

Friends of the Herbarium

Biological Sciences Herbarium

California State University, Chico

Newsletter

Vol. 5 No. 1

June 1999

!! MARK YOUR CALENDARS !!
Friends of the Biological Sciences Herbarium
Annual Meeting

6 November 1999

Look for details in the next *Newsletter*

.....

Learn about research by 1999
Jim Jokerst Field Botany Award winners
– see pages 3 - 6 –

.....

Ballot for members of the Board of Directors
Please Vote
– see insert –

.....

more
Friends of the Herbarium
Workshops
– see insert –

Remember, at least half of your registration fees help support
the Friends activities on behalf of the Herbarium.

.....

Time to renew annual memberships
in Friends of the Biological Sciences Herbarium
– Please Renew –

MESSAGE FROM THE BOARD

This issue of the Friends of the Biological Sciences Herbarium *Newsletter* marks the beginning of year five of this Friends group. Partly due to the influence of this group, partly due to the drive of the new Herbarium Director (Dr. Schierenbeck – with year one as Director almost completed), and partly due to the hard work of Dr. Abruzzo, chairman of the Department of Biological Sciences, progress continues to be made towards several major goals of the Friends of the Herbarium.

The Herbarium now has the new computer mentioned in the last Newsletter. Soon the Herbarium staff and volunteers will begin inputting herbarium label information from the collection. The near-term goal is to obtain grant funding to finance the data-basing of the

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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 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 May 1 of each year.

BOARD OF DIRECTORS

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Newsletter

Volume 5 Number 1

The Newsletter is published three times a 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.

New name for a Butte County *Elymus*

A recent article (Barkworth, M. E. 1997. *Elymus stebbinsii*: Taxonomy, Nomenclature, and Distribution. *Phytologia* 83:345-365) provides the name *Elymus stebbinsii* Gould ssp. *septentrionalis* Barkworth for the long-awned form of *Elymus stebbinsii*. This subspecies grows in the western Sierra Nevada and southern Cascade Mountains, including Butte County, while ssp. *stebbinsii*, with shorter awns, grows near the coast of northern California and in the Transverse Ranges. So get out your copies of the Butte County flora (Oswald, V. A. and L. Ahart. 1994. *Manual of the Vascular Plants of Butte County, California*. California Native Plant Society, Sacramento) and on page 282 add "*ssp. septentrionalis* Barkworth" after "*Elymus stebbinsii* Gould."

The taxonomic history of this new subspecies, including a misidentified type specimen, name changes, and difficult keys, is rather complicated, so I will not try to summarize it here. But the article by Dr. Barkworth makes interesting reading for those of us who appreciate taxonomic detail.

The article also provides a new key to the California species of *Elymus*, since Dr. Barkworth found using previous keys (i.e., Barkworth, M. E. 1993. *Elymus*. Pp. 1253-1256 in J. C. Hickman (Ed.), *The Jepson Manual: Higher Plants of California*. University of California Press, Berkeley) to be "frustrating."

A copy of this new key to California *Elymus* is available in the herbarium, and I have a copy of the whole article that I can share. LJ

- 1999 WINNERS - Jim Jokerst Field Botany Award

Congratulations to the *Jim Jokerst Field Botany Award* winners. This year's winners are Natalie Wight, David Parks, and Frances Phipps. Each of these award-winning researchers will give a short presentation of their studies to the General Meeting of the Friends of the Herbarium to be held November 6. Natalie Wight is studying the effects of prescribed burning on rare plants at the Sacramento National Wildlife Refuge, David Parks is determining the evolutionary relationships of *Arctostaphylos mewukka*, and Frances

Elymus stebbinsii subsp. *septentrionalis*
Barkworth, *ined.*
Voucher for study of *E. stebbinsii*
CHSC 42952

Determined by Mary E. Barkworth, 1997
Intermountain Herbarium - Utah State University

Phipps is analyzing the California populations of the rare *Howellia aquatilis* Summaries of these three projects are presented in this issue of the Newsletter (see pages 3 - 5).

Winners of the *Jim Jokerst Field Botany Award* receive a cash award contributed entirely by an anonymous donor. LJ

Continued from page 1

Message from the Board

entire Herbarium collection and library.

The current timeline for remodeling of Room 129, adjacent to the Herbarium, for Herbarium expansion, may begin within the next few weeks, with completion hoped for sometime next fall.

Stay tuned for more news on these activities and others by the Herbarium and the Friends of the Herbarium. LJ

Effects of prescribed burning on rare alkali plants at the Sacramento National Wildlife Refuge Complex.

A project by Jim Jokerst Field Botany Award winner Natalie Wight

Description of the management problem. The Sacramento National Wildlife Refuge Complex is one of several refuge complexes located along the West Coast Pacific flyway. These refuges are committed to the preservation of migratory birds, and endangered, threatened and rare species, along with their habitats. They also provide conservation-oriented recreation and educational opportunity for visitors and local researchers. At the Sacramento National Wildlife Refuge Complex (the refuge) a unique mosaic of vernal pools and alkali meadows provide habitat for 13 rare and endangered plant species, including four federally listed threatened and endangered species. But passive management practices and possible lack of fire, have resulted in alkali grassland communities covered with mats of tule debris (*Scirpus acutus*) and thickets of introduced annual grasses (Italian ryegrass – *Lolium multiflorum*, wild oat – *Avena fatua*, Brome – *Bromus* spp.). In several areas of the refuge these “invaders” are disrupting entire meadows of habitat occupied by rare plants.

The refuge managers are now in the process of developing fire management regimes to prescribe to these sensitive sections of habitat. While evidence from previously burned alkali meadows on the refuge suggests that prescribed burning does benefit native species, a detailed monitoring program is urgently needed.

This study concentrates on the native and rare plants found within tracts of the refuge in need of fire management. One species, palmate-bracted bird’s beak



(*Cordylanthus palmatus* – Scrophulariaceae) is on the CNPS list 1B (rare, threatened or endangered in California and elsewhere), and is also federally listed as an endangered species. Three other species of concern are heartscale (*Atriplex cordulata* – Chenopodiaceae), brittlescale (*A. depressa*), and San Joaquin spearscale (*A. joaquiniana*); all three are listed CNPS 1B and grow within alkali areas of the refuge disrupted by increasing numbers of exotic annuals. This creates a very special situation where research, monitoring and fire management must work together to protect the unique halophytic species and their habitat.

Description of the project. The focus of this study is on the pre- and post-burn data collected from four small sites on the refuge (approx. 40 x 20m each). Although spring burns have been more successful in removing exotic invasive species (such as ryegrass – *Lolium multiflorum*), multiple paired plots will be set up to determine how a spring vs. a fall burn will effect the frequency and distribution of the rare plants. Because the habitat of these species involves highly alkaline soils and scalds, burns at the refuge have shown that the pure nature of this habitat protects its vegetation from direct fire, as the flames have a tendency to move precisely around the edges of the scalds. But, again, a monitoring program needs to be installed to collect data on this phenomenon.

The actual burn plots, paired with no-burn control plots, will be very small scale using 1.5 x 1.5m steel “burn boxes” to control the flames

around the plants. Research and personal communication with Dr. Bruce Pavlik, a California rare plant ecologist, has shown that these boxes, for use with rare plants and other sensitive species, have been very successful in gathering valuable information while causing the minimum amount of damage to the actual plant populations. To measure the temperature of the burns inside the boxes, a combination of temperature sensitive paints and pellets will be experimented with. This information will be useful in comparing the intensities of fall vs. spring burns, as well as determining whether the “burn box” plots are comparable to the intensities of full field burns in the same type of alkali habitat. General species transects using nested frequency frames will be monitored seasonally at each study site, and on larger field refuge burns used for habitat comparison.

Laboratory seed viability tests will also be conducted to supplement the field data gathered. The seeds will be collected and subjected to various heat, cold and salt treatments in an effort to understand the germination requirements for these specific rare plants and whether fire has any effect on their germination rates. All germinating plants will be transplanted back at the refuge. Post-burn behavior is poorly documented for these species; therefore results from seed experiments would be a valuable factor in designing a management scheme to reduce invasive exotics encroaching on this rare plant habitat.

Literature addressing the policies of fire use as a management tool on other rare plant communities has

Continued on page 4

Evolutionary Relationships of *Arctostaphylos mewukka* and Associated Species

By Jim Jokerst Field Botany Award winner David Parks

Classification of angiosperms can be enigmatic. Systematics is dependent on evolutionary relationships which are influenced by factors such as edaphic and topographic conditions, survival strategies such as persistence in fire communities, and the occurrence of polyploidy and hybridization. Hybridization further complicates evolutionary pathways by involving more than just one set of parental species, i.e., more than a single phylogeny. The species in question is the central Sierran tetraploid *Arctostaphylos mewukka* Merriam, and whether or not it is of polyphyletic origin.

Classifying species of *Arctostaphylos* has been problematic due to the existence of clines between taxa and also due to the lack of reproductive barriers. Because of this, multiple taxa of *Arctostaphylos* may have been involved in the evolution of *A. mewukka*. It is proposed that *A. mewukka* could be the result of hybridization between *A. patula* E. Greene and either *A. viscida* C. Parry ssp. *viscida* or *A. viscida* ssp. *mariposa* (Dudley) P. Wells. Also, the species *A. trueii* Knight and *A. manzanita* C. Parry may be involved in the parentage of *A. mewukka*.

This study hopes to answer the

question of whether or not *A. mewukka* is an allopolyploid of polyphyletic origin. There are three hypotheses proposed for identifying the parentage of this potential polyphyletic allopolyploid species: 1) *A. mewukka* is a monophyletic allopolyploid derived from *A. patula* and either *A. viscida* ssp. *viscida* or *A. viscida* ssp. *mariposa*; 2) *A. mewukka* is polyphyletic and allopolyploid; 3) *A. mewukka* is not allopolyploid and did not arise from any existing species.

Previous studies of *Arctostaphylos* have used morphological characters to determine phylogenetic relationships. The goal of my Master's Thesis is to use genetic analyses to clarify the origin of *A. mewukka* and hopefully identify the parentage of this species.

The bulk of my work will be done in the lab using chloroplast DNA and ribosomal DNA to identify species-specific markers, and then apply these markers to a phylogenetic analysis of species relationships. However, before laboratory procedures are employed, considerable amounts of field collecting will be done. To date I have collected samples of 20 individuals from the following areas: Paradise, CA;



Magalia, CA; an area east of Nevada City, CA off of Highway 20; an area near the crossroads of Highway 20 and Interstate 80; and Peavine Ridge, east of Placerville, CA. Other collecting trips will be made to Yosemite National Park, Plumas County, and areas off Highway 70 in the Feather River Canyon. From each location samples will then be taken back to lab facilities in Holt Hall for genetic analyses.

Depending on the results that I obtain, the data will support or disprove the hypothesis that *A. mewukka* is of polyphyletic allopolyploid origin. If *A. mewukka* is indeed monophyletic I expect to see polymorphisms shared between only two of the proposed parental species. If it is of polyphyletic origin I expect to see a wide mosaic of polymorphisms associated with several of the parental species.

Depending on the results this project will hopefully shed light on the debate between monophyly versus polyphyly as means of speciation. If *A. mewukka* is indeed polyphyletic it will demonstrate how one species may arise from several distinct lineages that reproductively overlap enough to produce the same progeny on separate occasions.

Continued from page 3

Natalie Wight

been very helpful in directing our own experimental approach in this study. Emphasis on the need for conservative or light hand tactics is a reoccurring theme in general rare plant literature. Most botanists suggest the use of small-scale experiments on specific species when dealing with sensitive plant populations. Following the guidelines established

under Section 7 of the Endangered Species Act, the advice of federal, state and local conservationists, the refuge personnel and myself have designed a project to best suit the interests of these rare plants and their specific habitat.

The information gathered from this study will be developed into a series of reports for the Sacramento National Wildlife Refuge and other funding agencies. Fulfilling the the-

sis portion of my Masters degree, the final product will consist of: 1) a full literature review and background report on the four rare halophytes and how to manage alkali habitat 2) two seasons of pre- and post-burn monitoring data and analysis on both full-field and intensive burn box sites, 3) laboratory seed viability analysis on the four rare species, and 4) an evaluation of this information lead-

Continued on page 6

RAPD and chloroplast DNA analysis of the six California Populations of *Howellia aquatilis*

A project by Jim Jokerst Field Botany Award winner Frances Phipps

Introduction. *Howellia aquatilis* (water howellia) is a federally listed threatened aquatic plant, which was thought to be extirpated in California until it was rediscovered in Mendocino National Forest in June 1996. This member of the Campanulaceae is an annual species which grows mostly submerged in ponds with colluvial or Madonna soils. It also tends to favor shaded areas surrounded by mixed conifer and hardwood forests. The California populations are found exclusively within the Mendocino National Forest in ponds at elevations from 1067 to 1372 meters.

Howellia aquatilis is currently known from populations in California, Idaho, Montana, and Washington. Preliminary work conducted by Dr. Steven Brunsfeld, at the University of Idaho, show that the Idaho, Montana, and Washington populations are genetically closely related, whereas the California population seems to have a separate evolutionary history. There is no information on the extent of relatedness of individuals within a pond (i.e. whether they are clonal) or among ponds. A determination of genetic variation in these populations will provide much needed information on the mode of reproduction and dispersal of this species.

I am proposing to analyze the genetic variation within and among the six known California populations of *H. aquatilis* using data generated from the nuclear chloroplast DNA genomes.

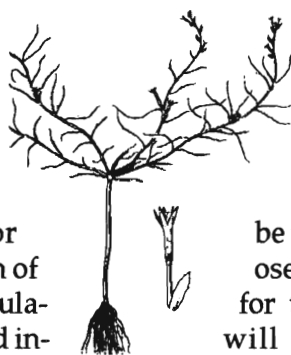
Question. What is the level of genetic variation within and among the California populations of *Howellia aquatilis*?

Methods. Collection: Collection of plant tissue from the study species will be conducted during the growing season (June to August). Ten leaves will be collected from each plant sampled. These plants will be chosen from fifteen transect sites along the perimeter of the pond.

Each transect site will consist of two meters long transect lines that will lay perpendicular to each other. The samples will be collected at 0.5 meter intervals (4 samples per line) along the transects in order to account for clonal growth, giving a total of 120 samples from each pond.

Extraction: Total DNA extraction will be done with a modified CTAB procedure.

Amplification: Using a PCR protocol for RAPDs, the DNA will be amplified using single primers that have an arbitrary sequence. At least 25 different RAPD "loci" will be optimized for identification of polymorphisms using as many primers as necessary.



Each sample will be run on a 1.5% Agarose gel at 45 milliamps for two hours. The gel will be stained with ethidium bromide and the bands will be analyzed with the use of the Kodak 1D 2.0.0 program.

The chloroplast DNA (cpDNA) will be amplified and digested, using the protocol of Symonds et al. to provide a 7.0 Kilobase product from the *PetA* to the *rbcl* genes.

The PCR-cpDNA products will be digested with multiple restriction enzymes to identify restriction fragment length polymorphisms and

resolved electrophoretically on a 1.5% agarose gel and visualized by UV fluorescence after staining with ethidium bromide.

Analysis: RAPD Data- A matrix of pairwise distances between all individuals within each species will be calculated using Euclidian distance measures using the RAPDistance Analysis Package. The distance matrix will be analyzed using the Analysis of Molecular Variance (AMOVA) package which uses an analysis of variance framework to partition the variation within and among populations and regions.

CpDNA Data- Weir's Theta-P (equivalent to Wright's *Fst*), and genetic diversity statistics will be calculated for both the nuclear and chloroplast data using Genetic Data Analysis version 01.

Relevance. The genetic data collected in this study will enable us to better understand the reproductive biology of this federally threatened species. For example, they will allow us to determine the extent of clonal growth and contribute to understanding of the mode of dispersal.

Other important impacts related to *Howellia aquatilis* are economic issues for the U.S. Forest Service. Management of this species conflicts with grazing allotments which occur in Mendocino National Forest. The existence of *H. aquatilis* makes cattle ranching against the law in desirable ranching areas which the plant grows.

A more thorough understanding of the population genetics and biology of *H. aquatilis* will provide the U.S. Forest Service with some of the information needed to manage the habitat in which this threatened species grows.

Yes! I would like to join!

____ Student.....\$5.00
____ Individual\$10.00
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____ Lifetime\$1,000.00
____ Donation\$ _____

This is a renewal for 1999

Please make your check payable to:
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Name _____
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State _____ Zip Code _____
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Board Meetings

– meet in the herbarium –
Fridays at 3:30 pm

Aug. 6, 1999 Feb. 4, 2000
Nov. 5, 1999 May 5, 2000

All members are welcome and encouraged to attend.

– call to verify meeting –

Continued from page 5

Natalie Wight

ing to successful management strategies for alkali habitat and its species—not only for the Sacramento National Wildlife Refuge, but also on other Great Valley National Wildlife Refuge Complexes having similar rare plants and vegetation (i.e.

San Luis and Kern National Wildlife Refuge Complexes). With a detailed monitoring regime and supplemental seed experiments, this study will develop a reproducible approach to understanding more specific areas of accumulated fuel fire management—while protecting the species that may benefit most.

Friends of the Biological Sciences Herbarium

California State University, Chico

Chico, CA 95929-0515

(530) 898-5381

ADDRESS CORRECTION REQUESTED

WORKSHOPS
SPONSORED BY THE
FRIENDS OF THE BIOLOGICAL SCIENCES HERBARIUM
CALIFORNIA STATE UNIVERSITY, CHICO

INTRODUCTION TO KEYING THE SUNFLOWERS (ASTERACEAE).
25 September 1999, Saturday.

INTRODUCTION TO KEYING CAREX.
13 November 1999, Saturday.

TO REGISTER FOR WORKSHOPS:

Please make checks payable to:
"Friends of the Biological Sciences Herbarium"

include your name, address, and phone number and mail to:
Friends of the Biological Sciences Herbarium
California State University, Chico
Chico, CA 95929-0515

INTRO TO KEYING THE SUNFLOWERS (ASTERACEAE). 25 September 1999, Saturday.

With over 1,300 genera and 21,000 species recorded, the sunflower family (Asteraceae) is the largest plant family in the world, and with over 207 genera represented, it is also the largest family in California. Come and learn the taxonomy of this remarkably diverse group with John Dittes, local botanist and consultant with Jones and Stokes Associates. John will lead this one-day workshop during which participants will key as a group and individually, using *The Jepson Manual*. John will provide fresh specimens from Butte, Tehama, Plumas, Lassen, and Sierra Counties. Beginners, as well as those wishing to brush up on their skills, are invited.

Please bring forceps (tweezers), dissecting needle, and a 6" millimeter ruler. You are also invited to bring any plants you may have been wondering about. If possible, also bring a copy of *The Jepson Manual* (we have several copies to loan to those who need them); we can direct you to sources for *The Jepson Manual* if you contact us ahead of time.

The workshop will meet on Saturday, September 25, from 9:00 am to 4:30 pm in Holt Hall room 129 at CSU Chico. The registration fee is \$35.00 (\$25.00 for members). Please register in advance; class size is limited to 16 participants (class cancelled without a minimum of 5 participants). For more information about workshop content, please contact John Dittes at (530) 895-0349. For information about registration or directions, please call the Herbarium at (530) 898-5381.

INTRODUCTION TO KEYING CAREX. 13 November 1999, Saturday.

The genus *Carex* (Cyperaceae) is by far the largest genus in California, with about 135 species in California and more than 1,000 species worldwide! This workshop, led by Lawrence Janeway, is an introduction to keying *Carex* using *The Jepson Manual*. Material of several species of *Carex*, mostly from northern California, will be provided for use by all members of the class keying together, each person with their own specimen; herbarium labels will be provided for those participants who would like to take home their sample material for later reference. Terminology for this notoriously difficult group will be explained and illustrated as it is encountered during the keying process.

Please bring forceps (tweezers – the sharper, the better), dissecting needle, 6" millimeter ruler, and a copy of *The Jepson Manual*.

The workshop will meet on Saturday, November 13, from 9:00 am to 5:00 pm in Holt Hall room 129 at CSU, Chico. The registration fee is \$35.00 (\$25.00 for members). Please register in advance; class size is limited to 16 participants (class cancelled without a minimum of 5 participants). For more information about the workshop, please contact Lawrence Janeway by e-mail at lpjaneway@compuserve.com or by phone-mail at (530) 899-7434. For information about registration or directions, please call the Herbarium at (530) 898-5381.

FRIENDS OF THE BIOLOGICAL SCIENCES HERBARIUM
CALIFORNIA STATE UNIVERSITY, CHICO
(530) 898-5381

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Student \$5.00
Individual.....\$10.00
Contributing.....\$25.00
Sustaining.....\$100.00
Lifetime\$1000.00

Please make checks payable to
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and mail to:

Friends of the Biological Sciences Herbarium
California State University, Chico
Chico, CA 95929-0515

Dear Friend of the Herbarium,

The Friends of the Biological Sciences Herbarium at CSU, Chico is now going into its fifth year and it is time to renew your membership. We appreciate your support. With your help, we can continue to tackle the numerous tasks needed in the herbarium to keep it functioning as the important resource to the botanical community that it is. Remember, the Friends group operates under the California State University and benefits from its non-profit status. Membership is renewed on May 1 of each year. If you have already paid your 1999 dues, please disregard this notice.

It is also time to elect a "new" Board of Directors. Please vote on the ballot provided below and return to Friends of the Biological Sciences Herbarium.

RENEWAL FOR 1999

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Address _____

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State _____ Zip Code _____
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LJ 7/2

ELECTION of BOARD OF DIRECTORS

Friends of the Biological Sciences Herbarium at CSU, Chico

The following seven people have expressed an interest in serving on the Friends of the Biological Sciences Herbarium Board of Directors. Write-in candidates are also welcome.

Please vote for seven:

____ **John Dittes**
botanist, Jones and Stokes Associates,
Sacramento
____ **Robin Fallscheer**
private botanical consultant,
Contour Botanical Consulting, Chico
____ **Tom Griggs**
Adjunct Professor,
CSU, Chico
____ **Linnea Hanson**
Forest Botanist,
Plumas National Forest, Oroville

____ **Lawrence Janeway**
Herbarium Curator, CSU, Chico
botanist, CA Dept. of Water Resources
____ **Joyce Lacey**
environmental specialist/botanist
CA Dept. of Water Resources, Red Bluff
____ **Richard Lis**
botanist
CA Dept. of Fish & Game, Redding

write in

Please return your ballot by August 1, 1999.