# BOTANICAL TREASURES IN NORTHERN CALIFORNIA – WHAT'S AT STAKE?

THE THIRD ANNUAL SYMPOSIUM
PRESENTED BY

## NORTHERN CALIFORNIA BOTANISTS

California State University, Chico
11-13 January 2010

# Botanical Treasures in Northern California – What's at Stake?

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Cover photo courtesy of Rob Schlising. Larkspurs (*Delphinium variegatum*) at The Nature Conservancy's Vina Plains Preserve in the Sacramento Valley (Tehama County); view looking northeast to the foothills of the Cascade Range. Note the small amount of medusahead (*Taeniatherum caput-medusae*) present among the larkspurs at this site one year after a controlled burn. Medusahead often dominates these grassland/wildflower field plant communities in the absence of fire or grazing. May 1992.

# WELCOME!

## Northern California Botanists

welcomes you
to our third annual symposium!

MISSION STATEMENT: Northern California Botanists is a Cooperative Association of Federal, State, Academic, Consulting, and other Botanists in the Northern California Region, with the purpose of increasing knowledge and communication about botanical issues concerning science, conservation, education, and professional development.

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**PROGRAM OF PRESENTATIONS BY INVITED SPEAKERS**
Bell Memorial Union Auditorium

**Monday 11 January 2010**

**7:30 – 9:00 a.m.** **Check-in for registered participants, late registration, and poster set-up**

**ALL DAY** **Poster Session** – Bell Memorial Union second floor Mezzanine

## Welcome

**8:30 – 8:40 a.m.**

1. **Linnea Hanson**, President, Northern California Botanists
   *Welcome to Our Third Northern California Botanists Symposium*

## Session 1
## Maintaining the Wealth of Plant Diversity for Long-term Conservation

**9:10 – 10:10 a.m.**

**Christine Hantelman, Session Chair**, consulting botanist

2. **Christina Sloop**
   *Conservation Genetics of Butte County Meadowfoam (*Limnanthes floccosa *ssp.* californica *Arroyo), an Endangered Vernal Pool Endemic*
3. **Kimiora Ward**
   *Restoration Germplasm in a Changing World: How Local is too Local?*
4. **Susan Harrison**
   *Large-scale Threats to Serpentine Ecosystems*

**10:10 – 10:30 a.m.** **Break**

## Session 2
## Exotics: Robbers in the Native Landscape

**10:30 a.m. – 12:10 p.m.**

**Samantha Hillaire, Session Chair**, Garcia and Associates

5. **Clare Aslan**
   *Emerging Mutualisms: The Role of Bird Dispersal in Non-native Plant Invasions*
6. **Marit Wilkerson**
   *Downsides to Corridors: Examining Plant Invasion Potential in Linear Biodiversity Features*
7. **Kristina Schierenbeck**
   *Targeted Grazing Study for Management of Non-native* Lolium multiflorum *in Alkali Meadow Habitat Containing the Rare Plant* Cordylanthus palmatus *at Colusa National Wildlife Refuge, California*
8. **Christina Sloop**
   *The San Francisco Bay Area Early Detection Network*
9. **Craig Thomsen**
   *Invasive Plant Management on BLM's Bear Creek Ranch, Cache Creek Natural Area*

**12:10 – 1:40 p.m.** **Lunch**

## Session 3
## Pollination and Reproductive Biology: Spreading the Wealth

**1:40 – 3:00 p.m.**

**Karen Wiese, Session Chair**, Tahoe National Forest

10. **Gordon Frankie**
    *Native Bees are a Rich Natural Resource in Urban California Gardens*
11. **Justen Whittall**
    *The Metcalf Canyon Jewelflower (*Streptanthus albidus *ssp.* albidus*) – Still a Mystery*
12. **Robbin Thorp**
    *Native Bees and Vernal Pool Flowers: The Upland Connection*
13. **Pete Haggard**
    *Attracting Pollinators in a Native Plant Garden*

**3:00 – 3:20 p.m.** **Break**

## Session 4
## Plant-animal Interactions: Cashing In and Paying the Price

**3:20 – 4:20 p.m.**

**Barbara Castro, Session Chair**, California Department of Water Resources

14. **Don Miller**
    *Gall Induction by* Tamalia *Aphids Lowers Seed Set in* Arctostaphylos patula
15. **Colleen Hatfield**
    *The Health of Blue Elderberry (*Sambucus mexicana*) and Colonization by the Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*) in Restored Riparian Habitat*
16. **Ian Pearse**
    *Predictors of Herbivory on 57 Species of Non-native Oaks*

**5:30 – 7:00 p.m.** **Reception** – Bell Memorial Union second floor Mezzanine
No-host bar and complimentary hors d'oeuvres – adjacent to the Poster Display area.

**7:00 p.m.** **Dinner** – Bell Memorial Union Auditorium
Tickets required. Buffet dinner will include fish, meat, and vegetarian entrees. Complimentary wine served with dinner.

## KEYNOTE SPEAKER

**8:00 p.m.** Bell Memorial Union Auditorium

17. **Bruce Baldwin**, University of California, Berkeley
    *Botanical and Conservation Challenges of Cryptic Diversity in the California Flora*

**Tuesday 12 January 2010**

**8:00 – 8:30 a.m.** **Check-in for one-day registrants**

**ALL DAY** **Poster Session** – Bell Memorial Union second floor Mezzanine

## Introduction

**8:30 – 8:40 a.m.**
**Linnea Hanson**

## Session 5
## Assessing Our Net Worth: Some Tools for Evaluating Ecosystems

**8:40 – 10:00 a.m.**
**Joe Silveira, Session Chair**, U.S. Fish and Wildlife Service

18. **Jason Schwenkler**
    *Sticking with Tradition: An Aerial Approach to Digital Interpretive Mapping*
19. **Christopher Dolanc**
    *Changes in Structure and Composition of High-elevation Conifers of the Central Sierra Nevada Since the Early 1930's*
20. **Don Hankins**
    *The Green Side of Black: Burning to Achieve Multiple Objectives*
21. **Kevin Rice**
    *Evolutionary Considerations in Ecosystem Conservation*

**10:00 – 10:20 a.m.** **Break**

## Session 6
## Bryophytes: Gems in the Landscape

**10:20 – 11:40 a.m.**
**Julie Nelson, Session Chair**, Shasta-Trinity National Forests

22. **Carl Wishner**
    *Bryophyte Diversity of Fens in the Northern Sierra Nevada*
23. **Colin Dillingham**
    *Bryoflora of Plumas National Forest*
24. **Jim Shevock**
    *Catching the Bryo Bug in Northern California: Can Vascular-trained Botanists Become Great Bryologists?*
25. **Brent Mishler**
    *Factors Influencing the Biogeographic and Ecological Distribution of Bryophytes in California: Mosses are from Mars, Vascular Plants are from Venus*

**11:40 – 1:10 p.m.** **Lunch**

## Session 7
## How Do We Encourage Future Botanists: Establishing a Living Trust

**1:10 – 2:30 p.m.**

**Gail Kuenster, Session Chair**, California Department of Water Resources

26. **Carol Witham**
    *Increasing Nature Observation Skills in Primary School Children*
27. **Adrienne Edwards**
    *Where the Wild Things Are: Establishing a Native Plant-pollinator Garden to Inform the Wild Rumpus!*
28. **Tanya Heaston**
    *An Early Teaching Experience in Science: Why We Need It, Why We Teach It, and How Do We Get Teachers to Teach Science in Elementary School?*
29. **Teresa Sholars**
    *Creating Future Botanists: Being the Match to Light the Spark*

**2:30 – 2:50 p.m.** **Break**

## Session 8
## New Botanical Treasures

**2:50 – 4:10 p.m.**

**Chris Christofferson, Session Chair**, Plumas National Forest

30. **Judy Perkins**
    *Range Extension Discoveries of* Tuctoria greenei *(Greene's Tuctoria) on Modoc National Forest*
31. **Michael Mesler**
    *A Resurrection for Siskiyou Bells,* Prosartes parvifolia *S. Watson (Liliaceae), a Rare Siskiyou Mountains Endemic*
32. **Roy Buck**
    Sidalcea gigantea*, a Remarkable New Species from Northern California*
33. **Dana York**
    Eriogonum villosissimum *(Polygonaceae, Eriogonoideae), a New Species Endemic to Acker Rock, Oregon*

## Closing Remarks

**4:10 – 4:20 p.m.**

**Linnea Hanson**

## POST-SYMPOSIUM WORKSHOPS

Northern California Botanists

**Wednesday 13 January 2010**

**Workshop 1: Introduction to the 2nd Edition of A Manual of California Vegetation**
9:00 a.m. – 5:00 p.m. Holt Hall room 170

Instructors: **John Sawyer,[1] Todd Keeler-Wolf,[2] and Julie Evens[3]**
[1]Humboldt State University, Emeritus; [2]California Department of Fish and Game; [3]California Native Plant Society

The authors will debut the second edition of *A Manual of California Vegetation*. They will provide an overview of additions and changes to the manual, including new vegetation types recognized or redefined across many habitats. You will learn how to use the new manual in conservation and management of California's diverse vegetation types.

**Workshop 2: Positively Lively Photosynthesis: Hands-on Botany Lab for Teachers**
9:00 a.m. – 1:00 p.m. Holt Hall room

Instructor: **Tanya Heaston**
California State University, Chico

Do the California Science Standards make you blue? Join this workshop filled with fun-filled experiments to help 4-9th graders enjoy learning the process of photosynthesis and basic botany. This workshop is geared for all who work with 4-9th grades and interested educators. Leave with a bounty of experiments and lessons bound to excite your students.

**Workshop 3: Resources for Beginning Professional Botanists: What You Didn't Learn in College**
9:00 a.m. – 4:00 p.m. Holt Hall room 129

Instructor: **Samantha Hillaire**
Garcia and Associates

This workshop is intended to familiarize the beginning or aspiring professional botanist with a basic overview of State and Federal agency laws, regulations and practical applications as they relate to botany and the environment, including the National Environmental Protection Act (NEPA), the California Environmental Quality Act (CEQA), the Federal Endangered Species Act (ESA), and the California Endangered Species Act (CESA). We'll cover the general regulatory framework of several State and federal agencies including the US Fish and Wildlife Service, California Department of Fish and Game, Army Corps of Engineers, and the US Forest Service. Each agency operates independently, yet often in parallel on one project, so key permits and processes for working with these agencies is helpful and very important to understand. Topics such as Biological Assessments, Biological Evaluations, Initial Studies, and wetland delineations will be introduced, with a focus on the practical working information for a beginning botanist. Workshop materials will include a collection of government and other public references for your further use.

## POST-SYMPOSIUM WORKSHOPS
continued

**Workshop 4: Restoring Riparian Habitats on the Sacramento River Floodplain (Field Trip)**

8:00 a.m. – 2:00 p.m. Meeting location to be announced.

Instructors: **Tom Griggs,[1] Greg Golet,[2] Ryan Luster,[2] John Anderson,[3] and Joe Silveira[4]**
[1]River Partners; [2]The Nature Conservancy; [3]Hedgerow Farms; [4]Sacramento National Refuge Complex

This field trip is designed to expose participants to various issues of restoring riparian floodplain habitats for indigenous flora and fauna. Since 1991, The Nature Conservancy, River Partners, Hedgerow Farms and other partners have restored over 4,000 acres of riparian habitats at Sacramento River National Wildlife Refuge. We will explore past restoration projects at the Refuge to discuss restoration site evaluation, plant materials selection, plant propagation, approaches to horticultural restoration and restoration monitoring, including how invertebrates and vertebrates have responded to our 20-year effort. We will discuss and evaluate how the current abiotic conditions and physical processes of the Sacramento River influenced the development of our planting designs, while considering the current post-Shasta Dam hydrograph and socio-economic interests. Results from over 30 monitoring surveys and research investigations give insights about the potential for various taxa to colonize restoration sites, while also raising questions about how future restoration designs will account for scale and connectivity of floodplain habitats along the Sacramento River. This is a unique opportunity to see several projects in various stages of development and exchange information with experienced restoration practitioners, scientists and habitat managers. Field trip leaders have a combined 80 years of experience in restoration ecology and habitat management. Handouts will be provided.

What to Bring: Layered clothing (could be warm, cold, windy or wet), trail boots, camera, binoculars, and lunch. Refreshments and trail snacks will be provided. Meeting location will be announced. Plan on carpooling.

# ABSTRACTS OF TALKS

(Abstracts in chronological order; index to authors on page 35)

1. **HANSON, L.**

Feather River Ranger District, Plumas National Forest, 875 Mitchell Avenue, Oroville, CA 95965

### Welcome to Our Third Northern California Botanists Symposium

I'd like to welcome all of you to our third symposium. We hope you will enjoy the program that we have organized for you this year. We again hope to provide botanists with a forum to listen to talks on a variety of subjects and to spend time socializing with each other. We have encouraged students to attend, so please be sure to take time to meet them and for them to meet you. Northern California Botanists is a cooperative association of Federal, State, Academic, Consulting and Other Botanists in the Northern California Region, with the purpose of increasing knowledge and communication about botanical issues concerning science, conservation, education and professional development. Have a great symposium.

2. **SLOOP, C.,*[1,2] PICKENS, C.,[2] and GORDON, S.[2]**

[1]Laguna de Santa Rosa Foundation, Research Program, 900 Sanford Road, Santa Rosa, CA 95401
[2]Sonoma State University, Department of Biology, 1801 E. Cotati Avenue, Rohnert Park, CA 94928

### Conservation Genetics of Butte County Meadowfoam (*Limnanthes floccosa* ssp. *californica*), an Endangered Vernal Pool Endemic

The endangered annual *Limnanthes floccosa* Howell ssp. *californica* Arroyo is restricted to vernal pools in Butte County, California. Our study confirms previous isozyme results and suggests that any loss of occurrences represents a significant deficit in the species' genetic diversity, making it extremely vulnerable to chance catastrophes. Recovery requires active restoration of existing populations and permanent habitat protection. Determining extant genetic diversity and structure are key in identifying populations with unique genetic resources to design reintroduction efforts, and guiding the design of seed collection scenarios for long-term *ex situ* seed storage. We surveyed 457 individuals from 21 distinct occurrences using nine polymorphic microsatellite markers. We confirmed earlier accounts of low within-population genetic diversity: average allelic diversity = 1.9 (0.06 SE) alleles/locus; average $H_{obs} = 0.10 \pm 0.018$, average $H_{exp} = 0.19 \pm 0.015$, mean Shannon index: $0.317 \pm 0.025$, mean fixation index $0.556 \pm 0.044$. The number of polymorphic loci ranged between 11-89%. Bayesian ordination determined 20 distinct populations. We confirmed high genetic structure among these ($F_{st} = 0.65$, $P < 0.0001$). We identified notable gene flow barriers across populations, confirming regional structuring between three previously defined population density centers and two outlying populations ($F_{st} = 0.21$, $P < 0.0001$). Population size estimates ranged between ~50 and > 5000 extant plants per site. All four Chico Airport occurrences had notably declined from 1992 population levels. We recommend close comparison of microhabitats of declining occurrences with genetically similar occurrences, to determine the potential for human assisted gene flow via seed movement.

3. **WARD, K.L.,*[1] GISLER, M.,[2] FIEGENER, R.,[2] BARTOW, A.,[3] MILLER, S.,[2] YOUNG, A.,[2] and KAYE, T.[2]**

[1]King County Noxious Weed Control Program, 201 S. Jackson Street, Seattle, WA 98122
[2]Institute for Applied Ecology, P.O. Box 2855, Corvallis, OR 97339
[3]Corvallis Plant Materials Center, Natural Resources Conservation Service, 3415 Northeast Granger Avenue, Corvallis, OR 97330

### Restoration Germplasm in a Changing World: How Local is too Local?

Genetic considerations have risen to the forefront of restoration ecology as practitioners have repeatedly observed that success depends on the use of locally appropriate native plant materials. However, applying genetic concepts to restoration programs presents both theoretical and logistical challenges. The relative importance of local adaptation and genetic diversity is a subject of active debate when genetic data are lacking. While consideration of local adaptation is essential, the use of only extremely local seed sources can be impractical and may ultimately result in long-term failure if it exacerbates effects of recent

population isolation in a fragmented landscape. The Willamette Valley Seed Increase Program seeks an appropriate balance between acquiring locally adapted genotypes and capturing and maintaining genetic diversity in its restoration germplasm development. Working with common species and within the climatically uniform EPA Level III Ecoregion, seed transfer zones were defined based on literature review of each species' breeding system, potential for hybridization, polyploidy, taxonomic uncertainty, outbreeding depression and local adaptation. Spatial and temporal genetic diversity was captured by sampling from many populations per species, across the geographic range of the ecoregion and over a two-year period. Seed was combined using a conservative approach for those species with evidence of local adaptation at a spatial scale smaller than the ecoregion. Agricultural increase fields were planted using a novel design to help maintain genetic diversity. Results of common garden studies for four target species reveal the utility of the EPA Level III Ecoregion as a surrogate seed transfer zone is mixed.

**4. HARRISON, S.,*[1] DAMSCHEN, E.,[2] and GOING, B.[1]**
[1]Department of Environmental Science and Policy, University of California, Davis, CA 95616
[2]Department of Biology, Washington University, St. Louis, MO 63130

### Large-scale Threats to Serpentine Ecosystems

The vast majority of California's botanically rich serpentine soils have been only lightly affected by human land use. Climate change may end the status of serpentine as a relatively secure refuge for botanical diversity, however. While previous studies have suggested that nutrient-poor ecosystems might be relatively resilient to climate change, we used resampling of Robert Whittaker's historic plots in the Siskiyou Mts., and found that serpentine plant communities have changed even more over the past 60 years than have adjacent communities on normal (diorite) soils. The changes we observed were in a direction consistent with the warmer and drier climate: herb communities today as compared with 60 years ago show lower frequencies of species with broad thin leaves, lower frequencies of "northern-origin" (*sensu* Raven and Axelrod) taxa, and greater resemblance to communities on warm south-facing slopes. We are now using experiments to further examine effects of altered precipitation on serpentine plant communities and the endemic versus generalist species within them. Other potential large-scale threats to serpentine ecosystems include nutrient deposition, invasion by new exotic species, and altered fire regimes. These threats are likely to interact with one another and with climate change. None of them can be fully addressed by traditional conservation strategies based on land acquisition.

**5. ASLAN, C.**
Department of Evolution and Ecology, University of California, Davis, One Shields Avenue, Davis, CA 95616

### Emerging Mutualisms: The Role of Bird Dispersal in Non-native Plant Invasions

Plants with vertebrate-dispersed fruits are often considered to have high risk of becoming invasive following introduction to new regions. I ask whether there are identifiable barriers to the formation of new dispersal mutualisms under some circumstances. What factors might promote or hinder mutualism development? I study avian use of three case study nonnative plant species (*Triadica sebifera*, *Ligustrum lucidum*, and *Olea europaea*) with undetermined invasiveness in California, along with a contrast native species (*Heteromeles arbutifolia*). Proportionate fruit removal by vertebrates was highest for *H. arbutifolia* (94%) and lowest for *T. sebifera* (24%). Most removed fruits were taken by dispersers rather than seed predators, and by "pulse feeders" traveling long distances in flocks instead of by territorial "background feeders." American robins (*Turdus migratorius*) were major dispersers of all four species, while nonnative European starlings (*Sturnus vulgaris*) were important dispersers of *T. sebifera* and *O. europaea*. Among a variety of studied neighborhood factors, only the number of conspecifics in each fruiting stand was predictive of bird visitation. Gape width analyses enabled us to generate lists of potential dispersers for study stands of *O. europaea*; we predict increased dispersal potential for feral populations. We conclude that none of our focal species are dispersal-limited and that all have formed novel mutualisms in California.

**6. WILKERSON, M.**
**NCB 2008-2009 Research Scholarship awardee**
Graduate Group in Ecology, Department of Plant Sciences, University of California, Davis, One Shields Avenue, Davis, CA 95616

### Downsides to Corridors: Examining Plant Invasion Potential in Linear Biodiversity Features

Non-native invasive plants are a global threat to natural and agricultural ecosystems, but the landscape characteristics promoting invasion are still poorly understood. Edge habitat often has been linked to invasion, and as natural habitats become more fragmented due to development and agriculture, the amount of edge increases exponentially. Corridors are widely promoted to combat the negative effects of fragmentation, but an often-cited though understudied fear is that corridors may also aid *non*-native plant movement. As part of a broader study to address this potential problem, I examined a class of archetypal habitat corridors: hedgerows, linear strips of non-agricultural land that parallel field edges. In California's agricultural lands, hedgerows are being promoted and planted at a steadily increasing rate. These features capture quintessential corridor characteristics with their relatively narrow, linear shape and potential to aid movement. I am examining the mechanisms of invasive plant movement into, out of, and through linear landscape features, emphasizing the role of edge effects and landscape feature structure. In the summer of 2009, I surveyed native and non-native plant richness and abundance in hedgerows within Yolo County. These surveys confirm that hedgerows can function as harbors for invasive plants, but that invasion is spatially structured in the hedgerows, i.e. there are differences between edges and interiors as well as between middles and ends. I discuss how these patterns are dependent on key landscape variables, including hedgerow orientation and age. Findings from this observational study will inform my larger-scale research on landscape connectivity and permeability in California.

**7. WINGO, S.M.[1] and SCHIERENBECK, K.A.*[2]**
[1] USFWS, 10950 Tyler Road, Red Bluff, CA 96080
[2] Department of Biological Sciences, California State University, Chico, CA 95929

### Targeted Grazing Study for Management of Non-native *Lolium multiflorum* in Alkali Meadow Habitat Containing the Rare Plant *Cordylanthus palmatus* at Colusa National Wildlife Refuge, California

Alkali meadow habitats can be defined by their soil alkalinity and high salinity, creating an extreme environment for most plant species. An exception is *Cordylanthus palmatus*, a native rare endemic to this habitat and currently only found in five locations in the Central and Livermore Valleys in California. Currently the two largest populations of *Cordylanthus palmatus* are on the Colusa and Delevan National Wildlife Refuges (NWR) and are potentially being threatened by an increasing population density of *Lolium multiflorum*, a non-native annual grass. We investigated targeted grazing as a management tool to reduce *L. multiflorum* while having no impact, or improving, the fitness of *C. palmatus* populations. We evaluated two grazing treatments within the reproductive growing season of *L. multiflorum*, over two years. The study was conducted at Colusa NWR within the *C. palmatus* populations with response variables of *C. palmatus* relative fitness, soil pH and salinity, percent cover of native host focal species, and changes in species richness within the alkali meadow grazing plots. Climatic variation between the two study years at the site was extreme (150% and 50% normal precipitation) and likely influenced a lack of clear treatment effects. Results were mixed regarding an increase in *C. palmatus* fitness; however no decrease in fitness resulted from the targeted grazing. This study demonstrates that with well-defined management plans and closely monitored cattle grazing and removal, grazing within alkali meadow habitats can be used to reduce non-native grass cover without negatively impacting *C. palmatus* fitness.

**8. SLOOP, C.,[1,2,3] WILLIAMS, A.,[4] GLUESENKAMP, D.,[4] and ROSSI, A.[4]**
[1]speaker only
[2]Laguna de Santa Rosa Foundation, Research Program, 900 Sanford Road, Santa Rosa, CA 95401
[3]Department of Biology, Sonoma State University, 1801 E. Cotati Avenue, Rohnert Park, CA 94928
[4]Bay Area Early Detection Network, www.BAEDN.org

### The San Francisco Bay Area Early Detection Network

The Bay Area Early Detection Network (BAEDN) is a collaborative partnership of regional land managers and invasive species experts in the nine Bay Area counties to coordinate the Early Detection and Rapid Response (EDRR) to infestations of invasive plants still limited in distribution. Removing invasive plants while populations are small is a key to success, and keeps costs down. A goal of BAEDN is to provide a "toolbox" for land managers to use for EDRR, including a searchable online reporting database. Currently, most land managers hear about new invasive species in their area by word-of-mouth. The online occurrence reporting database (www.BAEDN.org), developed by BAEDN and Calflora, provides a mechanism for all partners to report priority invasive plant species early detections to a central repository, to facilitate rapid response. BAEDN is a participation-based organization, and there are actions that local botanists and land managers can take to become actively involved, including: 1) Try out the occurrence reporting tool, 2) Sign onto the email list, 3) If you are in the nine counties, please help us build BAEDN!, 4) Share your weed data for the comprehensive database, 5) Get the word out about BAEDN to other potential partners, and 6) Tell us about weeds you are seeing as emerging problems.

**9. THOMSEN, C.,*[1] DEAN, E.,[2] MANGAN, G.,[3] HARRINGTON, G.,[2] ALDERSON, J.,[4] TUIL, J.,[1] and WEIGAND, J.[5]**
[1]University of California, Davis, Department of Plant Sciences, M.S. 1, One Shields Avenue, Davis, CA 95616
[2]University of California, Davis, Center for Plant Diversity, Plant Sciences M.S. 7, One Shields Avenue, Davis, CA 95616
[3]Bureau of Land Management, 2550 North State Street Office, Ukiah, CA 95482
[4]Natural Resources Conservation Service, 100 Sunrise Boulevard, Suite B, Colusa, CA 95932
[5]Bureau of Land Management, 2800 Cottage Way, Sacramento, CA 95825

### Invasive Plant Management for Native Plant Conservation on BLM's Bear Creek Ranch, Cache Creek Natural Area

The Bear Creek Ranch is a 12,000-acre acquisition within BLM's Cache Creek Natural Area in western Colusa County with significant botanical features and major invasive plant issues. Ongoing botanical inventories have documented seven CNPS 1B and eleven List 4 plants, 25 serpentine endemics, 387 native and 105 non-native vascular plant taxa. Invasive plants, and how best to manage them, are chief land-stewardship concerns. Past weed management efforts – targeting riparian and upland species – have included prescribed burning, herbicide applications, livestock grazing, mowing, grubbing, revegetation, and biological control. Many of these approaches have had positive results; however, they are not specifically designed for long-term protection of high-value botanical areas, or for preventing further weed expansion. As part of a landscape-level native plant conservation planning program, we documented significant botanical areas and weed occurrences, developed a GIS data base, and evaluated management options that might best conserve native plants and their communities. The work is designed to provide information for BLM and support an Adaptive Management process for natural area land stewardship. Our findings indicate a need to: 1) place greater emphasis on small outlier infestations, 2) determine which weeds may be beyond meaningful control in certain sites, and 3) incorporate risk assessments to improve weed-control activities.

**10. FRANKIE, G.**
Department of Environmental Science, Policy and Management, University of California, Berkeley, CA 94724

### Native Bees are a Rich Natural Resource in Urban California Gardens

Evidence is mounting that pollinators of crop and wildland plants are declining worldwide. Our research group at UC Berkeley and UC Davis conducted a 5-year survey of bee pollinators in nine cities from Northern California to Southern California. Results indicate that many types of urban residential gardens provide floral and nesting resources for the reproduction and survival of bees, especially a diversity of native bees. Habitat gardening for bees, using targeted ornamental plants, can predictably increase bee diversity and abundance, and provide clear pollination benefits.

**11. WHITTALL, J.,*[1] DICK, C.,[1] FULKERSON, J.,[2] and STRAUSS, S.[2]**
[1]Department of Biology, Santa Clara University, 500 El Camino Real, Santa Clara, CA 95053
[2]Section of Evolution and Ecology, University of California, Davis, One Shields Ave, Davis, CA 95616

### The Metcalf Canyon Jewelflower (*Streptanthus albidus* ssp. *albidus*) – Still a Mystery

The federally endangered Metcalf Canyon Jewelflower (*Streptanthus albidus* ssp. *albidus*) is restricted to three populations in southern Santa Clara County. It grows adjacent to its closest relative, ssp. *peramoenus*, but can only be distinguished by its white sepals. We undertook a series of field, greenhouse and laboratory studies to determine its ecological preferences, primary pollinators, and molecular distinctiveness. After comparing 24 soil chemical characteristics from ssp. *albidus,* ssp. *peramoenus,* and *S. glandulosus*, no single soil characteristic reliably differentiated these taxa. In a reciprocal transplant study under greenhouse conditions, we found no preference for "home" soil: Metcalf Canyon soil produced the lowest fitness plants, whereas the potential reintroduction site (where no jewelflowers grow) produced the highest fitness plants. Combining the soil chemistry and reciprocal transplant results revealed soil iron as the best predictor of plant fitness. Since greenhouse-grown jewelflowers produce less than 5% fruits, yet in the wild over 55% of flowers produce fruits, we recorded 45 hours of pollinator observations to determine the primary pollinator of ssp. *albidus*. *Bombus vosnesenskii* accounted for 99% of visits and was also found at populations of ssp. *peramoenus*. To determine the molecular distinctiveness of these taxa, we compared >600 variable AFLP bands for 90 plants. No fixed differences between these three taxa suggests recent divergence or hybridization/introgression. Collectively, the molecular, greenhouse and field data question the taxonomic status of ssp. *albidus,* which can still only be distinguished by its white sepals.

**12. THORP, R.W.**
Department of Entomology, One Shields Avenue, University of California, Davis, CA 95616

### Native Bees and Vernal Pool Flowers: The Upland Connection

Pollinator guilds of many California vernal pool flowers with showy mass bloom displays contain both generalist and specialist native bees. Female specialist (oligolectic) bees collect pollen from one or a few closely related species of plants to feed their young. Flight periods of these bees are closely synchronized with bloom periods of their host plants. These specialist bees are often the most numerous and most effective pollinators of these flowers. Most of these bees nest in the uplands surrounding the pools where their pollen host plants occur. Thus, conservation of many endemic vernal pool flowers requires consideration of their connection to the broader landscape through the important ecosystem service, pollination, provided by bees.

**13. HAGGARD, P.**
Inspector (retired), Humboldt County Agricultural Commissioner's Office, Eureka, CA 95501

### Attracting Pollinators in a Native Plant Garden

Beginning in 1977 native plants have increasingly been incorporated into our home garden, which prior to our living there was open pasture bordered by pine trees. Over the period of thirty years we had an increase in both total number and diversity of wildlife. A determination was made to more closely track natural recolonization of our garden. Native bees and butterflies were considered as indicators but only

native bees were used in the baseline survey conducted in 2008. Native and non-native ornamentals were observed for bee preferences for food and nesting. Thirty taxa of native bees were recorded and identified to genus.

**14. MILLER, D.G.**
Department of Biological Sciences, California State University, Chico, CA 95929

### Gall Induction by *Tamalia* Aphids Lowers Seed Set in *Arctostaphylos patula*

Several species of *Tamalia* aphid (Hemiptera: Aphididae) induce galls on the leaves of at least one species of *Arbutus,* one species of *Comarostaphylis,* and over 30 species of *Arctostaphylos* shrubs (Ericaceae: Arbuteae). In certain populations of *Arctostaphylos patula, Tamalia coweni* is capable of causing galls not only on the leaves, but also on inflorescences of its host plant. This shift in host plant organ from leaf to inflorescence bract may be regarded as a key innovation presenting novel ecological opportunities for *Tamalia* gallers. By inducing galls on inflorescences, these plant parasites render presumptive flower buds sterile, appropriating host plant resources from sexual reproduction towards the development of tumors that in no way benefit the plant. Here I present evidence that galling activities by *T. coweni* potentially depress sexual reproduction in Sierra Nevada populations of *A. patula*.

**15. GILBART, M.,[1] SILVEIRA, J.,[2] and HATFIELD, C.*[1]**
[1]Department of Biological Sciences, California State University, Chico, CA 95929
[2]U.S. Fish and Wildlife Service, Sacramento National Wildlife Refuge, Willows, CA 95988

### The Health of Blue Elderberry (*Sambucus mexicana*) and Colonization by the Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*) in Restored Riparian Habitat

Horticultural restoration of floodplains is often intended to recreate riparian habitat critical to a diversity of wildlife, including many endemic, threatened and endangered species. This type of restoration frequently occurs on highly regulated rivers, where the natural processes that shape riparian plant communities have been modified and truncated. One of the larger riparian restoration efforts in the country is along the regulated Sacramento River in the Central Valley of California, where restoration targets imperiled wildlife such as the federally threatened Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*, VELB). The VELB is endemic to the Central Valley and specializes on facultative riparian blue elderberry shrubs. As a target species of restoration efforts, over 118,000 elderberry shrubs have been planted in the last 16 years in a range of planting designs to create VELB habitat. Beyond the initial three-year monitoring period, there has been no assessment of elderberry health and how it might be influenced by planting design. Using a factorial design, we sampled elderberry shrubs in both open and closed planting designs, and in older versus younger sites in 23 restoration fields of the Sacramento River National Wildlife Refuge. We evaluated current health of planted elderberry, VELB occupation and the interrelationship between VELB presence and shrub health. Results indicate that open, low cover planting designs can allow elderberry to develop into larger, more robust shrubs that are more likely to reach maturity, whereas closed canopy designs likely stress elderberry shrubs, alter growth form and reduce biomass over time. Recent VELB occupation was observed in 78% of all fields but only 21% of all shrubs searched. Beetle occupation increased with restoration age but showed a weaker and inconsistent relationship with cover. Closed canopy planting designs may attract beetles initially through chemicals released by stressed elderberry shrubs, but in light of successional changes that will take place in the planted fields over time, open canopy planting designs provide more consistent habitat. A diversity of planting designs is therefore recommended for restoration of VELB habitat. There is a need for continued monitoring of both elderberry health and VELB occupation as restoration fields mature and successional processes proceed.

**16. PEARSE, I.S.,*[1] and HIPP, A.L.[2,3]**
[1] Department of Entomology, University of California, Davis, CA 95616
[2] The Morton Arboretum, 4100 Illinois Route 53, Lisle, IL 60532
[3] The Field Museum, 1400 S. Lake Shore Drive, Chicago, IL 60605-2496

### Predictors of Herbivory on 57 Species of Non-native Oaks

Non-native plant species are common throughout most ecosystems worldwide. Understanding how native herbivores interact with non-native plants must be a priority for ecologists and conservationists that want to address plant invasions, habitat restoration, and urban ecology. Moreover, by understanding how native insects interact with plants with which they share no recent co-evolutionary history helps evolutionary biologists understand the evolution of plant-insect interactions. This study assesses both evolutionary predictors (relationship to native oak) and trait-based predictors of herbivory on non-native oaks. We created an AFLP phylogeny of 57 oak (*Quercus*) taxa, which were grown outside of their ranges in a common garden at UC Davis Shields Oaks Grove that contained one abundant native oak (*Q. lobata*). We used this phylogeny to ask whether oaks that are more closely related to a local native receive more damage from two types of herbivores (chewers and miners) than distantly related oaks. We also assessed 11 leaf traits, which likely have a bearing on herbivore performance in order to determine which if any of these traits affect herbivory rates on non-native oaks. We found that phylogenetic relatedness to a local native oak predicted both chewing and mining damage. Suites of plant traits were predictive of chewing damage but not mining damage, and these traits did not account for the phylogenetic trend in herbivory rates. This study suggests that ecological interactions between native species and introduced species are stronger when the introduced species is a close relative to a local native. This observation has broad implications for invasion biology and this trend may play a role in which species within a taxonomic group such as oaks can coexist in a natural community.

**17. BALDWIN, B.G.**
Jepson Herbarium and Department of Integrative Biology, 1001 Valley Life Sciences Building #2465, University of California, Berkeley, CA 94720-2465

### Botanical and Conservation Challenges of Cryptic Diversity in the California Flora

Extensive changes to our understanding of California's vascular plant diversity evident in the soon-to-be-released revision of *The Jepson Manual* represent major floristic and systematic progress since 1993. The rise of molecular and computational tools for analyzing plant relationships and of online access and querying capability for California herbaria have contributed significantly to that progress and have revealed additional diversity that still awaits formal description and recognition. The undescribed component of California's plant diversity includes lineages that are difficult or impossible to identify reliably based on morphology but are evolutionarily distinct based on multiple lines of evidence, including molecular (DNA) and biochemical findings. Inferred ecological differences between closely related cryptic lineages indicate that such diversity warrants conservation attention and should be anticipated in plant groups that are geographically widespread or occur across steep ecological gradients. A major challenge of 21st Century systematic botany is resolution of fine-scale phylogenetic structure and refinement of taxonomy to reflect natural groups that have largely evaded detection but may have irreplaceable ecological properties, including tolerances to physical environmental extremes or herbivory, or host status for other endemic organisms. Cryptic diversity, in addition to genetic diversity, needs to be incorporated in conservation strategies for responding to climate change and other human-caused habitat degradation and fragmentation. Otherwise, an untold number of endemic plants may become extinct through inadvertent neglect or from well-intended but irreversible actions.

**18. SCHWENKLER, J.**
Director, Geographical Information Center, California State University, Chico, CA 95929

### Sticking with Tradition: An Aerial Approach to Digital Interpretive Mapping

Vegetation and habitat mapping from aerial imagery has been a trusted process long before digital techniques have been available. Advances in technology have provided the power of geographic representation for comparisons, change detection, and analysis, resulting in improved workflow process, quality

control, and quality assurance. However, the underlying methodology has stood by its traditional theory. Aerial photography, teamed with available elevation, slope, and soils datasets, complemented with local knowledge and improved field verification techniques, has allowed accurate cost-effective medium- to medium-high-resolution efforts that are easily cross-walked and complement further high-resolution efforts.

**19. DOLANC, C.R.**
**NCB 2008-2009 Research Scholarship awardee**
One Shields Avenue, University of California, Davis, CA 95616

### Changes in Structure and Composition of High-elevation Conifers of the Central Sierra Nevada since the Early 1930's

Climate change models continue to make sufficiently alarming predictions regarding climate-induced shifts in vegetation; however these models are often coarse in resolution and do not properly account for biological complexities such as competition. Studies that re-sample historic plots can provide valuable on-the-ground evidence of current trajectories of change, thereby offering insight into future change. From 2007-2009, I re-sampled 139 historic vegetation plots originally sampled for the Vegetation Type Mapping Project carried out from 1929-1934. Re-sampling was concentrated in the central Sierra Nevada, from 2600 m up to tree line. Overall, modern stand structure exhibits increased abundance of small trees and decreased abundance of large trees. Seven of the eight tree species sampled have increased in abundance of small individuals (10-30 cm) ranging from 34-157% increases relative to historic stand levels (75+ years ago). This trend is strong for both high-elevation species such as whitebark pine (*Pinus albicaulis*) and species that have historically been relegated to lower elevations and predicted to move upslope, such as red fir (*Abies magnifica*). These results are surprising, given predictions made by climate models that much of our high-elevation vegetation will eventually be replaced by upslope species shifts.

**20. HANKINS, D.L.**
Department of Geography and Planning, California State University, Chico, CA 95929-0425

### The Green Side of Black: Burning to Achieve Multiple Objectives

Fire is an integral part of many California ecosystems, and is an important process in maintaining habitat for many species. California Indians likely played a significant role in managing ecosystems with fire at a landscape scale. It is estimated that annually up to 12 percent of the state was burned by indigenous people prior to European settlement. Following settlement the establishment of policies to suppress fire succeeded in altering the spatial and temporal extent of fire at a landscape scale. It has been observed that in some ecosystems wildfires are becoming larger, and are occurring more frequently. Climate change is predicted to exacerbate this problem. These changes may be counterproductive to conservation efforts for many rare species. This phenomenon is a global issue. In Australia's tropical savannas the decline of biodiversity due to devastating fires has been recognized, and the restoration of indigenous fire management strategies has been seen as a solution. This strategy has also been recognized to abate greenhouse emissions from the landscape, and contribute to carbon sequestration. Mitigating wildfires with such fire management may be an appropriate step towards slowing biodiversity declines and contributing to reduction of greenhouse gas emissions in other ecosystems as well.

**21. RICE, K.**
Department of Plant Sciences, University of California, Davis, CA 95616

### Evolutionary Considerations in Ecosystem Conservation

As more research examines the potential for rapid evolutionary change in both native and exotic plant populations, the distinction between ecological and evolutionary time becomes increasingly blurred. More and more, it is becoming obvious that ongoing global change is a potent source of "un-natural" selection and that management strategies for ecosystem conservation and restoration need to consider evolutionary processes. Given the importance of invasive species as a threat to plant conservation in California, I will discuss some recent work on how barbed goatgrass (*Aegilops triuncialis*) is adapting to serpentine soil ecosystems. This invasive grass has a diverse evolutionary "bag of tricks" that allows it to colon-

ize stressful serpentine soils. This is particularly unfortunate because these serpentine habitats are "hotspots" of plant endemism and previous research has indicated that this grass can cause substantial, and perhaps irreversible, changes to soil microbial communities and nutrient cycling. To demonstrate the importance of maintaining evolutionary potential in native plant populations facing climate change, I will also discuss how yearly climate variation and competition from exotic species may adversely affect the capacity of native bunchgrasses to adapt to changing conditions.

**22. WISHNER, C.**
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### Bryophyte Diversity of Fens in the Northern Sierra Nevada

Fens are peat-producing wetlands, or mires, of minerotrophic origin, often characterized as having high species diversity. While many botanical studies of Sierran fens have focused on vascular plants, bryophyte diversity remains sparsely documented. Further understanding of fen ecosystems, and their protection and maintenance is impaired by difficulty in field recognition of bryophyte species by those who are charged with monitoring and recording condition and function of wetland ecosystems. The results of qualitative surveys of a number of fens in the northern Sierra Nevada region of Tahoe NF, LTBMU, and Plumas NF, is augmented with macro- and photomicrographic images of common and rare or unusual species of management concern, intended for an upcoming field guide. Northern Sierran fens examined exhibit relatively low diversity compared to that of others in the northern hemisphere. Acrocarpous forms are most frequent, and sometimes pleurocarpous forms are lacking. Often overlooked thallose and leafy liverworts are more diverse than might be expected. Factors affecting local diversity and functional groups of bryophytes are related to physical condition of fens, and interesting research questions remain.

**23. DILLINGHAM, C.P.**
Plumas National Forest, P.O. Box 11500, Quincy, CA 95971

### Bryoflora of Plumas National Forest

196 described species, 4 undescribed species and 5 varieties of moss are documented on the Plumas National Forest, California, representing greater than 30% of the California moss flora. Eight additional species are represented in the collection but species determinations are unconfirmed and are only included provisionally in the catalogue pending confirmation. Ten species are new records for the Sierra Nevada of California. The high rainfall on the western slope of the forest and associated habitat conditions allow for many disjunct coastal species represented by taxa such as: *Alsia californica, Buxbaumia viridis, Dicranum howellii*, *Epipterygium tozeri, Fissidens pauperculus, Hypnum circinale, Orthotrichum consimile, Rhytidiadelphus triquetrus, Sphagnum angustifolium,* and *Trachybryum megaptilum*. Two species, *Scopelophila ligulata* (Spruce) Spruce and *Sphagnum angustifolium* (Russow) C. Jensen are reported new for California.

**24. SHEVOCK, J**.
California Academy of Sciences, Department of Botany, 55 Music Concourse Drive, Golden Gate Park, San Francisco, CA 94118

### Catching the Bryo Bug in Northern California: Can Vascular-trained Botanists Become Great Bryologists?

Since the days of Bolander in the 1860s, many California botanists during their careers have collected bryophytes. However, most vascular-trained botanists have not added measurably to the herbarium record to catalog the California bryoflora. This is, in part, based on the exceedingly random event when a bryophyte catches the eye of the collector and it is then added among the other seed plants being collected. Few vascular plant collectors have been trained in the proper methods to collect and document a bryophyte sample and transform it into a voucher herbarium specimen. This factor alone can determine whether a voucher sample is obtained from the field or not. But I view the most critical factor why bryophytes are under-collected is from a lack of awareness of actually 'seeing' how bryophytes partition the available habitat. Inventory efforts for bryophytes require a completely different sampling scale and methodology than used for documenting vascular plants, since even a few inches away can actually be a con-

siderably different bryophyte community. Due to the small size of most bryophytes, they can easily be overlooked if not systematically sampled. Another factor has been the lack of more localized bryophyte identification manuals and floras. Fortunately, new bryophyte identification guides and picture books like the new *California Mosses*, published in 2009, are becoming available. With a bit of field training, vascular-trained botanists can readily make this transition and therefore can make significant advances toward bryophyte inventories.

**25. MISHLER, B.,*[1] and WILSON, P.[2]**
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[2]Department of Biology, California State University, Northridge, CA 91330-8303

### Factors Influencing the Biogeographic and Ecological Distribution of Bryophytes in California: Mosses are from Mars, Vascular Plants are from Venus

Fully 24% of the native species of vascular plants in California are endemic. By comparison, there are comparatively few endemic species of bryophytes; however, comparisons of endemicity with vascular plants are problematic because species concepts in bryophytes are quite different, and exploration of the bryoflora of the state is far from complete. Despite their diversity, phylogenetic importance, and key roles in the ecosystems of the world, study of the biology of bryophytes has lagged behind that of the larger land plants, perhaps because of their small size and the few scientists specializing on them. This is unfortunate because of the intrinsic scientific interest of these plants. Many aspects need much more study, but what is known about bryophyte biology suggests that the bryophytes differ in most ways in their genetics, physiology, ecology, and evolution from tracheophytes. Major differences in bryophyte biology from vascular plants include: 1) haploid dominance in the alternation of generations, 2) extensive phenotypic plasticity, 3) poikilohydry and desiccation-tolerance, 4) need for free water for sexual reproduction, 5) the clump acting as a "super-organism," 6) heavy reliance on asexual reproduction, 7) small stature and the occupation of microhabitats, 8) less selection pressure from the biotic component of the environment than from the physical component, and 9) relatively slow evolutionary rates in morphology. Better understanding of California bryophytes, and their biogeographic and ecological distribution, will require both empirical and conceptual advances. New molecular and quantitative ecological data need to be developed and applied using better conceptual models and informatics tools.

**26. WITHAM, C.W.**
1141 37th Street, Sacramento, CA 95816

### Increasing Nature Observation Skills in Primary School Children

It has become increasingly apparent that children are not connecting with nature and the outdoor environment. Additionally, creative arts such as drawing are no longer taught in public schools. To increase kids' connection to nature and their observational skills, the California Native Plant Society is launching a new education program. This state education standards-compliant curriculum will combine drawing, writing, and nature observation. The program will be available to teachers – and to anyone else that does outdoor education such as scout leaders. Highlights of the program include videos of how to sketch plants, by John Muir Laws; special journals to record observations; and a variety of journaling activities tailored around observing plants.

**27. EDWARDS, A.**
Holt Hall, Room 205, California State University, Chico, CA 95929

### Where the Wild Things Are: Establishing a Native Plant-pollinator Garden to Inform the Wild Rumpus!

School vegetable and flower gardens have been emphasized as educational tools periodically for over 200 years in the USA. The need for native plant-pollinator gardens in schools has become evident more recently. Today, greater than 80 percent of U.S. children live in metropolitan areas with limited exposure to native habitats. Charismatic animals naturally appeal to children, but without exposure, plants are often regarded as inanimate background. One of the most important goals of schoolyard native gardens is to engender an understanding of biodiversity and a sense of place. Recent research supports the hypothesis

that children are more likely to develop an appreciation for biodiversity if they become familiar with at least some native plants. This appreciation for the intrinsic value of biodiversity then includes less charismatic native plants and invertebrates. Schoolyard native gardens range from "butterfly gardens" to native plants in habitat context. Although the latter clearly provides more depth of information, education literature suggests that to teach an appreciation for native biodiversity, we must first introduce young children to native plants in an experiential setting. Based on a review of the literature and my local experiences with school gardens, I argue that the basic requirements for native plant-pollinator gardens in schools are 1) high visibility, 2) repetitive access, 3) low maintenance, 4) appropriate plant selections, 5) provisions for associated organisms, 6) compatibility with pedestrian traffic and play, and 7) informational signage.

**28. HEASTON, T.**
Hands on Science Lab, 400 West First Street, California State University, Chico, CA 95929

### An Early Teaching Experience in Science: Why We Need It, Why We Teach It, and How Do We Get Teachers to Teach Science in Elementary School?

Research shows the need to improve science education at all levels. Our unique program offers undergraduate students an opportunity to teach a series of science activities in a supportive environment. This special class at CSU, Chico is helping our future teachers become better equipped to teach science to elementary school students. When teachers feel more confident with the science background and activities, they are more willing to teach it in the classroom, and are therefore more successful with their science programs.

**29. SHOLARS, T.**
College of the Redwoods, 1211 Del Mar Drive, Fort Bragg, CA 95437

### Creating Future Botanists: Being the Match to Light the Spark

Creating an opportunity for beginning students to be out in wild habitats is the best way to build excitement about botany and the plant world. Students are traditionally taught in classes with a lecture/lab format. Field trips are normally not part of lower division curricula. In fact most students rarely get an opportunity to go out in the field with their professors until their third year in upper division courses. At some colleges all instruction is done in the lab with dry or collected specimens. Taking students out in the field and teaching not only plant identification but also about the roles plants play as part of an ecosystem and relating these roles to the student's lives is one of the best ways to open the door to the botanical world and create future botanists.

**30. PERKINS, J.L.**
USDA Modoc National Forest, 800 W. 12th Street, Alturas, CA 96101

### Range Extension Discoveries of *Tuctoria greenei* (Greene's Tuctoria) on Modoc National Forest

*Tuctoria greenei* is primarily known from low-elevation vernal pools in California's Central Valley. However, it was discovered at higher elevations in vernal pools on the Modoc Plateau on Lassen National Forest in 1991, and on Modoc National Forest in 2008. Modoc Plateau Vernal Pools differ from Central Valley pools, forming in pockets of shallow clay soils on top of flood basalt rock layers. The two currently known *Tuctoria greenei* occurrences on Modoc National Forest were originally misidentified as *Orcuttia tenuis*, perhaps a case of seeing what one expects to see, since *Tuctoria greenei* was not at that time (2003) believed to occur in Modoc County. Management to protect the Modoc *Tuctoria greenei* occurrences has been complicated by 1981 range improvements. The largest population was disked and drilled with non-native range grasses, of which western wheatgrass and meadow foxtail have securely established. Cattle grazing is being retained on this site to prevent these exotic grasses from converting the vernal pool habitat into grassland and thereby squeezing out the *Tuctoria greenei*.

**31. MESLER, M.,* BENCIE, R., and HAYASHI, B.**

Department of Biological Sciences, Humboldt State University, Arcata, CA 95521

### A Resurrection for Siskiyou Bells, *Prosartes parvifolia* S. Watson (Liliaceae), a Rare Siskiyou Mountains Endemic

We provide an expanded description, illustrations, and a distribution map for the rare Siskiyou Mountains endemic, *Prosartes parvifolia* S. Watson, currently known only from 15 sites in Del Norte County, California, and Curry and Josephine Counties, Oregon. We also present an identification key to the *Prosartes* of northwestern California and southwestern Oregon. Contrary to prevailing taxonomic opinion, *P. parvifolia* is a) fertile, b) not of hybrid origin, and c) obviously distinct and worthy of recognition. Unlike congeners, its flowers produce ovaries with a single locule, and are pollinated by bees who buzz pollen from connivent anthers. Nectar is not produced.

**32. BUCK, R.,*[1] CLIFTON, G.,[1] and HILL, S.[2]**

[1]EcoSystems West Consulting Group, 819½ Pacific Avenue, Santa Cruz, CA 95060
[2]Illinois Natural History Survey, University of Illinois, 1816 S. Oak Street, Champaign, IL 61820

### *Sidalcea gigantea*, a Remarkable New Species from Northern California

Work by Glenn Clifton in the 1980s on a flora of the Plumas National Forest resulted in the discovery of an undescribed species of *Sidalcea*. This species is among the largest species in stature in the genus *Sidalcea*, with stems to 2.5 m. tall. Remarkably, despite this species' stature, densely colonial habit, showy flowers, and the occurrence of some populations along relatively well-traveled roads, the species escaped previous discovery by botanists. The new species is readily identifiable by a combination of characters, including its stature and tendency to grow in dense colonies as well as characteristics of the rhizomes, stems, stem pubescence, and fruit segments. The species occurs in the northern Sierra Nevada and southernmost Cascades from Sierra County to Shasta County, California, with approximately 37 populations known. It occurs in wet or seasonally moist, open to partly shaded habitats, including meadows (especially margins), forest edges, and relatively open forest, and sometimes colonizes disturbed areas such as roadsides. Recent molecular studies indicate that the species belongs to an informal "*asprella* clade" along with the widespread *Sidalcea asprella*, the northern California species *S. celata*, and the Oregon species *S. campestris*, *S. hirtipes*, and *S. maxima*. Incidental observations suggest that the new species is largely pollinated by bees. Although it does not appear to be endangered, it faces potential threats from road maintenance and logging. A description of the new species is in press, and it will be published as *Sidalcea gigantea* in an upcoming issue of *Madroño*.

**33. REVEAL, J.,[1] YORK, D.,*[2] and HELLIWELL, R.[3]**

[1]Cornell University, L.H. Bailey Hortorium, 412 Mann Library, Ithaca, NY 14853
[2]Caltrans, Environmental Management, 1656 Union Street, Eureka, CA 95502
[3]U.S. Forest Service, Umpqua National Forest Supervisor's Office, Roseburg, OR 97471

### *Eriogonum villosissimum* (Polygonaceae: Eriogonoideae), a New Species Endemic to Acker Rock, Oregon

In 2005, while rock climbing in the Western Cascades of southwestern Oregon, York discovered a previously unknown *Eriogonum* Michx. (Polygonaceae Juss.: Eriogonoideae Arn.) growing in crevices and small shelves of a volcanic rock formation known as Acker Rock. The new species is a member of subgenus *Oligogonum* and is most closely allied to *E. alpinum*, a narrow endemic confined to north-central California. The plants form clumps that are scattered over the south-facing vertical faces of the formation. Nearby outcrops were searched in 2006 with no success of finding another population.

## ABSTRACTS FOR POSTERS

(Abstracts in alphabetical order by primary author name; index on page 35)

**1. AKULOVA-BARLOW, Z.**
LSA Associates, Inc. 157 Park Place, Pt. Richmond, CA 94801

### Identification of Northern California Plants in Early Stages of Development

The poster represents part of a large photographic collection of basal leaf rosettes of Northern California plants. This collection was created to help with the identification of plants in the early stages of ontogenesis, before blooming. This study includes plants from different habitats, seasons, and families. Photos were taken for the last three years: a) in natural habitats; unknown rosettes were marked with GPS points and revisited for identification, b) in my garden; rosettes were grown from seeds, c) in the University of California Botanical Garden at Berkeley; and d) in the Regional Parks Botanic Garden at Tilden. The rosette is a circular arrangement of leaves, mostly at ground level, formed by a modified stem with short internodes. Plants with rosettes can be divided into five groups by their duration and reproduction type: 1. Monocarpic annuals, 2. Monocarpic biennials, 3. Monocarpic perennials, 4. Polycarpic perennials, and 5. Rosettes on stolons. Transformation from one group to another is possible depending on growing conditions. Rosettes are especially common in the *Asteraceae* and *Brassicaceae*. Heterophylly within the same rosette occurs. Knowledge of the diversity of rosettes presented in this collection may assist field botanists in plant identification.

**2. ALFORD, J. and KNEITEL, J.M.**
Department of Biological Sciences, California State University Sacramento, 6000 J Street, Sacramento, CA 95819

### Sierra Nevada Subalpine Meadow Plant Competition across a Moisture Gradient

This study examines the relative degree of competition and facilitation in common meadow plants across a moisture gradient. Other studies have found that facilitation increases as stress increases. The experiment took place in three subalpine meadows in the Van Vleck Meadow Restoration Area of the Eldorado National Forest. We expected to find that facilitation increased as drought stress increased. The study organisms were *Deschampsia cespitosa, Ligusticum grayi, Stachys albens, Mimulus primuloides,* and *Senecio triangularis.* In each meadow, 8 pairs of each species were selected. One of every pair was assigned randomly to treatment. Treatment was hand removal of vegetation from a radius of 30 centimeters around the plant. At the end of the growing season, plants were harvested and dried. The above-ground biomass weights were compared using nonparametric statistics. Pair-wise species interactions differed among meadows along the moisture gradient. In moist meadows, species interactions were neutral, while negative species interaction (competition) was strong in the driest. There were also differences among species in their responses to the treatments along the gradient. These results differ from previous studies and our expectations. In this meadow community, standing water in wet meadows appears to be a source of stress. These results have implications for management of this unique ecosystem of the Sierra Nevada. Decisions regarding alteration of hydrology and other land management practices (e.g., burning, logging) should consider the potential consequences on interactions among species, which can determine ecosystem biodiversity and functioning.

**3. CALLAHAN, K.I.**
Redbud Chapter, California Native Plant Society, 13896 Jesse Lane, Grass Valley, CA 95945

### If It's Not a Vernal Pool, What Is It? Using Vegetation Sampling to Document Northern Sierra Nevada Wildflower Fields and Their Potential Rarity

The rocky shallow soils formed by ancient volcanic mudflows have created areas of colorful displays of spring wildflowers near Grass Valley, California. Grass Valley is located in western Nevada County at an elevation of 2,600 feet in the foothills of the Sierra Nevada. The native species found growing on these mudflows, or "lava caps," include at least ten vernal pool specialists. However, the numerous rain-fed pools are small and lack some characteristics of typical vernal pools. The soils are the Iron Mountain se-

ries, andesitic conglomerate. In 2009, members of Redbud Chapter, California Native Plant Society, (CNPS), in an effort to determine the significance of this plant community, launched a project to document local lava cap habitats. A weekend workshop was organized to train volunteers. Sixteen plots to sample vegetation were established at four different locations. The CNPS relevé protocol was followed to gather data within the 100-square-meter plots. The resulting field-assessed association is *Allium amplectens/Vulpia microstachys*. These two species were found in all the plots and covered 2% to 25% of the surface. *Eriogonum prattenianum* and *Allium sanbornii* are two uncommon species recorded by our fieldwork. The lava caps in our study are on privately owned land. Unfortunately, the flat, open land has often been degraded by off-highway vehicles, trash dumping, domestic animals, and recreational use. We are hoping that the information gained from Redbud Chapter's vegetation sampling project will classify this habitat as unusual and worthy of preservation.

**4. CASTRO, B.**
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### Inspection of Riverine Habitat Restoration on DWR Critical Levee Repair Sites: Issues and Successes During the 2008-2009 Maintenance Period

Recent levee repairs by the California Department of Water Resources (DWR) have included planting of native riparian species, both woody and herbaceous, into soil surfaces added to the usual bank protection rock. This vegetation, as well as anchored woody materials, is intended to provide self-sustaining riparian and aquatic habitat to comply with federal fisheries agencies' requirements to mitigate for loss of Shaded Riverine Aquatic habitat for endangered salmonid fish species. Over the last 1.5 years, DWR botany staff has monitored the maintenance of revegetation at 11 sites along the Sacramento River, Bear River and Butte Creek, working with landscape contractors to keep plantings irrigated and weed-free. Most sites are approximately 1000 ft in length, and are maintained for 2 years after a 1-year establishment period. Issues encountered include water supply arrangements, weed control, erosion and vandalism. At most sites monitored by DWR's Northern Region, native riparian vegetation now fills most of the formerly barren sites. Success has been based on an excellent contractor and crew, good communication, and botanical expertise in identification of native volunteers vs. non-native invaders. A color photo manual to aid crews in distinguishing weeds from native volunteers (and planted species) has been compiled by DWR botany staff and provided to all crew teams. Specimens of unusual weeds or native volunteers are vouchered at the Chico State Herbarium.

**5. CHRISTOFFERSON, C.,[1] MERRIAM, K.,[2] HANSON, L.,[1] and JANEWAY, L.[1]**
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### Burning Bear-grass for California Indian Basket Weavers

Bear-grass (*Xerophyllum tenax*) is an essential element in traditional Maidu basketry, art and culture, and it must be burned to produce the flexible, strong leaves which are necessary for the craft. A century of fire suppression has reduced the amount of bear-grass suitable for basketry. Fire suppression has also resulted in an accumulation of flammable material, which complicates the process of applying prescribed fire to meet resource objectives. The Feather River Ranger District is working together with local basket weavers and the California Indian Basket Weavers Association to reintroduce fire to promote bear-grass regeneration. Permanent monitoring plots were established to evaluate the effects of burn seasonality. Bear-grass cover, number of plants, species diversity, and fuel loading were recorded pre- and post-treatment. Our results show that fuel moisture is a significant factor influencing fire intensity and bear-grass mortality. Prescribed fires conducted when there was no moisture in the duff layer killed much bear-grass. This is because the meristematic tissue is located at the soil/duff interface. We also show that prescribed fires *can* meet resource objectives in the spring or fall when there is adequate moisture in the duff layer.

**6. COLLINS, T., SNIDER, D., SYKES, D., EGAN, S., and BALFOUR, P.**
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### Observed Trends in Dominant Wetland Plant Species within a Constructed Vernal Pool Complex in Sacramento County, California

Construction/restoration of vernal pool habitat to offset development-related impacts to vernal pools has been a commonly required mitigation measure pursuant to permitting under Section 404 of the federal Clean Water Act. The Clay Station Mitigation Bank (CSMB), located in southeastern Sacramento County, CA contains over 84 acres of constructed vernal pools and other seasonal wetlands. The CSMB, originally established to help mitigate wetland impacts associated with a residential development, is one of the earliest vernal pool restoration projects in the Central Valley. Wetland construction at the CSMB occurred in two phases. The vernal pools in Phase I were constructed in 1994 and were inoculated with topsoil collected from vernal pools at the impact site. Pools in Phase II were constructed in 1999 but were more sparsely inoculated due to limited amounts of available inoculation material. Vegetation within the pools in both phases was monitored annually for a five year period. Phase I pools were monitored from 1995-1999, and Phase II pools were monitored from 2000-2004. Preliminary review of Phase I monitoring data suggests a trend in vegetation composition with an increase in dominance of vernal pool plant endemic/associated species and a decline in wetland generalist species over the 5-year period. This trend was not observed in Phase II, as relative percentages of dominant vernal pool and generalist species remained, relatively, more static. We discuss here possible causes for these differences and other species-specific trends including variations in inoculation amounts, soil types, differences in constructed vernal pool size/hydro-period, and annual rainfall patterns.

**7. COLWELL, A.E.L.,[1] TAYLOR, D.W.T.,[2] KAROL, K.G.,[3] HALL, J.D.,[3] and PÉREZ, W.[3]**
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### Unusual Aquatic Floras of the Yosemite National Park Region

Recent finds of new populations of rare aquatic plant species in the Yosemite region motivated a field survey to inventory aquatic floras in areas of Yosemite not previously or not recently explored. This survey, conducted over the 2008-2009 field seasons, focused special attention on locations with unusual rock substrates, mineralized waters, or quaking bog habitat that had been reported to the surveyors or suggested by satellite imagery (Google Earth). Forays were also mounted to regions of Yosemite (northwest boundary, southern central area) for which few or no botanical specimens exist. Data was collected on the flora (vascular plant, moss, liverwort, lichen) of 300 lakes, ponds, fens, seeps and springs. In addition, a pilot survey of macro and micro algae was undertaken (Karol, Hall, Pérez) which has confirmed the occurrence of a diverse algal flora with over 350 species identified to date. Rare species were found in water bodies at all elevations and in all types of substrates and water bodies, but lower elevation water bodies showed the highest species diversity and unusual habitats the highest incidence of rare species. Although over 100 new populations of rare species were documented by this survey, rare species occurrences remain scattered in this region, occurring in less than 1% of water bodies, and they generally do not occur in adjacent similar habitats, suggesting that barriers to dispersal and/or local extinction limit their ranges.

**8. FISCHER, R.D.**
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### Big Chico Creek Ecological Reserve (BCCER) – Where Education Meets the Land

This poster is a photo-enhanced summary of years of hard work and dreams by a small group of dedicated managers. Two tracts of land were acquired along Big Chico Creek in 1999 and 2001. They form the 3,950 acres owned and operated by the Research Foundation of CSU, Chico. BCCER manages the next 4½ miles of Big Chico Creek watershed beginning above Chico's 3,750 acre Bidwell Park. A shoestring budget, countless volunteer hours, and 10 years have leveraged this once logged and overgrazed property into a land-use role model. Today the Reserve woodlands are far better prepared to receive the benefits

rather than the injuries of future wildfires. It is a growing center for academic field-related research and restoration studies. It has been a hands-on outdoor classroom for over a thousand children, providing the beginning of an ethical land-use education. What will the next 10 years bring?

**9. GOTTSCHALK-FISHER, E.,[1,2] SILVEIRA, J.,[3] and HATFIELD, C.A.[2]**
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### Vernal Pool Restoration for Two Rare Grasses, *Neostapfia colusana* and *Tuctoria greenei*, at the Sacramento National Wildlife Refuge Complex

Urbanization and intensive agriculture practice have resulted in the loss of vernal pool habitat throughout California, resulting in high numbers of rare species. Two examples of rare species endemic to California vernal pools are *Neostapfia colusana* (Colusa grass) – State Endangered and Federal Threatened – and *Tuctoria greenei* (Greene's tuctoria) – State Rare and Federal Threatened. The goal of this project is to increase viable populations of Colusa grass and Greene's tuctoria at Colusa National Wildlife Refuge and the Llano Seco Unit Management Area, both of which are part of the U.S. Fish and Wildlife Service's Sacramento National Wildlife Refuge Complex. We will gather physical and biological background information on the restored (target) pools as well as reference pools that currently support extant populations of Colusa grass and Greene's tuctoria, to facilitate development of a reintroduction protocol based on physical conditions. The proposed activities will also include preliminary germination tests on Colusa grass and Greene's tuctoria seeds. Introduction of the two grass species (using seeds and seedling plugs) at the restored and reference vernal pools and weekly monitoring will document germination and survival through several early life stages.

**10. GROSSENBACHER, D.L.,[1] SMITH, J., RUNQUIST, R.B., and PORTER, S.**
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### Testing for Non-random Community Assembly Patterns in Three Genera of California Plants: *Limnanthes*, *Mimulus*, and *Clarkia*

A fundamental goal of community ecology is to understand the processes that contribute to the assembly of ecological communities. Although much work has focused on the role of abiotic factors in structuring communities, much less is known about how biotic interactions influence species establishment and persistence at local scales. In particular, interactions among plant species that are mediated by pollinators might result in strong negative or positive interactions, which in turn will affect whether species coexist locally. Using a phylogenetic framework, we examined patterns of fine-scale species co-occurrence, as well as floral and vegetative characteristics in three unique lineages of annual plants*: Limnanthes, Mimulus*, and *Clarkia*. We visited 50 randomly chosen sites per genus located in the northern and central Sierra foothills. We used null model comparisons to test whether the observed patterns of co-occurrence differed significantly from a neutral process of community assemblage. We found evidence of competitive exclusion among species of *Limnanthes*, environmental filtering in *Mimulus* (resulting in clustering of closely related species with similar vegetative and floral traits), and random species assemblages in *Clarkia*.

**11. GUILLIAMS, C.M.**
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### "Popping onto the Scene" – Phylogenetic Relationships of the Popcorn Flowers, *Plagiobothrys* (Boraginaceae), Inferred Using nrDNA (ITS) and cpDNA (*trnL-trnF* intergenic spacer, *rps16* intron)

*Plagiobothrys* (Boraginaceae) is a diverse genus (about 65-70 species) of annual and perennial herbs, largely distributed in western North America with a center of diversity in the state of California. While the genus has been extensively studied using a traditional morphological taxonomic approach, it has not been the subject of critical reappraisal using modern phylogenetic methods and DNA sequence data. The

goal of this project is to estimate the phylogenetic relationships in *Plagiobothrys*, with a focus on section *Allocarya*, a putative clade that appears to have largely diversified in vernal pool ecosystems in California, Oregon, and Baja California, Mexico. Preliminary phylogenetic analyses performed using three non-coding regions (ITS, *trnL-trnF* intergenic spacer, *rps16* intron) provide an intriguing first glimpse into possible evolutionary scenarios in the genus. While most taxa within *Plagiobothrys* appear to have arisen from a single common ancestor, members of other genera (e.g., *Amsinckia*) are intercalated among *Plagiobothrys* taxa at deeper nodes. Additional sampling of these putative outgroups will be necessary to better understand this conflict. Many relationships within *Plagiobothrys* at shallower nodes are well-supported, including strong support for a monophyletic section *Allocarya*. Several well-supported clades were resolved within section *Allocarya*, although relationships among these clades cannot be inferred with this dataset. This lack of phylogenetic structure at the base of section *Allocarya* is suggestive of a rapid diversification, possibly with the development of vernal pool ecosystems in the California Floristic Province.

**12. HAYDEN, M.K.[1] and BATTLES, J.J.**
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### Drivers of Pioneer Riparian Forest Establishment in Abandoned Channels: When Does Competition Matter?

Cottonwood (*Populus*) and willow (*Salix*) pioneer species have experienced significant declines due to a reduction in the extent of mature forest as a result of land conversion, and less frequent establishment of new cohorts downstream of dams. If senescing stands are not replaced, the long-term persistence of these species is threatened. Pioneer species typically have multiple strategies for persistence, and in meandering rivers, abandoned channels may provide important spatial refugia as an alternate recruitment pathway for woody pioneers. Understanding the mechanisms that drive establishment of these pioneers within abandoned channels is a key component to improving management and conservation of the riparian corridor at the landscape scale. We are testing a conceptual model that links sedimentation and vegetation dynamics within abandoned channels. This model suggests that conditions change through time from a period where abiotic factors are the primary drivers of forest dynamics, to conditions dominated by biotic interactions, particularly competition for light and moisture. Using a space-for-time substitution approach, we quantified the competitive environment within four abandoned channels and a point-bar reference site in the middle reach of the Sacramento River. Within replicated 1-$m^2$ plots, we measured percent cover by species, light availability, and depth to water table. The point-bar site had the lowest overall percent cover (mean 22%), abandoned channel sites ≤20 yrs-since-cutoff were intermediate (~50–75% cover), and the oldest abandoned channel site had the highest cover (93%). A controlled community competition study along a realistic environmental gradient is planned to isolate the mechanisms driving observed patterns.

**13. HEISE, K.L.[1] and MERENLENDER, A.M.[2]**
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### The Botanical Resources of the Hopland Reservation: Past Use, Present Distribution, Future Protection

The EPA and the Hopland Tribal government have embarked on a multi-year effort aimed toward promoting natural resource protection and fostering native land stewardship. As part of this overarching project, a 3-year inventory is in progress of the vascular plants, bryophytes, and macro-lichens across the entire 2,070-acre Hopland Reservation located in the Mayacmas Mountains of southeastern Mendocino County. Additionally, voucher specimens are being collected and housed in the reservation herbarium to serve tribal members, educators, and scientists. Due to this intensive botanical survey a great deal has been learned about the plant diversity found here and adds substantially to our knowledge of the Mayac-

mas Mountains flora in general. A total of 764 vouchers were collected during the 2008 and 2009 field seasons representing 465 vascular plant, 117 bryophyte, and 50 macro lichen taxa. Many of these plants have traditionally been a source of food, fiber, tools, medicine, and shelter, and remain important today as younger generations seek to cultivate their traditional ecological knowledge. In conclusion, this effort demonstrates the commitment of the Hopland Band of Pomo Indians to conserve and further their knowledge of the natural resources located within the historical boundary of the Reservation.

**14. JURJAVCIC, N.,[1] KEEVER, M.,[1] and McCANN, M.[2]**
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### Adder's Tongue Ferns: Rare Plant Population Monitoring Lessons from Oregon

As part of re-licensing for Eugene Water & Electric Board's Carmen-Smith Hydroelectric Project, Stillwater Sciences is conducting a five-year, annual survey of two rare plant populations: *Botrychium virginianum* (rattlesnake fern); and *Ophioglossum pusillum* (northern adder's tongue). Information gained from this study of annual baseline variability will be utilized to inform long-term management of each species. To date, two years of monitoring have been completed at the site. In Year 1, it was discovered that the population count for both populations was much higher than expected; therefore permanent belt transects were established such that data collected and variables analyzed between years could be compared across a controlled area. Additionally, within the *B. virginianum* population one timed-search survey site was established at a location that supported a smaller, relatively diffuse, population; within the *O. pusillum* population, several discrete auxiliary patches were also surveyed and mapped. Variables collected include number of individuals (fertile and vegetative), canopy cover, plant associates, hydrologic characteristics, and soil information. For the *B. virginianum* population, results thus far indicate that the population has increased along the transects and in the timed search site. For the *O. pusillum* population, results indicate a shift of population density from the belt transect patches to off-transect patches. For both populations, potential causes include natural population variation or annual differences in temperature, precipitation, or snowpack. Over the next three years, further insight into the the populations' dynamics will be evaluated by additional surveys, climatic data, and, in the case of *O. pusillum*, groundwater monitoring.

**15. KEELER-WOLF, T., YACOUB, R., HICKSON, D., BOUL, R., ROYE, C., and KLEIN, A.**
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### Vegetation Mapping in the Northern Sierra Foothills

The CDFG Vegetation Classification and Mapping Program recently completed a map of the vegetation alliances of the Northern Sierra Nevada Foothills region. The map includes an area of about 1.4 million acres from just east of Redding to just south of Auburn. The map was produced through heads-up digitizing of summer 2005 NAIP true color imagery (1 m resolution). The map legend is based on a classification of vegetation data developed through the analysis of over 2600 sample plots, and adheres to the hierarchical rules of the National and State Vegetation Classification systems. A total of 57 different natural vegetation classes are mapped; the thematic resolution is primarily at the alliance level, with some mapping units resolved at the alliance group level. Only one non-standard mapping unit was used, which depicts a combination of vernal pools within a matrix of grassland. The >70,000 polygons are attributed with 9 different interpreted attributes, including disturbance attributes and percent cover estimates for each vegetative stratum. The map has an overall accuracy of 82% by class. We compare this map to other recent efforts including local watershed-scale efforts (Hatfield et al. 2007), timber and fire maps (CalVeg-EVEG), and the new CalGAP map (USGS). Several issues affect comparisons and uses of the maps: minimum mapping unit, extent, imagery, value of field classification, variation between mapping classifications, and methodological underpinnings of the products.

**16. KEEVER, M., ARAYA, S., DIGGORY, Z., JURJAVCIC, N., and ORR, B.**
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### Inventory and Management of Botanical Resources: Data Visualization as Decision-Making Tools

Spatial viewing of information provides an interactive and empowering approach to ecosystem management and the assessment of impacts of human activities on physical and biological systems. In addition to familiar GIS applications, the use of the flash-based revegetation design tool HoneyComb© and linking GIS databases with user-friendly Google Maps API or Google Earth has streamlined communications with resource agencies, linked rare plant inventories with resource management activities, simplified restoration design and planting plan development, facilitated adaptive management, and improved decision-making. Examples reviewed include a Google Maps "mashup" (API) of invasive weed populations in northern California showing population abundances and associated geographic extent that were used to understand the movement and spread of weed populations through the study area. At another site in the Western Cascades, a combination of vegetation data layers from comprehensive botanical surveys were used in conjunction with physical data layers, exported in KML format, and viewed in Google Earth to refine vegetation management priorities with the entire management team. Along the San Joaquin River, GIS was used to provide a spatially-explicit indication of natural vegetation types that might be restored along the river corridor, as well as to develop and parameterize the San Joaquin River Riparian Recruitment Model, which was used to predict the extent of natural recruitment of woody riparian vegetation under various flow regimes. These tools have allowed scientists, project managers, and non-technical staff alike to visualize potential impacts to botanical resources and make informed management decisions.

**17. MERRIAM, K.,[1] WENK, E.,[1] BELSHER-HOWE, J.,[2] COPPOLETTA, M.,[2] and CHRISTOFFERSON, C.[3]**
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### Restoring Rare Plant Populations on the Plumas National Forest Using Prescribed Burning and Thinning

Many rare plant species in fire-adapted ecosystems such as the Sierra Nevada require high light environments with little competition. A century of fire suppression has made these kinds of early seral habitats rare. The USDA Forest Service (USFS) has been implementing prescribed burning and thinning projects to restore forest structure and composition; however, rare plant species are typically excluded from such treatments because of lack of information and concern over extirpating small populations. *Packera layneae* and *Astragalus webberi* are two rare species found on the Plumas National Forest. In 2008, the USFS treated a portion of an *A. webberi* population by hand thinning, and conducted a prescribed burn within an occurrence of *P. layneae* to determine if these treatments might also benefit these rare species. We collected data on species and environmental variables both before and after treatment implementation. We found that *A. webberi* and *P. layneae* cover did not change one year after thinning or prescribed burning, respectively. *Astragalus webberi* experienced a small increase in density after thinning. *Packera layneae* density did not change after prescribed burning. *Astragalus webberi* density and cover was significantly higher in areas with lower cover of other herbaceous species, while *P. layneae* density was significantly greater in plots with more exposed bare ground. These habitat variables were not affected by thinning or burning treatments. Our results one year post-treatment show that these rare species may benefit from restoration treatments; however, treatment prescriptions that are too conservative may not be sufficient to create critical environmental conditions. Further treatment and monitoring are needed.

**18. PETERSON, E.B., CARLBERG, T., BEYER, C., POULSON, B., and PIGNIOLO, A.**
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### A Process for Evaluating Lichen Species for Conservation

The California Lichen Society (CALS) in 2005 developed a process for evaluating lichen species for conservation. The active agents of the process are an oversight committee (CALS Conservation Committee), a sponsor, some form of publicization, professional and public notification, a review period, and final committee review. The process uses existing CNPS and Heritage program rank values. In 2006, the California Native Plant Society (CNPS) modified the process used to add or make status changes to the CNPS Inventory and the California Natural Diversity Database. Their new process is modeled on the one developed by the California Lichen Society. This is a direct result of including State botany and conservation personnel in planning stages of CALS conservation efforts. The salient points of the process are 1) identification of species and assignment of responsibility for sponsorship; 2) review of current understanding and completion of sponsorship form using best available information; 3) Committee review of sponsorship; 4) publicization of sponsorship, including notification of agencies, stakeholders, and relevant experts as well as utilization of print and web-based resources; 5) 90-day comment period; 6) minimum one-year total review period; and 7) Committee re-review of sponsorship and final decision. The following species have completed the sponsorship process: as List 1b, *Hypogymnia schizidiata* – G2.3 S1.3, *Sulcaria isidiifera* – G1.1 S1.1; as List 2, *Calicium adspersum* – G4.3 S1??.2, *Cladonia firma* – G4.2 S1.1, *Solorina spongiosa* – G4G5.3 S1.2; as List 4, *Usnea longissima* – G5.1 S4.2. Five additional species are currently in process (*Bryoria pseudocapillaris, Bryoria spiralifera, Peltigera hydrothyria, Ramalina thrausta* and *Sulcaria badia*).

**19. PRESTON, R.E.**
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### Predicting the Number of Undiscovered Element Occurrences Using Discovery Curves

The number of existing element occurrences is an important parameter for determining a species' rarity status. Being able to predict the number of undiscovered occurrences could address some of the uncertainty over current occurrence numbers and might help in situations where a perceived need for additional surveys may delay listing decisions. Habitat modeling has been useful for predicting the location and extent of potential habitat, providing direction for surveys, and identifying areas for conservation, but estimating the extent of occupied habitat can be limited by the paucity of presence/absence data, poor understanding of habitat requirements, or unavailable or low-resolution geospatial data. Discovery curves, which have been a common tool for estimating species numbers for taxonomic groups or species diversity for specific geographic areas, may also be useful for predicting the total number of occurrences for rare species. The expected number of occurrences may be extrapolated from the discovery curve by curve fitting. Theoretical expectations suggest that a logistic curve should provide an acceptable fit to the data, which is supported by an analysis of data for plant species inventoried in the CNDDB. The reliability of estimates based on extrapolation will be dependent on factors that influence the discovery rate, including the level of effort spent on discovering new occurrences, how apparent the species is, how much unexplored habitat exists, how accessible the habitat is, and the taxonomic expertise of surveyors.

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### Distribution of Mosses in the Napa River Watershed in Response to Environmental Factors: Are Moss Distributions Determined by Distributions of Vascular Woody Plants?

Eighty plots within the Napa River watershed, Napa County, California were surveyed for moss occurrence, vascular plant occurrence, vegetation structure and environmental variables. From the 631 specimens collected, 87 moss species and 41 perennial vascular plants are reported. Moss distribution was significantly influenced by percent woody canopy coverage, and less significantly influenced by slope and elevation. Sampling was conducted during the winter to focus attention on perennial species.

**21. SCHILE, L.,[1,2] STRALBERG, D.,[3] CALLAWAY, J.,[4] PARKER, V.T.,[5] and KELLY, N.M.[4]**
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### Tidal Wetland Response to Climate Change in the San Francisco Estuary: Predictive Modeling of Marsh Distributions

The influence of predicted climate change is likely to affect all global ecosystems. Estuaries, in particular, are susceptible to the effects of climate change due to their coastal proximity and significant anthropogenic influence, and face the threat of tidal submersion and salt-water intrusion through sea-level rise. Predictions of regional effects of climate change for the San Francisco Bay Estuary and other coastal California watersheds present a future with reduced summer freshwater input and increased sea levels. In the Estuary, freshwater inputs clearly structure plant communities as freshwater marshes have higher rates of both diversity and productivity (>60 species, 2440 g m-2 y-1) than brackish (24-50 species, 900-1400 g m-2 y-1) or salt marshes (10-17 species, 270-700 g m-2 y-1). Tidal wetland marsh distributions in the San Francisco Bay Estuary were modeled under a variety of sea-level rise scenarios (0.17, 0.82, and 1.4m increase by 2100) and salinity regimes to understand how habitat types might shift, shrink, or migrate with predicted climate change. Under all sea-level rise scenarios, wetland area decreased and very little migration occurred. Increases in salinity shifted salt and brackish wetlands further upstream into the estuary, resulting in a loss in area of freshwater and low-salinity marshes. These changes could cascade into terrestrial and pelagic animal communities linked to wetlands, affecting many endangered and threatened species.

**22. SHULDMAN, M.I.[1] and DAWSON, T.E.**
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### Using the $\delta^{13}C$ of Leaf Sugars to Examine the Effects of Changing the Onset or Duration of the Heatwave Season in a Widespread California Native Shrub, *Heteromeles arbutifolia*

The length of the "heatwave" season is predicted to increase, yet it is uncertain if it will start earlier or end later. We examined the effect of a spring heatwave on *Heteromeles arbutifolia.* We used both full grown shrubs and plants that had regrown their canopies (resprouts). During the spring heatwave air temperature was approximately 5°C higher than the pre-heatwave day but leaf temperatures were not significantly different (or even cooler). The resprouts doubled their conductance compared to the previous pre-heatwave day. In addition, in the late afternoon, the resprouts had significantly higher conductance compared to the shrubs. There was a 1‰ difference of midday $\delta^{13}C$ of leaf sugars before (-24.2‰ ± 0.2) compared to during the heatwave (-25.4‰ ±0.4). Within a plant type we saw no difference in calculated $c_i/c_a$, between April 2009 and June 2009. Throughout this period $c_i/c_a$ stayed constant as conductance decreased, suggesting photosynthesis and conductance were declining in concert. In the shrubs, from July – September, we observed lower $c_i/c_a$. High conductance during the spring heatwave, in conjunction with low leaf temperatures, suggests plants were using enhanced transpiration rates to cool their leaves. High water loss rates were not observed later in the growing season when temperatures were comparable to the spring heatwave. Our results show that *H. arbutifolia* responds to extreme temperatures in spring differently than seasonal high temperatures during the summer drought, suggesting that changes in onset versus duration of the heatwave season may have important and negative impacts on this native plant species.

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### Increasing the Accuracy of Documenting the Presence of Listed Vernal Pool Plants: Comparison of Sampling Methods

Listed plant species can be easily overlooked during the field survey because of the rarity of occurrence and sometimes also a low abundance and a cryptic habit. We developed a new method for rare species survey that narrows down the range of habitats and emphasizes the search effort on those plant community types that were associated with the target species in our state-wide vernal pool survey. This community-based approach was tested against two commonly used methods of rare species surveys – the whole-pool walk, when an entire pool is searched, and transect sampling, when a series of replicate plots are placed along a transect. All three methods were applied at 29 pools that contain at least one out of the following four rare vernal pool species: *Castilleja campestris* ssp. *succulenta, Navarretia myersii, Orcuttia inaequalis,* and *Orcuttia viscida*. Pools were surveyed independently by six experts, each of whom applied only one sampling method in a given pool. Each method was used twice in every pool. We documented the percentage of pools in which the target species was found and the time spent when different survey methods were used. The accuracy of rare species survey varied from 72.4% (transect) to 79.3% (whole-pool) and 82.8% (community). The average time required per pool by different survey methods varied from 8.2 minutes (transect), to 8.4 minutes (whole-pool), and 5.7 minutes (community). Our results demonstrate that plant community types as predictive indicators can increase accuracy and efficiency of rare species surveys.

**24. TALLEY, S.N.,[1] MACDONALD, R.M.,[2] and KELLEY, D.B.[2]**
[1]4300 Eucalyptus Road, Fair Oaks, CA 95628
[2]Tuscan Foundation, 20 Baker Street, Winters, CA 95694

### A Multi-year Response of a Grassland Vernal Pool Ecosystem to Grazed and Fallow Conditions

Since 1994 the 60-acre Tuscan Preserve in northern Butte County, CA has been the site of studies to determine the effects of cattle grazing and climate upon the annual grassland-seasonal wetland-vernal pool ecosystem. From 1994 through spring 2000, the site was fallow after seven decades of cattle grazing. Under fallow conditions, there was widespread decline in native species richness and cover and a concurrent increase in cover of exotic species, especially *Lolium perenne* and *Taeniatherum caput-medusae* at both wetland and upland sites. However, the declines in native species were greatest in wetlands including saturated and shallow flooded edges of vernal pools, drainage swales, and Anita clay adobe sites. During a period of light and moderate grazing beginning in spring 2001 and continuing through 2005, there was widespread recovery of native species richness but not cover in both wetlands and uplands. Within vernal pool basins, recovery under moderate grazing was more complete, suggesting higher grazing intensities are necessary for optimal expression of native species in the grasslands. Since 2007 grazing has been heavy. Data from 2008 and 2009 indicate delayed return to the high 1995 cover of native species in uplands and shallow wetlands. Comparison of Preserve samples to similar habitats adjacent to the Preserve which have been heavily grazed throughout the study period underscore drought as a factor hindering recovery of late flowering native species.

**25. THOMAS, D.**
San Francisco Public Utilities Commission, Natural Resources and Lands Management Division, 1657 Rollins Road, Burlingame, CA 94010

### Active and Passive Restoration of Fountain Thistle (*Cirsium fontinale* var. *fontinale*)

Fountain thistle (*Cirsium fontinale* var. *fontinale*) is a federally and state endangered plant species endemic to the San Francisco Peninsula, with the majority of its populations occurring within the Peninsula Watershed of the San Francisco Public Utilities Commission (SFPUC). One of the populations has been heavily invaded by jubatagrass (*Cortaderia jubata*). As the result of a 12-year-long control program, the SFPUC has removed almost all of the jubatagrass, and this has permitted fountain thistle to begin to rec-

laim the lost habitat. A monitoring program is being conducted to track the progress of re-colonization of the habitat by fountain thistle. Initial surveys revealed an average rate of expansion of the fountain thistle population of 1.7 ft. (0.5 m) between 2007 and 2008 and of 2.6 ft. (0.8 m) between 2008 and 2009, or an average rate of about 2.2 ft. (0.7 m) per year. At this relatively slow rate of spread, there is the risk of re-invasion of cleared habitat by invasive plants. Tall fescue (*Festuca arundinacea*) is rapidly increasing at the site and threatens to exclude fountain thistle from its potential habitat. Therefore a program of active restoration, involving the planting of California hairgrass (*Deschampsia cespitosa),* the most common native associate of fountain thistle in the Watershed, was begun in 2009 to supplement revegetation through passive recruitment, and to provide a matrix of native plants that would resist further invasion. Survivorship of hairgrass will be followed to determine the effectiveness of this approach.

**26. VAN SUSTEREN, J.**
510 Mill Street, Mt. Shasta, CA 96067

### Changes in the Vegetation of Trout Creek Meadow after Large-scale Manipulation of the Creek Bed

Trout Creek Meadow is located on a post-glacial outwash terrace. Such meadows tend to be geologically impermanent; the undifferentiated sediment offers little resistance to the erosive powers of the creek and the channel soon forms a gully. At Trout Creek, anthropogenic activities such as ditching have accelerated gullying and meadow desiccation. Before restoration the creek channel was incised 30 feet below the meadow surface. In 2006, the Forest Service (with a grant from CalTrans) blocked the incised channel and diverted its flow into an historic channel. The old channel was blocked to create several depressions that will eventually fill with water. The design is intended to cause the stream to raise the water table, form multiple channels, and rehydrate the meadow. In order to observe how a raised water table would encourage historic meadow vegetation reestablishment, I established permanent plots along transects between the former eroded channel and the current creek bed. I have been measuring change in species cover since 2007. Precipitation during the last four winters has been at or below normal levels, so there has been minimal flooding. Consequently, the effects of the project have been marginal. The depressions along the original channel have not yet filled and changes in the water table have been moderate. While vegetation density has increased near the restored creek bed, meadow vegetation more than 20 meters from the creek has not obviously changed. Until several flood events occur, the long-term results from the manipulation of Trout Creek will be inconclusive.

**27. VANDERPLANK, S.,[1] MOE, R.,[2] and MARKOS, S.[2]**
[1]Rancho Santa Ana Botanic Garden, 1500 North College Avenue, Claremont, CA 91711
[2]University and Jepson Herbaria, University of California, 1001 VLSB #2465, Berkeley, CA 94720

### The Consortium of California Herbaria Online

The Consortium of California Herbaria (CCH) provides a view into the combined specimen data of seventeen herbaria in California. This resource is invaluable in representing current and historical distributions of California vascular plants and in promoting accuracy and consistency of specimen data. Over 1,000,000 records from 17 institutions can be searched by a variety of fields including scientific name, county, region, geographic locality, and latitude and longitude. Visit us online at http://ucjeps.berkeley.edu/consortium/. Displays include detailed specimen records and in some cases, links to an image of the specimen, web-based maps with various layers, and field-book entries. The CCH query result display can also include lists of taxa (for example CNPS listed taxa; taxa collected before 1860; taxa from Yolo Co.). User feedback is attached to each record. Records are regularly updated.

**28. WALDEN, G.K. and PATTERSON, R.**
San Francisco State University, Department of Biology, 1600 Holloway Avenue, San Francisco, CA 94132

### The Sweet-smelling Phacelias: A Reevaluation of *Phacelia suaveolens* Greene var. *suaveolens* and *Phacelia suaveolens* Greene var. *keckii* (Munz & I.M. Johnst.) J.T. Howell

*Phacelia suaveolens* Greene var. *suaveolens* (Boraginaceae) and *Phacelia suaveolens* Greene var. *keckii* (Munz & I.M. Johnst.) J.T. Howell are rarely-collected California endemic annual species. Populations have been historically collected post burns or on open disturbed sites, in chaparral or closed-cone pine forests. *Phacelia suaveolens* var. *suaveolens* is the northern occurring species, distributed in the Coast Ranges and Sierra Nevada foothills, whereas the southern occurring *P. suaveolens* var. *keckii* is restricted to the Santa Ana Mountains. Originally described as separate and distinct species, the two varieties are differentiated morphologically by corolla length, petiole length, and ovule number. *Phacelia suaveolens* var. *suaveolens* and *P. suaveolens* var. *keckii* have traditionally been included in Species Group *Pulchellae* due to morphological and cytological characters. However, molecular systematic data cast doubt upon the stability of the Species Group *Pulchellae* as revised by Howell, as well as the placement of *P. suaveolens* var. *suaveolens* and *P. suaveolens* var. *keckii* within this traditional infrageneric group.

**29. WENK, E. and MERRIAM, K.**
USDA Forest Service, Plumas National Forest, 159 Lawrence Street, Quincy, CA 95971

### Effects of Grazing on *Orcuttia tenuis* Populations on the Lassen National Forest

*Orcuttia tenuis* (slender Orcutt grass) is a federally listed species endemic to northern California vernal pools. In its northern range on the Modoc Plateau, primary threats to *O. tenuis* conservation are thought to be livestock use and changes in vernal pool hydrology. However, very little is known about the response of *O. tenuis* to grazing. During the summer of 2009, we studied several populations on the Lassen National Forest to determine if cattle grazing affects *O. tenuis* density and vigor, the vernal pool plant community, or environmental variables. We sampled four grazed, three ungrazed, and one partially-grazed population (Grassy Lake). Our forest-wide results, and those from a single site, Grassy Lake, both show that grazing reduced graminoid height. In addition, at Grassy Lake, grazing reduced litter cover and duff depth. We only saw a significant effect of grazing on *O. tenuis* density at Grassy Lake, where grazing increased *O. tenuis* density. *Orcuttia tenuis* culm and spikelet production was not affected by grazing, though forest-wide results show that *O. tenuis* height decreased where grazed. We saw a positive effect of grazing on species richness at Grassy Lake, and forest-wide, regression analyses show that species richness is negatively affected by duff depth. Our results suggest that, in general, grazing does not affect *O. tenuis*, but at some sites it may be beneficial to *O. tenuis* populations by increasing plant density. Grazing may improve *O. tenuis* site conditions and reduce competition, through decreased litter cover, duff depth, and graminoid height.

**30. WHEELER, J.**
USDI Bureau of Land Management, Arcata Field Office, 1695 Heindon Road, Arcata, CA 95521

### King Range Native Perennial Bunchgrass Program

Limited stands of historically abundant California native perennial bunchgrass remain in California wild landscapes. Many of these wild landscapes have been subject to a century or more of livestock grazing and decades of fire suppression. The Bureau of Land Management (BLM), in partnership with the Mattole Restoration Council (MRC), has inventoried, mapped, collected, and propagated seed of 11 native perennial bunchgrasses in order to generate enough seed and standing nursery capacity for on the ground restoration projects. Through partnership, the BLM has utilized native perennial bunchgrass material to 1) create an *in situ* seed bank for study and future seed collection; 2) develop and provide sufficient local seed supply for a hydroseeding project following the 2008 Paradise Fire; and 3) produce nursery capacity to thus far transplant 53,606 plugs of prairie Junegrass (*Koeleria macrantha)*, leafy reed grass (*Calamagrostis foliosa)*, Pacific hairgrass (*Deschampsia cespitosa* ssp. *holciformis*), California melic (*Melica californica*), and Idaho fescue (*Festuca idahoensis*). These five grass species were planted following the 2007 Spanish Fire, and also in November of 2009 as part of Paradise Ridge and Prosper Prairie native pe-

rennial grass enhancement projects. The BLM is committed to actively managing events responsible for resuming successional processes that may favor colonial establishment of transplanted perennial grasses. The King Range Native Perennial Bunchgrass Program has demonstrated that successful establishment of new native perennial bunchgrass colonies can be accomplished through the propagation of locally collected seed followed by transplantation of plugs.

**31. WILLIAMS, A.,[1,2] GLUESENKAMP, D.,[1] and ROSSI, A.[1]**
[1]Bay Area Early Detection Network: www.BAEDN.org
[2]San Francisco Area Network, Fort Cronkhite Building 1063, Sausalito, CA 94965

### The San Francisco Bay Area Early Detection Network

The Bay Area Early Detection Network (BAEDN) is a collaborative partnership of regional land managers and invasive species experts in the nine Bay Area counties to coordinate the Early Detection and Rapid Response (EDRR) to infestations of invasive plants still limited in distribution. Removing invasive plants while populations are small is a key to success, and keeps costs down. A goal of BAEDN is to provide a "toolbox" for land managers to use for EDRR, including a searchable online reporting database. Currently, most land managers hear about new invasive species in their area by word-of-mouth. The online occurrence reporting database (www.BAEDN.org), developed by BAEDN and Calflora, provides a mechanism for all partners to report priority invasive plant species early detections to a central repository, to facilitate rapid response. BAEDN is a participation-based organization, and there are actions that local botanists and land managers can take to become actively involved, including: 1) try out the occurrence reporting tool, 2) sign onto email list, 3) if you are in the nine counties, please help us build BAEDN!, 4) share your weed data for the comprehensive database, 5) get the word out about BAEDN to other potential partners, and 6) tell us about weeds you are seeing as emerging problems.

**32. WILLIAMS, M.,[1] HATFIELD, C.,[1] and CHRISTOFFERSON, C.[2]**
[1]Department of Biological Sciences, California State University Chico, Chico, CA 95929-0515
[2]Botany Department, Feather River Ranger District, Plumas National Forest, 875 Mitchell Avenue, Oroville, CA 95965

### Why Am I Rare? A Case Study of a Rare Serpentine Endemic

Many rare and threatened California plant species are endemic to ultramafic serpentine soils. Understanding what specifically makes these species rare is of high value to conservation and management efforts statewide. While there is no one definition of what makes a plant rare, there are many characteristics that are thought to contribute to a species' rarity. My study focuses on environmental and reproductive attributes of a rare serpentine endemic to evaluate their contribution to the plant's rarity. *Packera layneae*, or Layne's Butterweed, is a federally threatened and state listed rare species occurring in small, fragmented populations on serpentine soils in the northern California Sierra Nevada. I propose to evaluate environmental factors that define its restrictive habitat, including elevation, aspect, light availability and soil characteristics. I will collect data on these parameters in the field, and then apply the soil findings to greenhouse germination experiments. I will also burn plots within a population, to look at the role of fire as a possible contributor to *Packera layneae*'s rarity, based on the knowledge that fire suppression in chaparral communities has had a negative effect on native species. I will also use field data in combination with soils and geology to create a GIS habitat suitability map, to better understand this species' range. The map will help to predict potential undiscovered populations as well as identify potential restoration sites. Through the findings of this study, I hope to develop theories that can help us better understand rarity in serpentine systems and rarity in general.

**33. WILSON, B.L.,[1] BRAINERD, R.E.,[1] HIPP, A.,[2] OTTING, N.,[1] and ZIKA, P.F.[3]**
[1]*Carex* Working Group, 1377 NW Alta Vista, Corvallis, OR 97330
[2]The Morton Arboretum, 4100 Illinois Route 53, Lisle, IL 60532
[3]Herbarium, University of Washington, Seattle, WA 98195

**Sedges *Carex constanceana, C. davyi,* and *C. petasata*: Where are the Species Boundaries?**

Three upland *Ovales* sedges in Pacific Coast states have unusually large perigynia. *Carex davyi* has been known as a fairly rare plant endemic to the Sierra Nevada. *Carex constanceana* was described from plants collected by Wilhelm Suksdorf in 1989 and 1909 on Mt. Adams, Washington, but not relocated and eventually reduced to synonymy with *C. petasata*. *Carex petasata* is an uncommon but widespread sedge of grasslands and shrub steppe in all three states. Recent discoveries of apparent *C. constanceana* in California's Sierra Nevada and southern Oregon's North Warner Mountains revived the question of what this sedge really is. Morphological and genetic studies of variation in the three taxa show that *Carex constanceana* is not *C. petasata* but is *C. davyi*.

**34. WITZMAN, J., LINDHOLM, P., and HAMAMOTO, L.**
Division of Environmental Services, California Department of Water Resources, 3500 Industrial Boulevard, West Sacramento, CA 95691

**Botany Survey Planning, Logistics, and Results for the Delta Habitat Conservation and Conveyance Program (DHCCP)**

The CA Department of Water Resources conducted botanical surveys to identify the location of special-status plant species within the DHCCP conveyance planning area. These data will be used to conduct impact analyses on the alternatives selected for detailed evaluation in the Bay Delta Conservation Plan Environmental Impact Report/Environmental Impact Statement (EIR/EIS). Fifteen of the sixty-four special-status species identified as potentially occurring in the study area were found during the 2009 surveys. Approximately 5500 acres and 700 miles of shoreline were surveyed between March 4 and October 2. Twenty-one botanists and 16 boat operators took part in the surveys. Survey planning and logistics for this large scale survey utilized multiple databases and a Geographic Information System (GIS). In ArcMap, detailed vegetation associations mapped by the CA Department of Fish and Game (DFG) were consolidated into habitat types. The habitat layer was overlaid with land ownership to select areas of potential habitat for the target species within parcels with authorized access. A database with the optimal survey time and habitat of each species was linked with the map to direct the survey timing and staff scheduling. A second database defining appropriate low tides for boat surveys was linked with the waterway layer in GIS. Surveys followed DFG and USFWS protocols with botanists walking transects for terrestrial surveys or travelling by shallow draft boat for waterway surveys. Survey results, including species name, location, number of individuals, life stage, associated species, and habitat, were documented in a GPS receiver. Data was then uploaded to a geodatabase.

**35. ZAROLI, J.**
**NCB 2009-2010 Research Scholarship awardee**
Department of Biological Sciences, San Jose State University, Duncan Hall Room 354, San Jose, CA 95192-0100

**Assessing the Impact of Nutrient Enrichment on Native and Invasive Species in California's Serpentine Grasslands: Understanding a Growing Threat**

According to research by Stuart Weiss (*Conservation Biology* 1999, Vol. 13: 1476-1486), nitrogen is being deposited from 10 to 15 kg/ha/year onto our soils because of auto emissions and other atmospheric pollutants. My research focuses on areas off of Highway 101 and 280, where extensive areas of serpentine soils are found. In an effort to explore the effects of nutrient enrichment via atmospheric sources, we have designed a greenhouse project in which serpentine native plants are tested for their ability to compete against invasive plants under enriched nutrient conditions. We will grow the natives *Lasthenia californica, Vulpia microstachys,* and *Plantago erecta* with the common invasives *Bromus hordeaceus* and *Avena fatua* in four different nutrient treatments. It is our aim to explore whether invasives can truly outcompete our native species under enriched nutrient conditions. We will use nitrogen, phosphorus, mag-

nesium, and calcium, as these are elements plants require in large quantities for growth. The Low treatments with nitrogen and phosphorus will represent a slightly amended condition, while the Medium treatment will represent a higher amendment, and the High treatment an excessive condition. All treatments will be estimated based on actual and predicted nutrient concentrations for field soils. Magnesium (Mg) and calcium (Ca) will be amended to represent a change in the normal Mg to Ca ratios of serpentine. We anticipate invasive species to show both greater biomass and reproductive effort compared to the native species in highly amended soils. The research will provide a useful test to predict how California's native plants can perform in light of anticipated nutrient enrichment in light of global climate change.

# INDEX OF AUTHORS

(Talk abstract pages in **bold**; poster abstract pages in *italics*)

# Evaluation of Northern California Botanists Symposium

This is our third symposium and we would like to get your feedback. Please fill out the following evaluation and turn it in as you leave the symposium. Thank you!

**General Conference: Please circle the number that most fits your thoughts. Space is provided below each topic for comments**.

| | Poor | Fair | Acceptable | Good | Excellent | |
|---|---|---|---|---|---|---|
| Time of year: | 1 | 2 | 3 | 4 | 5 | |
| Comments: _____ | | | | | | |
| _____ | | | | | | |
| Chico State campus conference facility – Bell Memorial Union: | 1 | 2 | 3 | 4 | 5 | |
| Comments: _____ | | | | | | |
| _____ | | | | | | |
| Reception: | 1 | 2 | 3 | 4 | 5 | N/A |
| Comments: _____ | | | | | | |
| _____ | | | | | | |
| Banquet and food: | 1 | 2 | 3 | 4 | 5 | N/A |
| Comments: _____ | | | | | | |
| _____ | | | | | | |
| Web site and registration: | 1 | 2 | 3 | 4 | 5 | |
| Comments: _____ | | | | | | |
| _____ | | | | | | |

**Symposium Topics: Please circle the number that most fits your thoughts. Space is provided to highlight the talks that you liked the best or the least in that topic.**

| | Not useful | Fair | OK | Good | Excellent |
|---|---|---|---|---|---|
| 1. Maintaining the Wealth of Plant Diversity: | 1 | 2 | 3 | 4 | 5 |
| Comments: _____ | | | | | |
| _____ | | | | | |
| 2. Exotics: Robbers in the Native Landscape: | 1 | 2 | 3 | 4 | 5 |
| Comments: _____ | | | | | |
| _____ | | | | | |
| 3. Pollination and Reproductive Biology: | 1 | 2 | 3 | 4 | 5 |
| Comments: _____ | | | | | |
| _____ | | | | | |

4. Plant and
Animal Interactions: 1 2 3 4 5
Comments: _____
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Keynote Speaker: 1 2 3 4 5
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5. Some tools for
Evaluating Ecosystems: 1 2 3 4 5
Comments: _____
_____

6. Bryophytes: 1 2 3 4 5
Comments: _____
_____

7. How Do We Encourage
Future Botanists: 1 2 3 4 5
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8. New Botanical Treasures: 1 2 3 4 5
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Poster Session: 1 2 3 4 5
Comments: _____
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**Other comments**: Please include ideas for future topics that we should consider for the next symposium:

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**Suggestions**: Please suggest persons or organizations that should be considered for the next symposium. Please include suggestions on how to increase involvement from outlying parts of California and adjacent states?

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## Thank you for attending the Northern California Botanists Symposium