

Friends of the Herbarium

Biological Sciences Herbarium
California State University, Chico

Newsletter

Vol. 13 No. 1

November 2007



Kristina Schierenbeck
Distinguished Service Award
2007



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MESSAGE FROM THE BOARD

A number of exciting things associated with the herbarium have happened during the past year. The new sister group to the Friends of the Herbarium, *Northern California Botanists*, held its first annual two day symposium last January, attended by over 200 northern California botanists. Its second annual Symposium will be held January 14-16, 2008. The Friends of the Herbarium is a sponsor of each of these symposia. Be sure to sign up for this symposium to take advantage of this great local opportunity. The *Northern California Botanists* Symposium planning committee meets regularly in the herbarium to bring this exciting symposium to all northern California botanists.

Another exciting production related to the herbarium is the next volume in the series *Studies from the Herbarium*. **Vernal Pool Landscapes**, number 14 in the series, should be available sometime in January 2008. This volume, edited by Rob Schlising and

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Friends of the Herbarium

The **Friends of the Biological Sciences Herbarium**, California State University, Chico, was formed to help maintain the high quality of work that has been known to be associated with the herbarium. The primary purpose of the group is to provide community support for the herbarium. This includes raising funds for items that are not covered under the University budget. Scientific and academic pursuits are the focus of the group. The Friends also offers low cost workshops and classes on various botanical topics.

The Friends of the Biological Sciences Herbarium operates under the auspices of the California State University, Chico, and enjoys non-profit status and has access to the use of University classrooms and equipment.

Memberships are renewed on January 1 of each year.

BOARD OF DIRECTORS

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Newsletter

Volume 13, Number 1

The Newsletter is published one to three times per year by the **Friends of the Biological Sciences Herbarium**, California State University, Chico. Subscription is free with membership. Submissions on herbarium related topics are welcome.

Accessions into CHSC during 2006

Eight years ago Vern Oswald started this annual tradition in this newsletter of summarizing all of the collections accessioned into the herbarium during the preceding year by county and collector. Here is the latest set of summaries, for 2006.

The Biological Sciences Herbarium accessioned 2870 new collections during 2006. This compares to 2320, 2944, 1108, 1862, 4859, and 2455 collections during 2000, 2001, 2002, 2003, 2004, and 2005 respectively.

We continue to owe a HUGE debt of gratitude to our volunteer mounting specialist and plant collector extraordinaire, Lowell Ahart. Aside from a few exchange sheets that came already mounted, and the bryophytes and lichens, that are accessioned into the collection in packets rather than mounted, Lowell mounted most of the specimens accessioned into the herbarium during 2006. This means that Lowell prepared about 2373 beautifully mounted specimens for the herbarium during 2006, all as volunteer! Thank you once again, Lowell, for your continuing contribution of countless hours of invaluable time and some associated expenses to further the goals of the Biological Sciences Herbarium and northern California botany. In addition, during 2006 Robert Fischer mounted 428 specimens for the herbarium, mostly his own collections. Thank you Robert!

All new incoming specimens are databased before they are filed. The databasing in 2006 was mostly done by our wonderful former herbarium assistant, Morgan Loromer, as well as most of the filing of specimens. Local botanist and illustrator Susan Bazell has also been volunteering her time to database incoming, as well as older, collections.

Thanks also to all of the collectors for their time spent in collecting, identifying, and making labels for all of the specimens that they contributed to the herbarium during 2006. A lot of time goes into this process and I know that most, if not all, of this time is volunteer time on the part of the collectors.

The following tables summarize the plant specimens accessioned into the Biological Sciences Herbarium during 2006. LJ

SUMMARY

Lichens.....	22	Hornworts.....	0	Ferns.....	25
Mosses.....	45	Club mosses.....	7	Conifers.....	5
Liverworts.....	2	Horsetails.....	5	Flowering plants.....	2757

California accessions, 2440 total (counties with 18 or more):

Butte.....	720	Lake.....	41	Shasta.....	220
Colusa.....	184	Lassen.....	127	Sierra.....	94
Fresno.....	18	Los Angeles.....	18	Siskiyou.....	55
Glenn.....	202	Mendocino.....	151	Tehama.....	216
Humboldt.....	22	Plumas.....	220	Yuba.....	19

Contributions of local collectors (with 6 or more):

Lowell Ahart.....	1074	Robert Fischer.....	422	Paul Kirk.....	16
Susan Bazell.....	14	Samantha Hillaire.....	12	Kylene Lang.....	16
Barbara Castro.....	46	David Isle.....	235	Jenny Marr.....	6
John Dittes.....	64	Lawrence Janeway ...	395	Thomas Nelson.....	12

A Brief History of the Biological Sciences Herbarium.

by Kingsley Stern

26 May 2006

Vesta Holt, who founded the Biology Department at what was then a normal (teacher training) school, retired from Chico State College in 1958. When I arrived on campus in the fall of 1959, I found Vesta had decided to remain in an unofficial capacity for another year. I asked her about a herbarium, and she took me to a room where she showed me a herbarium case with mounted specimens.

After Vesta left I took a closer look at the specimens, which were mostly hers or those of her students. I counted roughly 2,000 sheets, and set to work to get them accessioned. I designed a herbarium stamp and asked the Chico State Business Office to allow me to get the herbarium stamp rubberized in order to be able to stamp and number specimens. The Business Office balked and wanted to know what the stamp was for and questioned that it was a necessary expense. However, they eventually permitted the purchase, which turned out to be little more than \$2.50. ▼



Two years before I arrived on campus Marge Anthony had taught a plant taxonomy course and contributed some of the students' specimens to the herbarium. One of her students, Lowell Ahart, eventually became a major contributor to the herbarium, not only in terms of specimens, but also by way of countless hours of volunteer work making labels and filing. His specimens also

are beautifully pressed and arranged works of art.

In the spring of 1960 I took over the plant taxonomy course and required a small collection from each of the students. Many of these specimens are now part of the herbarium collection. Then I started trading some of these specimens with other institutions. Meanwhile a new building (Holt Hall) was being planned. I asked that a large room on the first floor be reserved for a herbarium. My request was granted. I also was able to tap a special fund to buy herbarium cases. This fund furnished cases, two at a time, each year for several years. When we occupied Holt Hall I was allowed to hire students to assist with the herbarium work. Some non-students also volunteered their time for herbarium work.

In 1985, Lawrence Janeway, a graduated student at Humboldt State University where he was active in the operation of their herbarium, transferred to Chico State. At first he worked in the herbarium as a student assistant, and by 1988 he was awarded a graduate assistantship for the same purpose. At this point he was named Assistant Curator, and later, in 1995, he was named Herbarium Curator on a volunteer basis. In 1999 the Biology Department and the Friends of the Herbarium joined together to start paying him for one day a week, and July of 2000 he started working half time. For the first three years he was funded from a National Science Foundation grant to Kristina Schierenbeck, who be-

came Herbarium Director in the mid-1990s when I retired. ▼ Kristina's grant was for databasing the herbarium specimens.



Distinguished Service Award given to Kingsley Stern in 1998 upon his retirement as Herbarium Director.

In 1994 the College of Natural Sciences supported a proposal to celebrate the gift to the herbarium of well-known California botanist John Thomas Howell's personal library. This celebration included displays, a herbarium tour, and a series of speakers. The speakers addressed the importance of maintaining the herbarium and enlarging the herbarium's scope. Shortly after the celebration a group of botanists agreed to form a volunteer support group called *Friends of the Biological Sciences Herbarium*. Once this organization was established it offered classes and developed other sources that provide significant additional funds for the herbarium. The group's work also resulted in the herbarium being assigned an adjacent room, which now holds a small library of pertinent books and journals, microscopes, and space for graduate student studies. Lawrence Janeway

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Collecting Plants along the North Fork of the Feather River

by Lowell Ahart

18 January 2006

In the middle 1980s, Vern Oswald and I were working on the Butte County flora. I was supplying voucher specimens to the herbarium at Chico for Vern to look over and if any were new to County he could then add them to his flora. There had been several hard winters with big flows on the rivers in the county. On 6 May 1987, I decided to try collecting plants along the North Fork of the Feather River at the Poe Power House. It was a perfect year to collect on the gravel bars along the river. I made several trips over the spring, summer and into fall, over several years. Several hundred collections were made. A complete set was mounted and sent to the herbarium at Chico State. Duplicates went to John Thomas Howell at the California Academy of Sciences in San Francisco, to Sue Taylor at the Missouri Botanical Garden, and some to Barbara Ertter at the University of California at Berkeley. Out of this material Vern Oswald found *Muhlenbergia asperifolia* - Scratchgrass - (Ahart 5,708) to be new for the county; also *Myosotis laxa* - Bay Forget-me-not - (Ahart 5,848) and *Potentilla biennis* - Biennial Cinquefoil - (Ahart 5,689). *Rorippa palustris* var. *dictyota* - Netpodded Marsh Yellowcress - (Ahart 5,779) is one of two or perhaps three collections known from the county and is cited in Vern's Butte County Flora. In 2005 I returned to the Poe Powerhouse and the area where I had collected was barely recognizable. The river had washed away much of the gravel bars and although the river still flowed on the west side, it had cut a new channel to the east side, thus removing all the material on the east side and most of the middle. I found few things to collect and was glad I had worked so hard and gotten

so much during my earlier visits.

On 6 December 2005, Randall Morgan wrote to me and asked for seeds and material of *Trifolium obtusiflorum* - Clammy Clover - (represented by the collection Taylor 2,179 from 4 August 1979) from along Highway 70 between Pulga and Cresta. In Glenn Clifton's Plumas County and Plumas National Forest Flora, draft 2003, he lists three locations of the clover from Pulga to Cresta. Therefore, I thought this would not be too difficult to find, but it was 45 miles away from home. On 11 September 2006 I found time and empty presses available. I decided to go look for the clover. I went to the Poe Dam on the North Fork of the Feather River. Here I could see that I would not find much. Above the dam is a lake and the shores are steep and dangerous, below the dam is a big hole and also dangerous. I turned around and drove back towards Pulga. There is a passing lane and also large piles of road material along the north edge of the road. It is wide here and I parked and could see a place where people had gone over the bank to reach the river. I took a press and my backpack and went over the bank and down to the river. I followed the river east towards the Poe Dam. In about 100 yards the river turned to the northeast, leaving a small stream and a large gravel bar. I started collecting in and along the small stream and found *Veronica catenata* - Pale-flowered Speedwell - (Ahart 13,295) and *Crypsis alopecuroides* - Alopecurus-like Picklegrass - (Ahart 13,302). These species were new for Butte County. I then worked very hard collecting on the large gravel bar and along the stream. It was a hot calm day and the little flies were bad, but I was able to fill three plant presses (about 150

voucher specimens).

I did not find the clover, so on 13 September, I returned and parked in the same spot. This time I went west to another trail down to the river. Here there is a large sand bar high on the bank of the river. I collected specimens and continued on down the river. I crossed Mill Creek to another larger sand bar high on the bank of the river. People come down from an access road to go swimming and fishing here. I continued on down the river to where the river flows to the south side. To go on I would have to climb up the side of the mountain. There is a bedrock mortar with small holes here, perhaps once used to grind up small seeds. I returned to the large sand bar and went up to the access road and returned to my pickup. I then drove on, up Highway 70 to the Cresta Power House, and parked and went down to the river following the road to the powerhouse. Here I again collected plants. There is a large bedrock mortar here, probably used to process acorns. I returned to my pickup and called it a day - it was a hot day and I was tired.

Again I had failed to find the clover. So on 28 September, I returned to the rest area just south of the Arch Rock Tunnel on Highway 70. Many years ago, Dr. Rob Schlisling had led a plant fieldtrip to the Bear Ranch Creek to see the falls. I decided to go and see the falls. With a plant press and my backpack I took the access road to the creek. I checked out the falls and looked at mosses but found little to collect. I returned to the tunnel (there is a large tunnel below the falls on Bear Ranch Creek) and looked for mosses. I spotted an unusual fern high on the bank near the tunnel entrance. What in the

Collecting continued on page 5

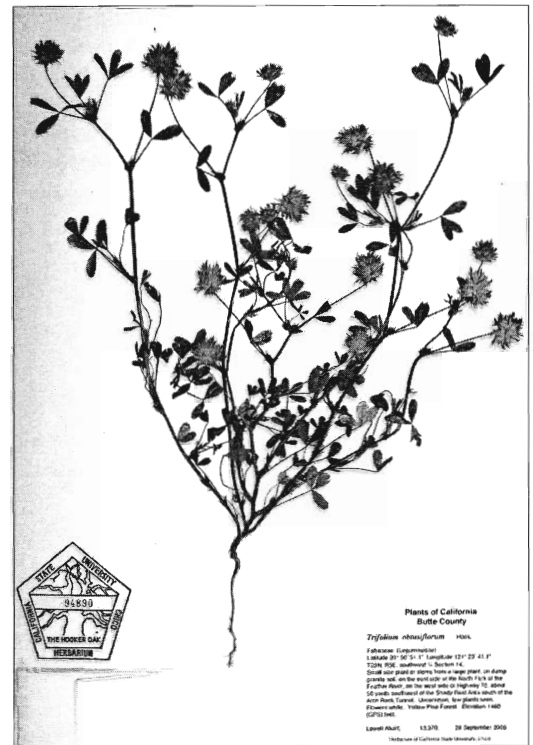
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Collecting

world is that I thought, and how do I collect some? I worked my way west along the creek, but there was no place to climb the steep cliffs safely. Here I collected some mosses and ferns and returned to my press and pressed the ferns. Finding a long limb I returned to the out of reach fern and tried to get some with the limb. The limb was not long enough. On looking around I discovered I could climb a steep mossy rock to a small ledge. From the ledge I might be able to reach the fern. Very carefully I climbed the rock to the ledge. By standing on tiptoes I could just reach the fern and I collected enough for three vouchers. The fronds were young and on looking around I found, lying flat, some old dried up fronds. These I collected so as to make complete useful vouchers. The fern keys to *Polypodium calirhiza* - Intermediate Polypody - (Ahart 13,360), but if this is correct I do not know. I will send some to Alan Smith, the fern expert at UC Berkeley. I then followed Bear Ranch Creek down to Highway 70. Here, by looking across the stream and high on the cliffs, I could see dried stems of *Lewisia cantelovii* - Cantelow's Lewisia. I went north along the east side of Highway 70 and in a little ways saw high on the road cut bank another colony of the Lewisia. I went

almost all the way back to the rest area, but saw a large sand bar along the river. I crossed the highway and went down to the sandbar. Along the river there is a moist area and in this area there were many different kinds of plants. One of the plants was the long looked for clover *Trifolium obtusiflorum* - Clammy Clover - (Ahart 13,370). ▶ Here I spent the rest of the day collecting plants. Again I filled three plant presses. It was hot and I got tired, and when I got all I could find I went home. On checking the plants I discovered what looks to be *Amaranthus hybridus* - Hybrid Amaranth - (Ahart 13,366). If this is the correct identification it would be another new plant for both the Butte County Flora and Glenn Clifton's Plumas County Flora.

I was having such a good time collecting along the North Fork of the Feather River that I decided to try my luck in Plumas County. On 8 October, I went to Chips Creek. Chips Creek is about 1¼ miles southwest of Belden. Here were sand and gravel bars that kept me quite busy and I filled two presses. I was getting tired so I returned to the Arch Rock Tunnel. From here on I watched the river to see if there were gravel bars. There is a large gradual turn in the river and below the turn I stopped. I got a plant press and worked my way through the trees and brush down to the river. There was a large gravel



bar, but it had few plants on it. I went on down the river until it flows into a large pool. A small stream flows into the river here and there are wet sand bars. Here I filled a plant press. Quite tired now, I returned to my pickup and went home. On identifying the plants collected I came to one that I had collected on a gravel bar in Chips Creek. It keys to *Polygonum minimum* - Leafy Dwarf Knotweed - (Ahart 13,392), but it does not look like any I have ever seen. Maybe it's an undescribed species. All Right!! Wow!!!

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History

writes a newsletter for the Friends of the Herbarium that is widely distributed. The herbarium has become a valuable tool for research throughout California and elsewhere.

While Lawrence's position was developing, Vern Oswald, who had become interested in photographing wildflowers, decided to take the taxonomy class to be able to identify what he was seeing. Shortly thereafter, he and Lowell Ahart teamed up

and began combing Butte County to write a county flora. They did the same for Mt. Lassen National Park. They obtained thousands of quality specimens, which were added to the herbarium collection. Many others also contributed small numbers of specimens, that brought the total in mid 2006 to roughly 95,000.

[We invite you to share your recollections of herbarium history, about your time working in the herbarium or making use of the herbarium resources. —the editor]

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Message

Doug Alexander, and with editorial shepherding by editor-in-chief Lawrence Janeway (who is also your herbarium curator), includes papers based on 18 talks presented at the vernal pool conference held in Chico in March 2006 by the Butte Environmental Council. The Friends of the Herbarium was also a sponsor of this important conference. Watch for announcements when this book becomes available.

The Effect of Four Levels of Irradiance on the Survival, and Growth Rate of *Artemisia douglasiana*, *Clematis ligusticifolia*, and *Vitis californica*

by 2007 Jim Jokerst Field Botany Award winner Prairie Johnston

The Sacramento River is the largest watershed in California (Golet *et al.* 2006). This riparian system provides habitat for a diverse array of flora and fauna. Originally this ecosystem covered over 323,748 hectares; today less than 8,093 hectares remain (Golet *et al.* 2006). In 1988 the restoration of the Sacramento River riparian corridor from Red Bluff to Colusa was undertaken by The Nature Conservancy and its government partners (Golet *et al.* 2006). The basic methodology for restoring the riparian vegetation has been to buy agricultural lands and replant them with native trees and shrubs. It was assumed that once the native canopy was restored native herbaceous understory species would colonize the restoration sites.

A survey of native understory herbs in 15 of the restored sites and five remnant forest sites was completed by Holl and Crone in 2001. They found native understory species richness and cover to be much higher in the remnant forest plots than any of the restored sites (Holl and Crone 2004). While the restoration sites have succeeded in replicating the woody overstory, the native herbaceous understory has failed to colonize. In restored sites the understory is dominated by non-native herbs, while native species make up only a small percent of the understory cover (mean 10.5%, range 1.8-36.3%) (Holl & Crone 2004). There is a range of possible causes for the native herb's failure to colonize these restored sites, including inappropriate habitats created by the restored forest canopy.

Plants native to the Sacramento River riparian ecosystem have evolved in a Mediterranean climate. Average temperatures for the central valley range from 35.2°C in July to

3.0°C in February. Rainfall averages 662 mm annually with most of the precipitation falling between November and April, and very little precipitation occurring between June and September. Understory species in Central Valley riparian ecosystems have to survive summer drought and the low light levels of the forest floor. Currently there are three hypotheses for how drought and shade may interact to affect a plants' survival and growth. The trade-off hypothesis predicts that the negative effects of shade will be multiplied under drought conditions due to increasing demand for growth resources (light and water) both above and below ground (Sack and Grubb 2002, Sanchez-Gomez *et al.* 2006). The facilitation hypothesis predicts that drought conditions can be eased by shade. This is based on the idea that plants transpire less water and are exposed to less thermal and irradiance stress in shady conditions (Demmig-Adams and Adams 2006, Sack 2004, Sack and Grubb 2002, Sanchez-Gomez *et al.* 2006). The third hypothesis proposes that along a gradient of shade the effects of drought are proportionally fixed (Sack and Grubb 2002, Sanchez-Gomez *et al.* 2006).

Many studies to date favor the facilitation hypothesis or have found that shade and drought tolerance vary independently (Prider and Facelli 2004, Sack 2004, Sack and Grubb 2002, Sack and Grubb 2001, Sanchez-Gomez *et al.* 2006). This suggests that individual species occupy different niches in the understory of Mediterranean riparian forests depending on their individual drought and shade tolerance levels. Studies have found that woody species with high growth rates in open sunlight have low survival rates in shade con-

ditions, whereas species that exhibit high growth rates in the shade have low survival in open sunlight (Sanchez-Gomez *et al.* 2006). Sanchez-Gomez *et al.* (2006) also found that species with low shade tolerance had higher growth rates overall, in both full sun and deep shade, than shade tolerant species. However, these shade intolerant species had very low survival rates in deep shade. Very few studies have focused on herbaceous species response to drought, and shade. Understory species spend their entire lives under the forest canopy either in light gaps or in deep shade and as a result they may respond differently to drought and shade than woody saplings.

My research will focus on how four levels of irradiance affect the survival, growth rates, and photosynthetic response for three riparian understory species: *Artemisia douglasiana* (mugwort), *Vitis californica* (California wild grape) and *Clematis ligusticifolia* (virgin's bower). Preliminary data from a large manipulative study examining the effects of canopy cover on native riparian herbs and vines suggests that these three species differ in their ability to tolerate shade. This data shows *C. ligusticifolia* and *V. californica* exhibiting higher survival in the shade, while *A. douglasiana* exhibited higher cover values in the full sun (Holl unpublished data). I hypothesize that *C. ligusticifolia* will have the highest growth rates in the deep shade treatments, *V. californica* will have highest growth rates in medium shade treatments, and *A. douglasiana* will have the highest growth rates in the full sun.

What constitutes good or successful ecological restoration is highly debated. It is generally

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Jokerst

accepted that the effectiveness of a restoration project can be evaluated based on its structural replication, functional success, and durability (Higgs 1997). In order to create structural replicates of Sacramento River riparian habitats some of these native understory species may need to be planted in existing restoration sites. Knowledge of the species' optimum level of irradiance will allow restoration managers to select the appropriate microhabitats for planting these species.

Research Question: How do different levels of irradiance affect the survival, growth rates, and photosynthetic physiology of *Artemisia douglasiana*, *Clematis ligusticifolia*, and *Vitis californica*?

Experimental design: This experiment will be replicated at two

sites on the National Wildlife Refuge (Pine Creek unit and Capay unit) located within the two year flood plain of the Sacramento River. These sites are scheduled to be restored in spring 2007. Neutral shade cloth will be used to create 70%, 40%, and 10% irradiance. Treatments with no shade cloth will represent 100% irradiance or no canopy. The shade categories will be replicated 25 times for each species at each site.

In December of 2006 an open field 60 by 60 meters at each site was mowed to facilitate plot setup. At each site, one hundred individuals from each species were planted in a stratified random grid separated by 3 meters. This buffer is large enough so that between April 1 and October 31, from 10:00 to 16:00 the shade structures will cast no shade onto each other. In late April/early May, depending on when the trees begin to

leaf out, a round shade tent (0.355 meters in diameter, 1.06 meters tall) will be placed over each individual receiving a shade treatment. The shade tents will be removed in late October/early November, timed with when the trees lose their leaves, and replaced again the following spring.

Throughout the growing season grass and forb competition will be controlled by mowing. Hobo data loggers (Onset Corp.) will be placed at ground level in a random sample of shade tents and open plots to record the air temperature throughout the growing season and to record flooding in the winter. Deep soil cores to the depth of refusal or ground water will be taken at each site. Surface soil cores (0-15 cm) will be taken at each site to determine texture and organic matter.

The survival and cover (growth)

Jokerst continued on page 8

The Friends of the Biological Sciences Herbarium thanks all of our new and renewing members for 2007!

Michael Abruzzo and Janet Brown, Forest Ranch	Beth L. Corbin**, Huntsville, UT	Jane E. Hazen, Chico	Melissa Perretti, Auburn
Lowell Ahart**, Oroville	Tina Costella, Nevada City	Samantha M. Hillaire, Chico	David Popp, Fair Oaks
Jack Alderson, Chico	Julie Cunningham and Larry Newman, Quincy	Amy Hiss, Davis	Rhonda Posey, Mount Shasta
Marge Anthony**, Gualala	Wes and Phyllis Dempsey, Chico	Peter Holloran, Santa Cruz	Alice Ratchiff, Redding
Laurie Archambault, Sacramento	Jim Dempsey, Chico	Russell Huddleston, Sacramento	Bonnie Riley, Apple Valley
Tim Armstrong, Woodland	Tim and Denise Devine, Chico	John Huls, Sacramento	Julie Rochlitz, Redding
Barry Baba, Sacramento	David DeVries, Berkeley	Brian Humphrey, Redding	Bonnie Green Ross, Fair Oaks
John H. Bair, Bayside	John Dittes, Los Molinos	David Isle, Stonyford	Dave Schlichting, Chico
Jennifer Ballard, Reno, NV	Michael P. Dolan, Alturas	Mr. & Mrs. Oscar Janeway, La Habra	Robert Schlising, Chico
Bob Battagin, Oakland	Hal Durio, San Leandro	Lawrence Janeway, Chico	Gary Schoolcraft, Susanville
Jim Battagin, Quincy	Kim Earll, Susanville	Henricus Jansen, Chico	Dulcy Schroeder, Forest Ranch
Jim Bauml, Chico	Robert Ediger, Oroville	Mike Jenkins, Magalia	Wayne Schwartzkopf, Grass Valley
Susan Bazell, Paradise	Dan Efseaff, Chico	Kelly M. Kawsuniak, Anderson	Renee Seely, Sacramento
Sarah A.N. Bennett, Sacramento	Woody Elliott, Chico	David Kelley, Davis	Paula Shapiro, Cohasset
Jim Bidlack, Edmond, OK	Brian Elliott, Albuquerque, NM	Paul Kirk, Chico	Mary A. Shea**, Concord
Albin Bills, Paradise	Tom Engstrom, Redding	Gail Kuenster, Paradise	Jim Shevock, Berkeley
Catie and Jim Bishop, Oroville	Peter Figura, Redding	Rodney Lacey, Chico	Joseph and Deborah Silveira, Durham
Colby Boggs, Chico	Robert Fischer, Chico	David Ledger, Arcata	Daria Snider, Rocklin
Robert Bowman, Gilroy	Erin Gottschalk Fischer, Nevada City	Martin J. Lenz, Montague	Sharon Stacey, Redding
Philip Brownsey and Rachel Brush, Berkeley	Mike Friend, Blairsden	Morgan LoRomer and Gavin Blosser, Asheville, NC	Tamara Steelman, Montague
Jennifer J. Buck, Galt	Tina Garcia, Sutter Creek	Jenny Marr, Chico	Leslie Steidl, Oroville
Richard Burgess, Oxnard	Margie Graham, Red Bluff	Susan Mason, Chico	Lynn Thomas, Chico
Donald Burk, Cottonwood	Herman Gray, Chico	Steve Matson, Crystal Bay, NV	Jeannie Trizzino, Chico
Phil Butler, Paradise	Tom Griggs, Chico	Mary Ann McCrary, Redding	Maria Ulloa-Cruz, Richfield, UT
Melinda Carlson, Gerber	Josephine Guardino, Los Molinos	Robert and Margie McNairn, Chico	Heather Von Allmen,
William K. Carlson, Chico	Rebecca Guenther, Berkeley	Bernice McProud, Chester	Heidi West, Sacramento
Barbara Castro, Chico	John Hale, Chico	Mary Merryman Benterou, Chiloquin, OR	Ann Willyard, Vermillion, SD
Stephanie Changaris and Bruce Bonar, San Carlos	Bill and Sandy Haley, Roseville	Twyla Miller, Yreka	Jean Witzman, Winters
Michelle Clark, Red Bluff	Linnea Hanson, Chico	Don Miller, Chico	Howard Wurlitzer**, Chico
Jessica Cook, Sacramento	Christine Hantelman and Richard Coon, Chico	Candace Miller, Dunsmuir	Sherry Yarnell and Ron Barnes, Orland
Dr. & Mrs. John Copeland, Chico	George Hartwell, Paradise	Joe and Linda Molter, Redding	
		Vivian Parker, Kelsey	** = Lifetime member

Yes! I would like to join!

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This is a renewal for 2008.....

Please make your check payable to:
“Friends of the Biological Sciences Herbarium”

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Jokerst

for each species will be recorded in the spring and fall of 2007 and 2008. Between May and November of 2007 and 2008 light response curves will be generated using a Li-Cor 6400 (Li-Cor Inc. Lincoln, NE)

throughout the growing season. Survival data will be analyzed using a chi-square test. Cover and photosynthetic saturation will be analyzed using a repeated measure ANOVA with site, shade, species, year, season, and replication as factors. The

slope of the light response curves for each species/irradiance level will be compared in a graph form, allowing us to assess photosynthetic plasticity of each species.

[The list of references provided upon request. —the editor]

Friends of the Biological Sciences Herbarium

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