SMASCH project that had its roots back in the 1980s. Virtually all the California specimen records of vascular plants in UC/JEPS were digitized in the 1990’s, supported by an NSF.

(Continued on page 4.)
Ben Carter, a graduate student in the Mishler lab, has been awarded a prestigious Doctoral Dissertation Improvement Grant (DDIG) from the National Science Foundation. His study, *Niche differentiation among cryptic moss species*, is just part of his dissertation work that focuses on the molecular systematics, taxonomy, biogeography, and ecology of the moss genus *Scleropodium*.

Ben’s study will examine a pair of sympatric, cryptic moss species in the genus *Scleropodium* that are hypothesized to occupy different niches along a strong ecological gradient (terrestrial-aquatic). To test whether habitat partitioning is taking place, Ben’s work will include field collections in an area of known sympatry, sequencing of molecular markers, and collection of ecological data.

Learning more about cryptic species is important because a substantial fraction of the world’s biodiversity is comprised of species that are morphologically indistinguishable from other species (i.e., “cryptic species”). Efforts to preserve and protect global diversity rely on an understanding of how and why these cryptic species evolve and coexist.

Additionally, most bryological studies are focused on deep clades and there are only very limited examples of studies like Ben’s that incorporate fine scale phylogenetic and ecological data to understand recent and ongoing evolution and diversification.

Ben’s interest in mosses is in part based on his belief that people’s environmental awareness and connection to conservation is in part facilitated by scientific research conducted in their own backyards. Because mosses are common throughout local regional wild lands, they can be a powerful tool for scientists to engage students and the public.

The archives of the University and Jepson Herbaria preserve and make accessible information related to the Herbaria and the history of botany at UC Berkeley. The archives uniquely complement the specimens held in the University and Jepson Herbaria and contain a wealth of materials. The archives are managed by Amy Kasameyer, Archivist, and Richard G. Beidleman, ecologist, author, and volunteer archivist. In this and future *Globe* issues, we’ll be bringing you stories that have been discovered in the collection.

One of our most diverse collections are historical field books from over 60 botanists. The field books are a valuable resource to botanists revisiting historical collections or verifying a collection record.

There are countless examples of ways that field books have been used to provide more information about a specimen. The following is one that highlights how using the field books can often help archivists connect seemingly unrelated events.

In the Jepson Herbarium, there is odd specimen of a single plant, an *Azolla* (Mosquito Fern) collected by Willis Jepson in Barstow, California, on January 17, 1916 (Jep. No. 304, which was not to be identified to species until 2006!). We wondered why on earth Jepson would collect just one plant in the desert in the middle of winter. The answer was found in his field books (Volumes 31 and 32).

That winter, Jepson was on leave at the Waterman Ranch, hostessed by former Governor Waterman’s daughter, Abby (which might explain, in part, why Volume 2 of his *Flora of California* was dedicated to her); and actually discovered that with no flowers to speak of (and hence only a single collection of a fern during this trip), The Botany Man essentially decided to watch birds!

When we realized this, it explained the French binoculars in our Jepson archives—the Chevalier Opticien model used by French soldiers during World War I, rumored to resemble those used at the infamous Battle of the Little Bighorn. Jepson birded with these in Barstow.

![Ben Carter on Santa Catalina Island, collecting Didymodon tophaceous and other mosses.](Photo by Linda Farley)
Production of the second edition of *The Jepson Manual* was made possible in part due to the foresight of Rimo Bacigalupi, Helen-Mar Beard, Mary L. Bowerman, Lawrence R. Heckard, Willis Linn Jepson, and Robert Ornduff, whom, with estate gifts, established endowment funds that benefit the Jepson Herbarium.

These visionaries knew the impact of planned gifts; they can ensure that the work that is important to the donor is continued in perpetuity. With their gifts, Bacigalupi, Bowerman, Heckard, Jepson, and Ornduff have all continued to support California floristics, a field they were deeply dedicated to.

With no support from the State of California, endowment revenue is especially critical to the Jepson Herbarium, where it is a major component of the annual budget and can provide funding for projects that cannot be fully supported with external funds.

A planned gift may enable you, too, to make a more significant contribution than you thought possible while at the same time allowing you to achieve your financial, philanthropic, and estate planning goals.

If you would like to discuss these possibilities, please contact Staci Markos (smarkos@berkeley.edu or 510-643-7008) or the Office of Gift Planning (ogp@berkeley.edu or 510-642-6300).

We are halfway to our goal of purchasing a full class set of Leica EZ4 zoom microscopes and their carrying cases. We are looking forward to using these amazing new tools in our 2012 workshops.

Many, many thanks to our latest donors:

- Anonymous
- Frank Ellis
- Mary Ann Hannon
- Alan Kaplan
- Donald Lepley
- Karen Markos
- Wendy McClure
- Tom Schweich
- Yulan Tong
- Desi & Karen Zamudio
We received funding as part of a large Biological Collections program at NSF. The Jepson Globe (http://www.chah.gov.au/avh/) has nearly complete coverage. I’m both learning and developing techniques that I hope to apply next in California when we are ready. I will report my results in a future column.

Jonathan Baio and Catherine Wang using the light box and camera in room 1066. Photo by Andrew Doran


To celebrate the release of the Manual, we are planning two events:

1) A reception and book signing at the CNPS conference Wednesday, January 11th, from 7:00 PM – 9:00 PM. Details about the conference can be found on the CNPS web site. http://www.cnps.org/cnps/conservation/conference/2012/ 

Advance registration for the reception is requested. If you would like to attend the reception and/or purchase a book, please send your reply to Staci Markos (smarkos@berkeley.edu) no later than December 15, 2011. Your reply will help ensure enough books are available for those who want a copy.

2) A release party at the Jepson Herbarium, April 14th. While the full details have yet to be developed, we are hoping for a day-long event that will include book signing, tours of the herbaria, a presentation about the new Manual, and a silent auction featuring duplicate books from the Jepson Library. Details will be sent early in the New Year.
DNA from extinct gymnosperms means that DNA alone can’t tell the whole evolutionary story; this is where plant morphology and anatomy are critical. Using morphological features like the arrangement of leaves on a stem or the pattern of leaf venation, comparisons among living and fossil plants can be made across the gymnosperm lineage. Patterns in DNA sequences, morphological traits, and anatomical features provide the foundation for inferring hypotheses about the evolution and diversification of seed plants. Variation in DNA sequences provides one lens for looking back through time to see how plants have diversified; variation in physical traits provides a second. When the two lenses are used together, they provide a much more resolved picture of how—and ultimately why, where, and when—seed plants diversified.

Over the lifetime of the project, researchers associated with the Gymnosperm Tree of Life project have dedicated time and resources to sharing information about gymnosperms and the findings of the project with the public. In 2010, these efforts culminated in a series of teacher-training workshops held around the country. The workshops were designed to help teachers integrate local resources, like the gymnosperms in their local botanical gardens or schoolyards, into their science curricula in order to teach key ecological and evolutionary concepts. Dean Kelch, a UC/JEPS research associate and primary investigator on the project, co-taught one such workshop at the San Francisco Botanical Garden with Matt Parks, a postdoctoral researcher at Oregon State University, and Nathalie Nagalingum, a postdoctoral researcher at UC Berkeley.

“Gymnosperms represent more than a lens through which to examine the past evolution of life on earth,” said Kelch. “They also illustrate the challenges that organisms face as they adapt to changing ecological conditions today.”

In addition to touring the Garden’s living gymnosperm collections while Kelch introduced gymnosperm ecology, teachers who attended the San Francisco workshop had a first-hand opportunity to look at plant diversity from 300 million years ago as it was preserved in coal balls. Coal balls are rocks from the Carboniferous Period (354–290 million years ago) that contain fossil plant materials embedded in a calcium carbonate matrix. Coal balls are useful because they contain three-dimensional plant structures that were infused with minerals as the rocks were forming, a process called permineralization. Of all the techniques available to paleobotanists, the so-called “coal ball peel” is one of the easiest and most informative about the anatomical structures of extinct plants that existed in a known time and place. The coal ball peel technique transfers a thin section of the fossilized plant material from the prepared surface of the rock to a clear cellulose acetate sheet, which students can examine using a microscope in the classroom.

The Gymnosperm Tree of Life project concluded this year. As a result of the project, four years of data collection and analysis will be directed toward the unanswered questions about the evolutionary history of seed plants. The major findings were presented at the International Botanical Congress in Melbourne, Australia. To learn more about the project, please visit the project website: http://www.hu..
Excerpted from letters sent by Jim Shevock

Earlier this year (Jan 5 to Feb 7, 2011), I was fortunate to be one of the bryologists participating in an NSF funded expedition to the Antártica Chilena Province. The only way to access nearly all of this area is by boat; there are no roads on the Chile side of Isla Grande de Tierra del Fuego.

For the duration of the expedition, we lived on a seaworthy ship and were hosted by a very experienced crew. Life on the boat was cramped but was offset by interesting colleagues, good food, fresh baked bread each day, and drinking water collected from melting glaciers. The hold of the ship, normally containing king crabs, was retrofitted into a bryophyte drying facility.

We attempted to visit two collection sites per day but our ability to do so depended on the sometimes unforgiving, cold, and wet weather. Each day, we disembarked in a new area, going ashore via zodiacs to explore and collect. Once ashore, hiking in the forested areas was slow going—the bryophytes can be up to waist-high! While hiking in the ‘rushlands,’ dominated by the perennial juncaceous Marsippuspermum, and countless shallow marsh-like pools, the footing was somewhat unstable; it often rippled beneath my feet as I bounced across it. Upslope were granitic, open landscapes but these, too, were slow going because the peaks were steep and covered by glaciers. The highest elevation I reached was 125 meters!

Despite these difficult collecting conditions, I was able to collect 30-40 specimens per day. I focused on the species occurring in streams and rivulets, especially those bryophytes called rheophytes (seasonally submerged then exposed on boulders). In total, I collected 621 bryophyte numbers in multiple sets, and collectively the team obtained over 3000 numbers.

The scenery we encountered was amazingly beautiful—glaciers were ever-present and streams cascaded down in all directions to the sea. The vegetation was dominated by bryophytes in both numbers of species and biomass. The tree-cover occurred primarily right along the fiords and bays. Occasionally, trees were seen in small pockets higher up slope but the ever-present snow and ice on the higher slopes kept the forests restricted...
mostly to the coastline. The dominant tree was *Nothofagus betuloides* and another common tree was the small but handsome *Drimys winteri*. *Pilgerodendron* was the only member of the Cupressaceae and in many areas it is only a ground cover.

In the *Nothofagus* and *Drimys* pockets of forest, the bryophytes carpeted everything. Most of the understory shrubs appeared to be members of Ericales, quite heath-like and with many shrubs in full flower. The other important and fairly common shrub was a species of *Berberis* with large fruits. This species is used in a type of local beer called ‘calafante,’ a nice darker colored beer with the juice of the *Berberis* as part of the ingredients. One small shrub has spectacular magenta-colored tubular-bell-like flowers about 3–4 inches long (*Philesia magellanica*, *Philesiaceae*). There was also a spectacular shrub in the Proteaceae, *Embothrium coccineum*, with whorls of red tubular flowers. Although it is a timber tree in Chile much farther north, it grows here as a small shrub (to 2 meters) or prostrate over wind-swept rocks. Herbaceous flowering plants were basically absent.

This trip took us to glacier-filled mountains, far away from shipping lanes and civilization. It was by far the most adventurous expedition I have ever been on. I have never seen anything that wild and pristine. No one lives there and from the look of the land, it is also very rarely visited. Our collections from the areas we visited are likely to be among the first made by bryologists.

*Jim Shevock is a research associate at the California Academy of Sciences and the University of California Herbarium*
Kurdish Delegation Visits 
UC/JEPS
By Barbara Ertter

On April 21, 2011, the University and Jepson Herbaria were visited by a botanical delegation from the semi-autonomous Kurdistan Regional Government (KRG) in northeastern Iraq. The delegation is working to establish botanical gardens in Erbil and Suleimaniah (both in northern Iraq), and they will also oversee a new regional herbarium that will be contributing to a new Flora of Iraq project. According to KRG prime minister Barham Salih, “The KRG places a great deal of emphasis on improving the standards of higher education, as well as giving students the chance to go and continue their studies abroad, a right denied to them by the dictatorial regime of Saddam Hussein”.

Members of delegation were Dr. Sarbagh Salih, Dr. Bahram K. Maulood, and Dr. Bushra Ahmed Hamdi. Dr. Salih, in addition to being a human rights activist and wife of KRG prime minister, is a horticulturalist who has worked at the Agricultural Research Center in Beltsville, Maryland. Dr. Maulood wears an even greater number of hats, including research limnologist, Senior Science Consultant for The American University of Iraq–Sulaimani, and former KRG Deputy Minister of Agriculture & Irrigation. His equally accomplished wife, Dr. Hamdi, is a zoologist and Chair of the Department of Laboratory Analysis at Hawler Medical University. Accompanying the delegation were Dr. Barbara Ertter (UC/JEPS), Dr. Christopher Davidson, and his wife Sharon Christoph.

The delegation represented the latest spin-off of the American-Iranian Botanical Program (AIBP), established by Dr. Fosiee Tahbaz (coordinator, AIBP) and Barbara Ertter after their joint trip to Iran in 1999. Among the more successful accomplishments of the AIBP has been an expedition to Iran in 2004, which included participants from various institutions in the United States and Iran. One of the participants in that expedition was Dr. Ihsan Al-Shehbaz of the Missouri Botanical Garden, an Iraqi-American who was a former colleague of Dr. Maulood’s at Salahaddin University in Iraq. This connection led to both Al-Shehbaz and Ertter being invited to participate in the inaugural floristic survey of a mountain range in the KRG in June 2010. Davidson and Christoph took advantage of the opportunity as well, furthering their ambitious goal of photographing all plant families in the world (floraoftheworld.org).

The visit by the Kurdish delegation in April 2011 provided an opportunity for the American participants to reciprocate the outstanding hospitality they were given in Iraq, with the added potential of broadening future collaborations. A guided tour of the University and Jepson Herbaria was only one of many during a 3-week whirlwind tour that included botanical gardens, herbaria, museums, and experiment stations in Texas, Arizona, California, Idaho, and Missouri. Time in the herbaria included a sumptuous reception hosted by Dr. Tahbaz, which allowed the delegation to interact with interested faculty, staff, and students.
2011 Workshop Year in Review

Clockwise, from top left: Removing Cholla spines in transit on San Clemente Island, Little Duck Lake at sunrise, a pack mule carries gear to camp, intensive Asteraceae keying, examining hydric soils for Wetland Delineation, Mimulus pulchellus, and Linda Beidleman in the field. Photos by Jeanne Marie Acceturo
In Memory of Dr. Isabelle Tavares

Dr. Isabelle Tavares died on May 21, 2011. Dr. Tavares had been associated with the University Herbarium for 59 years. Her academic career began at City College of Los Angeles, was interrupted by service in the Women’s Army Corps during World War II, and continued at Berkeley after the War. She received B.A., M.A., and Ph.D. degrees from the University of California. For her doctoral dissertation, under the guidance of Professor Lee Bonar, she investigated the Laboulbeniales, an order of minute fungi that parasitize insects. This research continued after her dissertation and eventually resulted in her magnum opus: The Laboulbeniales, published in 1985. She began working in the University Herbarium while still in graduate school, and continued uninterruptedly until long past her retirement in 1993. She curated the fungi (including lichens) and the bryophytes, and participated in all day-to-day operations of the Herbarium. Curating lichens led her to her second major research interest: the taxonomy of Usnea, a widespread and notoriously taxonomically difficult genus of lichens. Dr. Tavares was extensively involved in the California Botanical Society, especially in editing its journal Madroño. She was a founding member of the California Lichen Society, and an active promoter of California lichenology.

What took so long?

Some of you may have wondered why it took so long to produce the second edition of The Jepson Manual. There are many reasons: a huge flora (over 7600 terminal taxa), a large group of authors (over 300 from around the world), a concise format (treatments were edited to adhere to conventions), a small staff (equivalent to about four positions), a dispersed editorial board (members from various regions of California and beyond), and an extensive proof process. Pictured here is Tom Rosatti, one of the scientific editors, with the first and second sets of proofs (there were five sets in total). Each tab represents at least one change to the manuscript. We made hundreds of changes to the proofs, a process that took about six months! ☝️

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The Jepson Herbarium Projects & Resources

The Jepson Flora Project
Online Interchange for California Floristics
A Flora of California (electronic)

Educational Services & Resources
Botanical Workshops & Courses
Plant Identification
2,200,000+ Worldwide Plant Specimens
Botanical Library & Archives

Publications & Research Projects
Constancea: U.C. Publications in Botany
Director: Brent D. Mishler
Deep Green Plant Phylogenetics: Novel Analytical Methods for Scaling Data from Genomics to Morphology
Moorea Biocode Project (a complete inventory of an island ecosystem)
Systematics and ecology of Syntrichia
Curator: Bruce G. Baldwin
Systematics and Evolution of Calif. tarweeds and relatives (tribe Madieae, Compositae)
Unravelling the dynamics of mating-system evolution in tribe Collinsieae
Curator of Ecology: David Ackerly
Niche conservatism, functional trait evolution, and the diversification of the California vernal pool flora
Ecological Flora of California
Curator of Monocots: Chelsea D. Specht
Evolution and biogeography of Calif. alliums
Systematics and evolution of Heliconia
Floral developmental evolution in the tropical gingers (Zingiberales)
Curator of W. N. Am. Botany: Barbara Ertter
Flora of Mount Diablo & Flora of the East Bay
North American Potentilleae
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**In memory of Margaret Ashworth**
Wendy McClure

**In memory of Milo Baker**
G Douglas Barbe & Ann Evans

**In memory of Mary Bowerman**
Alfred & Barbara Sattler

**In memory of Esperance**
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**In honor of Paul Silva**
Susan Brawley

**In memory of Willis E. Simms**
Ellen Simms

**In memory of G. Ledyard Stebbins**
Charles E. Blair
Jepson Herbarium Public Programs

We’re still hard at work planning our 2012 workshop season, and it’s shaping up to be a great one!

The following workshops are confirmed, with more on the way:

- Wetland Restoration
- Death Valley’s Endemic Flora
- Flora of San Luis Obispo County
- Seaweeds of Central California
- Bees and Pollination Ecology of Spring Wildflowers
- Late-Season Flora of the White Mountains
- Introduction to Bryophytes

The full 2012 schedule will be available in late fall. Stay tuned for updates!

For more information, contact Jeanne Marie Acceturo
510-643-7008, jmarie@berkeley.edu or visit our Web site: http://ucjeps.berkeley.edu/workshops/