RESEARCH and CONSERVATION of Northern California's Vegetation Communities

THE NINTH SYMPOSIUM
PRESENTED BY

NORTHERN CALIFORNIA BOTANISTS
at California State University, Chico
14-16 January 2019

Research and Conservation of Northern California's Vegetation Communities

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Cover photo courtesy of Clare Golec. Northeastern Mendocino County view looking north with Little Red Mountain to the left (elevation 3,218 ft) and Red Mountain to the right (elevation 4,082 ft). Both mountains support unique serpentine soils ("Red Mountain laterite") and several endemic rare plants including Kellogg's buckwheat (*Eriogonum kelloggii*) and Red Mountain stonecrop (*Sedum eastwoodiae*), with the northern range extension of Sargent cypress (*Hesperocyparis sargentii*) in the Cedar Creek drainage between the two mountains. These serpentine soils have been heavily impacted by mining for chromium and nickel. California Department of Fish and Wildlife's Little Red Mountain is not subject to mining claims, but Bureau of Land Management's Red Mountain has existing mining leases even though it is recognized as an Area of Critical Environmental Concern. 10 June 2015.

WELCOME!

Northern California Botanists

welcomes you
to our ninth symposium

MISSION STATEMENT: Northern California Botanists is an organization with the purpose of increasing knowledge and communication among agency, consulting, academic, and other botanists about botanical issues concerning science, conservation, education, and professional development.

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PROGRAM OF PRESENTATIONS BY INVITED SPEAKERS

Bell Memorial Union Auditorium

(Abstracts of talks start on page 9; index to authors on page 37)

MONDAY, 14 JANUARY 2019

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

ALL DAY **Posters on display** – Bell Memorial Union second floor Room 203
See also Session 6, Poster Session, Tuesday at 8:30 a.m.

Opening Remarks and Welcome

8:45 a.m.

1. **Linnea Hanson**, President, Northern California Botanists

8:50 a.m.

David Hassenzahl, Dean, College of Natural Sciences, California State University, Chico

Session 1: Vegetation Mapping and Monitoring – Tools for Protection

9:00 – 10:20 a.m.

Session Chair: Teresa Sholars, Professor Emeritus, College of the Redwoods

2. **Teresa Sholars and Jennifer Garrison**
   Using vegetation classification and mapping to demystify and protect the Pygmy Forest Ecosystem of Mendocino and Sonoma counties
3. **Julie M. Evens and Diana Hickson**
   Vegetation in environmental review
4. **Mark Tukman**
   A living map for a changing landscape – fine-scale vegetation and habitat mapping in Sonoma County, California
5. **Michèle Slaton**
   Long-term monitoring and change detection in California's common and rare forests

10:20 – 10:40 a.m. **Break**

Session 2: The Importance of Herbaria for Research, Management, and Conservation

10:40 a.m. – 12:00 p.m.

Session Chair: Julie Kierstead, Shasta-Trinity National Forest

6. **Alison Colwell**
   The cultural significance of herbaria, past and present
7. **Steven Buckley**
   Using Symbiota to manage biodiversity information for conservation
8. **Len Lindstrand III**
   Establishing and digitizing "small" herbaria
9. **Jason Alexander**
   Upcoming changes in the Consortium of California Herbaria

12:00 – 1:20 p.m. **Lunch**

12:15 – 1:15 p.m. **Optional Lunchtime Discussions** – see page 6 for details.
1) Budding Botanists – Bell Memorial Union Auditorium
2) Consortium of California Herbaria – second floor Mezzanine

Session 3: Vegetation Response to Fire

1:20 – 2:40 p.m.

Session Chair: Jane Van Susteren, California Department of Water Resources

10. **Philip van Mantgem**
    Fighting drought with fire: Can managers increase forest resistance to drought using prescribed fire?
11. **Cajun James**
    Post-fire changes in riparian tree species with the Ponderosa, Rim, and King fires
12. **Heath Bartosh**
    Five years of post-fire research in North and Central Coast Range Chaparral: Lessons learned and future goals
13. **Michelle Halbur**
    Emerging from the ashes: How fire-shaped communities are responding to the 2017 Tubbs Fire in Sonoma County, California

2:40 – 3:00 p.m. **Break**

Session 4: Challenges and Solutions for Conserving Cryptic Diversity

3:00 – 4:20 p.m.

Session Chair: Jason Sexton, University of California, Merced

14. **Julie Kierstead and Teresa Sholars**
    Practical guidelines for detecting and conserving cryptic species
15. **Lisa Schultheis**
    Morphologically cryptic species in Downingia (Campanulaceae)

16. **Sarah Jacobs**
    The challenge of defining species in young lineages: A case study in the Castilleja pilosa species complex
17. **Brent Mishler**
    Biodiversity assessment and conservation without species

Session 5: Lightning Talks

4:20 – 5:00 p.m.

Session Chair: Jenn Yost, Cal Poly, San Luis Obispo

18. **Dan Gluesenkamp**
    California's Biodiversity Action Plan: Our role in the initiative
19. **Nadine Kanim**
    Yreka phlox recovery: How close are we?
20. **Adam Canter**
    Expansion of Hazelnut Scrub into Humboldt and Mendocino counties
21. **Kirsten Bovee**
    Collaborative study of rare Penstemon personatus
22. **Rob Thoms**
    Remote sensing capabilities for vegetation mapping
23. **Mary Patterson**
    OHV impacts on Hutchison's lewisia (Lewisia kelloggii ssp. hutchisonii)
24. **Naomi Fraga**
    Seed banking the California flora

* * * * *

5:15 – 6:15 p.m. **Reception** – Colusa Hall
No-host bar with complimentary hors d'oeuvres.

6:30 p.m. **Banquet** – Bell Memorial Union Auditorium
Dinner tickets required. Banquet will be east Indian cuisine and will include vegetarian dishes.

Keynote Speaker

7:30 p.m. Bell Memorial Union Auditorium – EVERYONE IS WELCOME

25. **Todd Keeler-Wolf**, California Department of Fish and Wildlife
    Becoming a naturalist and ecologist in Northern California

TUESDAY, 15 JANUARY 2019

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

ALL DAY **Posters on display** – Bell Memorial Union second floor Room 203
See also Session 6, Poster Session, Tuesday at 8:30 a.m.

Session 6: Poster Session

(Abstracts of posters start on page 22; index to authors on page 37)

8:30 – 10:00 a.m. Poster Session – Bell Memorial Union second floor Room 203

Session Chair: Barbara Castro, California Department of Water Resources
Poster presenters will be available to answer questions.

Second Day Opening Remarks

10:00 – 10:10 a.m. Opening Remarks – Bell Memorial Union Auditorium

Linnea Hanson, President, Northern California Botanists

Session 7: Native Plant Conservation

10:10 – 11:30 a.m.

Session Chair: Clare Golec, California Department of Fish and Wildlife, retired

26. **Cherilyn Burton**
The role of the California Department of Fish and Wildlife in native plant conservation
27. **Aaron Sims**
Tracking and assessing the conservation status of California's rare flora and upholding environmental policy: How a time-honored standard in rare plant assessment supports effective rare plant conservation
28. **Gordon Leppig**
Conservation botany from 30,000 feet: An ecosystem-based approach to riparian restoration, keeping common species common, and recovering rare ones
29. **Kerry Byrne**
Restoring a population of Applegate's milkvetch (Astragalus applegatei): Lessons learned for conservation

11:30 a.m. – 12:50 p.m. **Lunch**

11:45 – 1:45 p.m. **Optional Lunchtime Discussion** – see page 6 for details.
1) California Biodiversity Initiative – Bell Memorial Union Auditorium

Raffle, Auction, and Awards

12:50 – 1:20 p.m. Raffle, Auction, and Awards – Bell Memorial Union Auditorium

Session 8: New Discoveries

1:20 – 2:40 p.m.

Session Chair: Jane Van Susteren, California Department of Water Resources

30. **Dana York**
    Castle Crags sedge, a rare plant hiding in plain sight
31. **Kevin Mason**
    Discoveries in the Lomatium caruifolium complex – Diversity and patterns of speciation within differing geologic zones
32. **Barbara Wilson**
    Lomatium – A treasure trove of undescribed variation
33. **Michael Kauffmann**
    Status and distribution of yellow-cedar (Callitropsis nootkatensis) in the Klamath Mountains

2:40 – 3:00 p.m. **Break**

Session 9: Now the Good News

3:00 – 4:20 p.m.

Session Chair: Daria Snider, Madrone Ecological Consulting

34. **Alison Stanton**
    The story of the Pine Hill Preserve: Conservation successes old and new
35. **Geri Hulse-Stephens**
    Pleuropogon hooverianus relocation and rehabilitation: The Willits Bypass meets a rare grass
36. **Renee Pasquinelli and Peter Warner**
    Liberating form and function: Rehabilitation of a Coastal Dune Ecosystem
37. **Carol Witham**
    Introduction and reintroduction as an aid to species recovery

Closing Remarks

4:20 – 4:30 p.m.

Linnea Hanson, President, Northern California Botanists

5:00 p.m. **Optional – Tour of the Chico State Herbarium**

Meet Lawrence Janeway outside of the Bell Memorial Union Auditorium to walk across campus

OPTIONAL LUNCHTIME DISCUSSIONS

There will be an option for ordering a boxed lunch from the Cafeteria each day. A menu will be on the table each morning. If you choose to order a lunch, these must be turned in by the end of the morning break. Lunches will be delivered. Please join us!

MONDAY 12:15 – 1:15 P.M.

two concurrent discussions

1) **Budding Botanists**
Discussion Chair: Jane Van Susteren, California Department of Water Resources
Location: Bell Memorial Union Auditorium

Join us for the popular Northern California Botanists' Budding Botanists Career Lunch Discussion. Eat your lunch, meet people, and learn about careers in botany! Professionals, you will find your next job applicant here – send us your job announcement and come have lunch. Our panel of early career botanists will discuss how they got their jobs, what they do, basic salary and resources to know, and one piece of advice they want you to know. We will take all your questions and have resources to share. To join the Northern California Botanists' Budding Botanists Program, subscribe to the listserv, ask career questions, or volunteer to answer career questions as an experienced botanist and mentor. For more information please contact buddingbotanists@norcalbotanists.org.

2) **Consortium of California Herbaria** – in the Bell Memorial Union second floor Mezzanine
Discussion Chairs: Jenn Yost, Cal Poly, San Luis Obispo, and Jason Alexander, Staci Markos, and Brent Mishler, University of California, Berkeley
Location: Bell Memorial Union second floor mezzanine

Join us for a lunchtime discussion about the Consortium of California Herbaria. Please bring your questions about the current NSF funded project (California Phenology Thematic Collections Network), the new CCH2 (a Symbiota portal), and anything else you'd like to discuss.

About the Consortium: http://ucjeps.berkeley.edu/consortium/about.html
About the California Phenology TCN: https://www.capturingcaliforniasflowers.org/

TUESDAY 11:45 – 1:45 P.M.

one discussion

1) **California Biodiversity Initiative** – in the Bell Memorial Union Auditorium
Discussion Chairs: Todd Keeler-Wolf, California Department of Fish and Wildlife, and Genevieve Walden, California Department of Food and Agriculture
Location: Bell Memorial Union Auditorium

California Governor Brown's Executive Order (CA EO B-54-18) directs the Department of Food and Agriculture and the Department of Fish and Wildlife to work together to safeguard

existing plants and ecosystems while restoring and protecting habitat across both working and wild places. The enacted 2018-19 state budget allocated $2.5 million to launch the California Biodiversity Initiative in partnership with tribal groups, educators, and researchers, the private sector, philanthropic groups, and landowners. The steps outlined in the executive order and complementary California Biodiversity Initiative will improve understanding of the state's biological richness and identify actions to preserve, manage, and restore ecosystems to protect the state's biodiversity from current and future challenges of climate change.

Please join us for a discussion on this exciting and unprecedented California Biodiversity Initiative. We will outline issues and opportunities needed to make progress on inventory, education, and general advancement of biodiversity knowledge for California. Ideally, we hope to come out of this discussion with shared resources and concrete ideas to increase our effectiveness and have an overall strategy of cooperation.

For more information about the Governor's Biodiversity Initiative, please see Executive Order B-54-18 and the California Biodiversity Initiative https://www.gov.ca.gov/2018/09/07/governor-brown-takes-action-to-protect-californias-plants-animals-and-unique-biodiversity/
For questions please contact genevieve.walden@cdfa.ca.gov.

POST-SYMPOSIUM WORKSHOPS

WEDNESDAY, 16 JANUARY 2019

Workshop 1: Collecting and Preserving Herbarium Specimens

9:00 a.m. – 1:00 p.m. Chico State Campus, Holt Hall, Room 129 (the Chico State Herbarium)
Instructors: **Jane Van Susteren**, Environmental Scientist, Calif. Dept. of Water Resources
Genevieve Walden, Senior Plant Taxonomist, Calif. Dept. of Food and Agriculture

Document your discoveries! Deposit your vouchers with herbaria!

Herbarium collections are evidence of what you observe in the field. Collecting plants and making herbarium specimens is a skill you should be able to access when you need it. If you are ever required to make herbarium specimens as part of a contract, have taxonomically complex taxa you want to unravel, are undertaking a botanical or ecological study that involves defined plant species, or might find an exciting range extension of a rare plant or a depressing range extension of an invasive weed, you should be comfortable collecting and processing plant specimens.

In this workshop, you will learn to make herbarium specimens. You'll learn the appropriate and ethical collection of plants, how to collect and record additional morphological information for future identification, how to make an accurate and useful label, and how to deposit specimens with a partner herbarium. There will be a short field component where we will collect plants to press and process later in the day.

Whether you've never collected plants, mounted herbarium specimens before, or are looking to refine your skills, come join us!

Workshop 2: New Calflora Tools for California Botanists and Plant Enthusiasts

8:30 a.m. – 3:30 p.m. Bell Memorial Union, second floor Room 203
Instructor: **Cynthia Powell**, Executive Director of Calflora

This course will be a combination of lecture and field exercises on new Calflora tools. We will go over how we crosswalk old and new scientific plant names, Calflora taxon pages, importing, exporting, and using Calflora wild plant data. We will discuss applications for collecting data in the field using Calflora apps, creating history stacks to track changes over time, and mapping. Much of the class will take place in the meeting room at CSUC, and the hike will take place right out the door.

Workshop materials are useful for professional and student botanists, ecologists, Calflora Professional Users, land and resource managers, restoration volunteers, plant enthusiasts, and conservationists.

Participants will learn
• Applications of Calflora in the field and at work
• How Calflora data can be used for rare plant and mapping projects
• How to collect rare and non-rare plant data using Calflora tools
• How to document data using customized forms and offline map caches
• How vegetation types and attributes can be mapped

Important note: Participants should be physically able to hike for 1-2 hours. This workshop will be held rain or shine. Please contact Cynthia Powell at cpowell@calflora.org with any questions.

ABSTRACTS OF TALKS

Abstracts are in chronological order; index to authors is on page 37
See also the List of Common Acronyms on page 36

1. HANSON, L.
2837 Mariposa Avenue, Chico, CA 95973. linneachanson@gmail.com

Welcome to our Ninth Northern California Botanists Symposium

I'd like to welcome all of you to our ninth symposium, *Research and Conservation of Northern California's Vegetation Communities*. We hope you will enjoy the program that we have organized for you this year with great speakers and posters. Our keynote speaker, Todd Keeler-Wolf, will address *Becoming a Naturalist and Ecologist in Northern California*. We have three lunchtime discussions planned, on Monday for Budding Botanists and for the Consortium of California Herbaria and on Tuesday for the California Biodiversity Initiative. We plan to have seven lightning talks Monday afternoon before our reception. 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. We will again have the poster session on Tuesday morning to provide ample time to view the many varied posters that have been submitted. 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. SHOLARS, T.A.[1] and J.I. GARRISON[2]
[1]Professor Emeritus, P.O. Box 2340, Mendocino, CA 95460. tsholars@mendocino.edu
[2]Senior Environmental Scientist, 32330 North Harbor Drive, Fort Bragg, CA 95437
Jennifer.Garrison@wildlife.ca.gov

Using Vegetation Classification and Mapping to Demystify and Protect the Pygmy Forest Ecosystem of Mendocino and Sonoma Counties

An ambiguous definition of "pygmy forest" has hampered effective protection of the rare species and vegetation that comprise the unique ecosystem of the Mendocino Cypress Woodland and associated vegetation types. This is further complicated by only some of the forest types being short in stature. We present results from four years of classification and mapping vegetation on oligotrophic soils: six new rare associations within four alliances. The new associations are: 1. *Hesperocyparis pygmaea - Pinus contorta* var. *bolanderi / Rhododendron columbianum.* 2. *Hesperocyparis pygmaea - Pinus contorta* ssp. *bolanderi - Pinus muricata / Rhododendron macrophyllum.* 3. *Hesperocyparis pygmaea - Pinus muricata / Arctostaphylos nummularia* in the *Hesperocyparis pygmaea* Alliance (G1/S1). 4. *Pinus muricata - Chrysolepis chrysophylla / Arctostaphylos nummularia* (G2/S2) in the *Pinus muricata - Pinus radiata* Alliance. 5. *Chrysolepis chrysophylla / Vaccinium ovatum* (G2/S2) in the *Chrysolepis chrysophylla* Alliance. 6. *Arctostaphylos nummularia* (G2/S2) in the *Arctostaphylos (nummularia, sensitiva)* Alliance. In addition, two provisional associations were described and ranked**:** *Pinus muricata - Notholithocarpus densiflorus* (G3/S3) and *Sequoia sempervirens - Hesperocyparis pygmaea* (G1/S1). Sensitive natural communities are protected under CEQA. However, the greatest threat to them in Mendocino County is development not subject to CEQA, activities not regulated by local ordinances, or those that occur outside the coastal zone. We present the next steps for protection including development of a Conceptual Area Protection Plan and working with the County to develop standards and ordinances for the protection of sensitive natural communities.

3. HICKSON, D.E.[1] and J.M. EVENS[2]

[1]Vegetation Classification and Mapping Program, California Department of Fish and Wildlife, P.O. Box 944209, Sacramento, CA 94244-2090. diana.hickson@wildlife.ca.gov

[2]Vegetation Program, California Native Plant Society, 2707 K Street, Suite 1, Sacramento, CA 95816-5130. jevens@cnps.org

Vegetation in Environmental Review

We present an overview of laws and regulations that address rare vegetation in the environmental review process. This includes the use of combining districts to increase zoning in a specific area and enforceable policies in General Plans. Information and tools provided on the CNPS and CDFW websites include vegetation maps in the BIOS map viewer, reports in CDFW's Document Library, descriptions in the Manual of California Vegetation Online, and sample comment letters. We provide updates from our two programs including guidance on considering rare communities in as-yet unclassified and unmapped areas of the state, how vegetation types are ranked for rarity, and how Element occurrences of natural communities in the California Natural Diversity Database will be migrated to a separate layer on BIOS.

4. TUKMAN, M.L.

Tukman Geospatial LLC, 1955 Cleveland Avenue, Santa Rosa, CA 95401. mark@tukmangeospatial.net

A Living Map for a Changing Landscape – Fine-scale Vegetation and Habitat Mapping in Sonoma County, California

A recently completed fine-scale vegetation map for Sonoma County showcases many of the most recent advances in landscape and habitat assessment. Based on high resolution imagery and LiDAR data, the vegetation map was created using automated image classification, machine learning, traditional photography, and field work. The project was funded by a consortium led by Sonoma County's Agriculture and Open Space District, and the Sonoma County Water Agency. The mapping classification was adapted from a classification developed by CDFW VegCAMP and based on a field campaign led by CDFW. Trimble eCognition was used to develop a mostly automated lifeform map with broad floristic classes. Lifeform mapping was followed by machine learning, which used field validated stand data and a stack of predictor variables to produce map class predictions (generally at the alliance level) for each map polygon. Map labels were reviewed and edited by photointerpreters and field workers. Accuracy assessment was conducted using a combination of Fish and Wildlife/CNPS rapid assessment plots and accuracy assessment plots. The mapping classification, map specifications, and methods were informed by the needs of the County and the guidance of two advisory committees. The recently completed accuracy assessment supports the validity of the process. The map has a myriad of users, including the conservation community, water managers, planners, and others. The county is now in the process of developing protocols for map updates and map improvements.

5. SLATON, M.

USDA Forest Service, Pacific Southwest Region Remote Sensing Lab; 351 Pacu Lane, Suite 200, Bishop, CA 93514. mslaton02@fs.fed.us

Long-Term Monitoring and Change Detection in California's Common and Rare Forests

California forests are experiencing exceptional rates of change in structure and function. Monitoring has traditionally relied upon airborne campaigns and limited site inspection to assess forest disturbances such as fire, harvest, disease, and drought. The increased pace of changes in forests over recent years requires novel and creative approaches to monitor these rapid changes, and allow managers and communities to prepare for, and adjust and react to changing conditions. I describe the capability of remote sensing systems to monitor northern California's forested ecosystems. Ponderosa pine and mixed conifer ecosystems serve as a case study in the human-wildland interface, where historic and current land management practices have largely shaped the landscape. A second case study is presented for high elevation ecosystems dominated by the at-risk species whitebark pine (*Pinus albicaulis*), where a combination of disturbance agents, ranging from white pine blister rust (*Cronartium ribicola*), mountain pine beetle (*Dendroctonus ponderosae*), drought, and changing fire regimes are re-shaping the landscape.

6. COLWELL, A.E.L.
Research Associate, University and Jepson Herbaria, 1001 Valley Life Sciences Building, Berkeley, CA 94720. aelcolwell@gmail.com

The Cultural Significance of Herbaria, Past and Present

The term herbarium appears to come down to us from the ancient Latin *herbarii*, referring to the herb-dealers whose business it was to know the properties of plants and the differences between them. The following millennia saw the elaboration of living collections of the "physic garden" used to train physicians, with the illustrated herbal following close behind the invention of printing, and the concept of preserving the original plant itself, attached to paper, appearing in multiple countries when mass-production of paper made such use feasible. Originally dried specimens were bound into books, but Carl Linnaeus, whose ambitions outstripped the capacity of the book-binders, championed the practice of mounting specimens on unbound sheets. Herbaria as we know them today subsequently burgeoned worldwide, in tandem with exploration, comparative biology and taxonomy, and today 3,000 institutions around the world preserve some 380 million plant specimens. Of these, 109 California herbaria are listed in *Index Herbariorum*, holding several million specimens, and offering diverse resources near to all of us. Today's uses of herbarium specimens facilitate studies never dreamed of by early pressers-of-plants, and increasingly herbaria are becoming the guardians of our plant biodiversity knowledge as it ebbs away in nature. The herbarium has proven over centuries to be the ultimate reference library for this task, but we must contribute to the effort. Peter Raven famously said "a record without a voucher remains a rumor," and we are in peril of constructing the corollary axiom: a herbarium without users and supporters becomes a memory.

7. BUCKLEY, S.
Lassen Volcanic National Park, National Park Service, 38050 Hwy 36 East, Mineral, CA 96063 steve_buckley@nps.gov

Using Symbiota to Manage Biodiversity Information for Conservation

Bioinformatics technologies such as Symbiota have made herbarium data more accessible to both end-user scientists and land managers. Prior to digitization and the development of systems such as Symbiota, collections data was literally locked up in cabinets. Accessible herbarium records have reshaped how land managers are interacting with and using collections data. The increasing accessibility of collections data has also led to an emerging paradigm of one-stop floristic information systems that seamlessly connect the public and research community. Symbiota provides a platform for managing checklists and floras digitally that connects hundreds of herbaria and collections with species-level descriptions, distribution information, and a wealth of other data. The Public Lands Flora (www.symbiota.org/nps) is a pilot project to develop a floristic data management system for collections information on all public lands in the United States. This pilot has been funded by the National Park Service, the Fish and Wildlife Service, and the Bureau of Land Management. The use of such bioinformatics system can help land managers better understand the biodiversity they are tasked with stewarding. Systems such as the Public Lands Flora increase the value of herbarium collections data by providing ways to better organize, visualize, and utilize the data for management decision-making.

8. LINDSTRAND III, L.
Sierra Pacific Industries, 19794 Riverside Avenue, Anderson, CA 96007. llindstrand@spi-ind.com

Establishing and Digitizing "Small" Herbaria

Small herbaria are important information sources for understanding North America's plant diversity. These small collections are typically regional in scope and provide valuable local ecological, taxonomic, and geographic information. Many often hold specimens unduplicated in larger herbaria and often represent intense samplings of local ecological communities; making these small herbaria important to the study of regionally and nationally significant natural communities. Access to small herbaria may be difficult given travel requirements, coordinating appointments with herbaria "staff," and logistics associated with specimen loans. With the arrival of collections digitization, small herbaria are now able to provide data and specimen images and make them available online through searchable electronic databases to increase collaboration among institutions and working professionals. Establishing a small herbarium is sim-

ple; following standard field collection, pressing, mounting, and labeling, follow a few more steps and accession your specimen collections digitally in the North American Network of Small Herbaria (NANSH). I'll describe the process from registering your small herbaria, bar coding collections, organizing and preparing label data, photographing specimens, and finally uploading the information into NANSH where your collection becomes part of a searchable online electronic database. This relatively new ability to digitize small collections and facilitate collaboration assists our work and motivates staff to collect more specimens during field surveys throughout our California ownership. It's easier than you might expect, simple to curate from your desktop, professionally engaging, and beneficial for the botany community.

9. ALEXANDER, J.

University and Jepson Herbaria, University of California, 1001 Valley Life Sciences Building #2465, Berkeley, CA 94720-2465. jason_alexander@berkeley.edu

Upcoming Changes in the Consortium of California Herbaria

Since its inception in 2003, the Consortium of California Herbaria (CCH) has grown significantly and now contains over 2.2 million specimen records from over 36 institutions. The CCH began as a data aggregator for California vascular plant specimen data and that remains its primary purpose to date. Responding to requests from participants to display specimen data from all groups of plants and fungi, from all locations (including those outside California), we have developed a new Symbiota portal (CCH2). There are now two CCH portals and each has a special purpose. CCH1 is a specialized portal for presenting highly curated specimen data about the California vascular flora, tightly linked to *Jepson eFlora*. It is restricted to vascular plant specimens of native and naturalized taxa from California. This portal will include California specimen records from many sources worldwide. The Index of California Plants Names (ICPN) will continue to be developed and will be used for both the *Jepson eFlora* and CCH1. CCH2 will be a general Symbiota portal and serve all specimen data from all participating CCH members. It will be worldwide in scope and have a broad taxonomic coverage of land plants, algae, lichens, and fungi. Unlike the original CCH database, some members will use CCH2 for data entry and collections management directly. In the next 4 years, CCH2 will add nearly a million images of specimens from California Herbaria. People interested in the out-of-state holdings of vascular plants in California herbaria will find this portal to be another useful resource. Additionally, the portal will capture phenological data: information about the timing of, e.g., flowering or fruiting.

10. VAN MANTGEM, P.J.

U.S. Geological Survey, Western Ecological Research Center, Redwood Field Station, 1655 Heindon Road, Arcata, CA 95521. pvanmantgem@usgs.gov

Fighting Drought with Fire: Can Managers Increase Forest Resistance to Drought Using Prescribed Fire?

Prescribed fire is a primary tool used to restore southwestern forests following more than a century of fire exclusion. Prescribed fire reduces fire risk partly by removing small trees, shrubs, and surface fuels; it is also assumed that following fire there is less competition for water, nutrients and light, so that remaining trees are more resistant (more likely to survive) in the face of additional stressors, such as drought. I present several studies, including studies conducted in the Sierra Nevada and southern Cascades of California, demonstrating that there is empirical support for this idea. However, resistance to drought may depend on drought severity and the measure of drought response that is used.

11. JAMES, C., D.W. TAYLOR, and B. KRUMLAND

Sierra Pacific Industries, 19794 Riverside Avenue, Anderson, CA 96007. cjames@spi-ind.com

Post-fire Changes in Riparian Tree Species with the Ponderosa, Rim, and King Fires

Riparian tree inventories were conducted along Class I (= perennially flowing) streams after the Ponderosa, Rim and King Fires in montane northerly California. Our inventories were intended to characterize the extent of fire impacts and recovery on riparian tree mortality and post-fire sprouting. We found differences at two-years post fire in mortality, regeneration, and species mix. These results indicated that the species composition and distribution following these fires had changed and recovery in these riparian eco-

systems would mean a different composition of species following these fires. We found indicators that *Alnus rhombifolia*, an important riparian forest dominant, decreased substantially in some fluvial settings within the study watersheds.

12. BARTOSH, H. and B. PETERSON
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Five Years of Post-fire Research in North and Central Coast Range Chaparral: Lessons Learned and Future Goals

Elusive and fleeting, post-fire flora in chaparral has long captured the interest of botanists and ecologists alike. Attention however has largely been focused on post-fire floras within the massive tracts of chaparral found in southern Californian climates. In contrast, few research projects investigate this flora in central and northern California chaparral. In this presentation, we highlight some results from six post-fire research projects in four locations throughout the Central and North Coast Ranges. These include Mount Diablo's 2013 Morgan Fire, Carnegie State Vehicular Recreation Area's 2015 Tesla Fire, Berryessa-Snow Mountain National Monument's 2015 Jerusalem and Rocky fires, and Sonoma's 2017 Tubbs and Nunn fires. Each of these projects has provided unique insight into local post-fire floras and ecology as well as broader drivers of diversity including fire severity, patch size and soils. This is an ongoing research project aimed at providing baseline post-fire floristic data at a regional level, as well as giving shape to local and landscape level ecological dynamics throughout central and northern California.

13. HALBUR, M., T. COMENDANT, M. GILLOGLY, R. FERRELL, and L. MICHELI
Dwight Center for Conservation Science at Pepperwood, 2130 Pepperwood Preserve Road, Santa Rosa, CA 95405. mhalbur@pepperwoodpreserve.org

Emerging From the Ashes: How Fire-shaped Communities are Responding to the 2017 Tubbs Fire in Sonoma County, California

Pepperwood serves as an integrated climate-ecosystem field station for California's Coast Ranges and facilitates productive exchanges between scientists and land managers. Prior to the 2017 Tubbs Fire, which burned over 90% of the 3,200-acre preserve, Pepperwood had been collecting weather, hydrology, and biological data via a Sentinel Site monitoring framework for nearly a decade. As climate change pushes us towards a more fire-prone future, the time is now to take a multi-disciplinary approach to collect the data our community needs in order to understand the local drivers of fire, to monitor landscape recovery, and to support resilient forest management and rebuilding strategies. In addition to coordinating assessments of recent fire impacts, we are translating the growing information base to help identify management needs and prioritize climate-smart adaptive management actions with public and private partners. This presentation will provide a high-level overview of pre- and post-fire ecosystem indicators, highlight post-fire botanical observations including 12 new plant species to the preserve, and describe how these findings are informing resilience strategies at scales ranging from the parcel to the region as a whole.

14. KIERSTEAD, J.A.[1] and T.A. SHOLARS[2]
[1]Shasta-Trinity National Forest, 3644 Avtech Parkway, Redding, CA 96002. jknelson@fs.fed.us
[2]Mendocino College Coast Center, 1211 Del Mar Drive, Fort Bragg, CA 95437. tsholars@mendocino.edu

Practical Guidelines for Detecting and Conserving Cryptic Species

As molecular analysis of plant samples becomes more commonplace, more systematic treatments of plants are relying on these characters as a predominant line of evidence, even when other lines of evidence such as morphological characters and habitat preferences are contradictory or missing. We present suggested guidelines for publishing new names or resurrecting older names for cryptic taxa, especially those that may need protection as rare plants. Guidelines include: 1. Before publishing a cryptic taxon, contact agency or other knowledgeable field botanists, who can help find your research subject in the field. 2. Discuss the proposed cryptic taxon with most current authority(ies) on the species complex of the group. 3. Make a good faith effort to identify plant and/or habitat characters that distinguish cryptic taxa

from related taxa. 4. Document enough populations to determine whether the taxon is sympatric with its look-alike relatives. 5. Submit good herbarium vouchers to participating institutions in the Consortium of California Herbaria, with complete label data. 6. Take photos of your cryptic taxa and their habitats, at multiple points in their life cycles. 7. If a cryptic taxon has no apparent morphological traits that differentiate it from other similar taxa, make best attempts to co-author with a taxonomist that can do a morphometric analysis. 8. Review and compare similar taxa from multiple herbaria, including herbaria within the region where most similar taxa occur, and provide appendix in manuscript listing all voucher specimens examined.

15. SCHULTHEIS, L.M.
Foothill College, 12345 El Monte Road, Los Altos Hills, CA 94022. schultheislisa@foothill.edu

Morphologically Cryptic Species in *Downingia* (Campanulaceae)

Downingia (Campanulaceae) is a genus of 15 species distributed primarily in vernal pool habitats of western North America. The genus contains an interesting example of morphologically cryptic species within what has long been known as *D. yina*, but is now split into *D. yina, D. willamettensis,* and *D. pulcherrima*. This cryptic variation was hinted at in the early taxonomic history of the group. Despite an inability to consistently distinguish these species morphologically, several lines of evidence support their recognition. Molecular evidence suggests three main clades within this complex, corresponding more with cytological variation than with morphological variation. Additionally, the molecular evidence suggests a phylogeographic pattern where members of the clade characterized by chromosome counts of n = 6, 8, and 10 are distributed primarily to the west of the Cascades while members of the clade characterized by n = 12 are distributed primarily to the east. A third clade characterized by n = 10 is localized to the Cascades of southern Oregon. This talk will examine the evidence from molecular, cytological, interfertility and phylogeographic data used to redefine these species limits, and the relationships of these species to *D. elegans* and *D. bacigalupii.*

16. JACOBS, S.J.[1], S. HERZOG[2], and D.C. TANK[3]
[1]Department of Ecology and Evolutionary Biology, University of California, Los Angeles, 621 Charles E. Young Drive South, Los Angeles, CA 90095. sarahjjacobs@gmail.com
[2]Natural Resource Management, South Dakota State University, 1175 Medary Avenue, Brookings, SD 57006. herz6627@gmail.com
[3]Department of Biological Sciences and Stillinger Herbarium, University of Idaho, 875 Perimeter Drive, MS 3051, Moscow, ID 83843. dtank@uidaho.edu

The Challenge of Defining Species in Young Lineages: A Case Study in the *Castilleja pilosa* Species Complex

Because species are the integral unit of much of the biological sciences, and an important unit in conservation, the way that we define species can have great impact. In young, rapid radiations of plants, identifying species can be challenging because diagnostic characters (morphological, ecological, molecular traits) may reflect different, sometimes conflicting species boundaries. But it is often in rapid radiations that we are especially interested in identifying species—rapid radiations can have high levels of both cryptic species and endemism, scenarios typically of high conservation priority. The plant genus *Castilleja* (Orobanchaceae) is a recent and rapid radiation in the North American West. Evidenced by its notoriously difficult taxonomy, the genus contains numerous species complexes where the boundaries between species are unclear. For example, the *Castilleja pilosa* species complex is centered around two species and four named varieties (one, a highly localized endemic and potentially of conservation concern) that are extremely difficult to diagnose, particularly when in sympatry. Detailed morphological studies indicate little distinction, while preliminary molecular evidence suggests limited gene flow between some populations. Molecular delimitations are currently hampered, however, by the challenge of discerning incomplete lineage sorting from contemporary gene flow, both evolutionary processes that can confuse the interpretation of molecular signal. The challenge of defining species in this complex (a process that remains ongoing) exemplifies the difficulties faced when working in young lineages; however, it also highlights the opportunities they provide to characterize the early stages of speciation and consider how best to define species in these cases.

17. MISHLER, B.
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Biodiversity Assessment and Conservation Without Species

Biodiversity has usually been measured by examining changes in the number of species across a region to identify areas of particularly high species diversity and endemism. Beta-diversity is likewise typically measured by comparing proportions of species shared among subareas. However, the species rank is at best an arbitrary level in the tree of life, and investigations based on species alone miss the full richness of analyses that can result from taking a phylogenetic approach. Advances in digitization of natural history collections, broad-scale DNA sequencing of many taxa represented in public databases, and scaling-up of methods for building phylogenies have made it possible to apply a phylogenetic approach to assessment of biodiversity and endemism that can be termed "spatial phylogenetics." Our research group is applying a novel suite of tools including two new metrics, Relative Phylogenetic Diversity (RPD) and Relative Phylogenetic Endemism (RPE), and new methods called Categorical Analysis of Neo- And Paleo-Endemism (CANAPE), and phylogenetic range-weighted turnover (PhyloRWT). Hotspots of diversity and endemism can be mapped, their make-up assessed, and similarities and differences among them characterized, leading to insights into ecological, evolutionary, and biogeographic processes that have shaped these patterns. Understanding such patterns of biodiversity on the landscape is also important for conservation planning, given the need to prioritize efforts in the face of rapid habitat loss and human-induced climate change. I will present a newly published phylogenetic gap analysis for California that identifies complementary areas of biodiversity that have unique evolutionary histories of highest priority for conservation.

*****Numbers 18 through 24 are Lightning Talks*****

18. GLUESENKAMP, D.
California Native Plant Society. dgluesenkamp@cnps.org

California's Biodiversity Action Plan: Our Role in the Initiative

19. KANIM, N.
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Yreka Phlox Recovery: How Close Are We?

20. CANTER, A.
Wiyot Tribe. adam@wiyot.us

Expansion of Hazelnut Scrub into Humboldt and Mendocino Counties

21. BOVEE, K.
Lassen National Forest. kirstenbovee@fs.fed.us

Collaborative Study of Rare *Penstemon personatus*

22. THOMS, R.
Stillwater Sciences. rthoms@stillwatersci.com

Remote Sensing Capabilities for Vegetation Mapping

23. PATTERSON, M.
U.S. Forest Service. marypatterson@fs.fed.us

OHV Impacts on Hutchison's Lewisia (*Lewisia kelloggii* ssp. *hutchisonii*)

24. **FRAGA, N.**
Rancho Santa Ana Botanic Garden and California Plant Rescue. nfraga@rsabg.org

Seed Banking the California Flora

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25. **KEELER-WOLF, T.**
Vegetation Classification and Mapping Program, Biogeographic Data Branch, California Department of Fish and Wildlife, P.O. Box 944209, Sacramento, CA 94244-2090. Todd.keeler-wolf@wildlife.ca.gov

Becoming a Naturalist and Ecologist in Northern California

This homage to growing up as an interpreter of nature in Northern California emphasizes the importance of revisiting familiar landscapes to build an ecological understanding of species and natural communities. I discuss several Northern California landscapes that have profoundly influenced my evolution of interests and pursuits in a career centered on describing regional and local ecological patterns and processes. These include the eastern Klamath Mountains, Modoc Plateau, Oakland-Berkeley Hills, and the Central Sierra Nevada. Retrospectively, my ability to incorporate what I have learned into what my colleagues and I have been able to accomplish has much to do with building a sensibility through broadening experiences, arriving at an "ecological aesthetic." As with the development of any sense of aesthetics, a multitude of factors such as personal interest, past experience, prior knowledge, and cultural biases are influential. Developing an aesthetic for ecological system function includes an appreciation for the processes that have produced biological diversity, interdependence, and stability within the realm of environmental possibility. An ecological aesthetic grows and improves with training, and breadth of experience. In this case, the aesthetic is tested and improved upon using the scientific process. I argue that it is important to trust the synthetic abilities of the human brain to incorporate the multi-temporal and multi-variate characteristics of ecology to arrive at an aesthetic not easily replaced by technological or ideological shortcuts.

26. **BURTON, C.**
Native Plant Program, California Department of Fish and Wildlife, P.O. Box 944209, Sacramento, CA 94244-2090. cherilyn.burton@wildlife.ca.gov

The Role of the California Department of Fish and Wildlife in Native Plant Conservation

The California Department of Fish and Wildlife (CDFW) works to support native plant conservation by mapping natural communities, tracking the locations of rare plant populations, implementing the California Endangered Species Act (CESA), and through other regulatory responsibilities. CDFW regional offices cover specific geographic regions of California. Staff in these regional offices are responsible for a variety of tasks including land management, enforcement, conservation planning, and environmental review and permitting. Three main programs at CDFW's headquarters focus on conserving native plants: the Vegetation Classification and Mapping Program (VegCAMP), the California Natural Diversity Database (CNDDB), and the Native Plant Program. VegCAMP develops, maintains, and implements a standardized vegetation classification and mapping system in California. The CNDDB is part of a nationwide network of programs that tracks the status and locations of plants, animals, and natural communities of conservation concern throughout California. The Native Plant Program conducts CESA status reviews, issues permits to take state-listed plants for scientific, educational, or management purposes, and monitors state-listed plant populations. Although a permit is required to take or possess state-listed plants, CDFW's Native Plant Program encourages research and conservation of state-listed plants and works to facilitate CESA permitting for all projects that will benefit native plants.

27. SIMS, A.
California Native Plant Society, 2707 K Street, Suite 1, Sacramento, CA 95816. asims@cnps.org

Tracking and Assessing the Conservation Status of California's Rare Flora and Upholding Environmental Policy: How a Time-honored Standard in Rare Plant Assessment Supports Effective Rare Plant Conservation

The California Floristic Province is a biodiversity hotspot, and as such, California holds a large number of native and rare plants, with over 1/3 of the entire state's native flora (2,300+ taxa) currently considered rare, threatened, or endangered. Such a high amount of diversity makes ranking and conserving the state's rare flora a remarkable undertaking, and with human population, development, climate change, and other significant threats on the rise, the need to conserve California's unique flora is ever growing. California Rare Plant Ranks developed and assigned by the California Native Plant Society and California Natural Diversity Database identify and prioritize rare plants for effective, science-based conservation through the use of environmental policy such as CEQA and NEPA. Tracking and assessing the state's rare flora, while ensuring that environmental policy is upheld, is a remarkable undertaking that cannot be done effectively without the help and assistance of the botanical community as a whole.

28. LEPPIG, G.
California Department of Fish and Wildlife, Coastal Conservation Planning, 619 Second Street, Eureka, CA 9550. Gordon.Leppig@wildlife.ca.gov

Conservation Botany from 30,000 feet: An Ecosystem-based Approach to Riparian Restoration, Keeping Common Species Common, and Recovering Rare Ones

We present a constellation of integrated strategies the California Department of Fish and Wildlife is deploying to restore extensive riparian habitat along the lower Mad and Eel Rivers in coastal Humboldt County. California and the North Coast have lost approximately 80-90% of their riparian habitat in the last 150 years. Numerous State policies and initiatives promote riparian habitat restoration and there are State grants for restoration planning, permitting, and implementation. Despite State and local support, large-scale riparian restoration is hampered by existing agricultural and commercial uses in former riparian habitat; multiple ownerships; floodplains disconnected by levees; technical, regulatory, and permitting complexity; and the lack of a shared community vision with integrated objectives. Using an ecosystem-based approach, and focusing on ecological processes, CDFW is working with willing land owners, community groups, and local, state, and federal agencies to potentially restore over 5,000 acres of riparian habitat in these lower river systems. To accomplish this, we are using opportunistic and systematic strategies that: 1) optimize environmental settlement and violation funds, 2) focus quasi-advanced mitigations, 3) improve in-stream gravel mining techniques, 4) modify management objectives on our Wildlife Areas, 5) promote climate change adaptations that enhance public health and safety, and 6) pursue land acquisition and conservation easements.

29. BYRNE, K.M.[1] and A.A. DICKINSON[2]
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[2]Graduate Student, Natural Resources Graduate Program, Humboldt State University, 1 Harpst Avenue, Arcata, CA 95521. aad72@humboldt.edu

Restoring a Population of Applegate's Milkvetch (*Astragalus applegatei*): Lessons Learned for Conservation

The genus *Astragalus* is the largest flowering plant genus within the Fabaceae (legume family), with over 3,200 described species worldwide. Given the large number of species and relatively large geographic extent of the genus worldwide, there are many endangered and geographically restricted taxa within the genus. For example, there are over 150 described taxa within the state of California; and nearly half of those taxa are considered rare. Despite the large number of rare taxa within the genus worldwide, the factors limiting reproductive success of *Astragalus* species is understudied. Basic knowledge of the reproductive biology and factors limiting survival and recruitment of rare *Astragalus* taxa is needed so that scientists and land managers can use this information to help create conservation plans for other rare species for

which it is impossible to gather life history information without further threatening the species. Here, we present the conservation story of Applegate's milkvetch (*Astragalus applegatei*), a rare endemic species of the Klamath Basin in southern Oregon. Although this species is not found within the state of California, the challenges of restoring a population of this federally endangered species will be useful to scientists and land managers that work with rare taxa within the large and diverse genus *Astragalus*.

30. YORK, D.
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Castle Crags Sedge, a Rare Plant Hiding in Plain Sight

Castle Crags Sedge (*Carex yorkii* sp. nov.) was originally discovered and collected by the author (*York 3192*), in June of 2013, while rock climbing with Reid Whittlesey (Humboldt State University botany student working on his senior project) on the Shasta County portion of Castle Crags in Castle Crags Wilderness (Shasta-Trinity National Forests). After the inability to identify the *Carex* from the 2013 voucher collection, the author had it sent to Chico State University with a batch of sedges from Humboldt State University as part of a request for *Carex* section *Acrocystis* collections. The *York 3192* voucher collection vanished without a trace during or after the transfer of specimens to Chico. In 2015, the author returned to Castle Crags and made more collections, including a voucher to send to the *Carex* Working Group. The *Carex* was determined to be undescribed. The novel sedge was subsequently found growing in crevices and on ledges throughout the Castle Crags granitic monolith, in both Shasta and Siskiyou counties, from 1,220–1,980 m (4,000–6,500 feet) elevation. *Carex yorkii* belongs in section *Acrocystis* which is based on pubescent perigynia, three stigmas, and spikes less than 1.5 cm long. *Carex yorkii* is close to *C. deflexa* var. *boottii*, but *C. yorkii* has no basal spikes, does not form mats, and has narrower, rush-like leaves. Other *Carex* section *Acrocystis* sedges known from California's Klamath Ranges include *C. brainerdii, C. rossii*, and *C. serpenticola*. *Carex yorkii* associates, with California Rare Plant Rank (CRPR) if applicable, include *Campanula shetleri* (1B.3), *Draba howellii* (4.3), *Erigeron miser* (1B.3), *Heuchera merriamii*, *Ivesia longibracteata* (1B.3), *Myopteris gracillima*, *Penstemon newberryi* var. *berryi*, *Picea breweriana*, *Pinus jeffreyi*, *P. monticola*, and *Trisetum canescens*.

31. MASON, K.M.
Carex Working Group, 35510 Pathfinder Road, Mountain Center, CA 92561. quercusboletus@gmail.com

Discoveries in the *Lomatium caruifolium* Complex – Diversity and Patterns of Speciation within Differing Geologic Zones

The *Lomatium caruifolium* complex is a highly diverse subgroup in *Lomatium*, consisting of at least 10 species. The majority of these taxa are endemic to California. Three of the 10 grow in western Oregon with one growing as far north as southwest Washington. While some *Lomatium* species are widespread, many are narrow endemics, as a result of short-distance seed dispersal. When reviewing *Lomatium* for the Flora of North America project, anomalous species from the *L. caruifolium* complex were found within northern California. Most of the species within this group grow on serpentine or ultramafic soils. For example, the recently described *Lomatium kogholiine* is a strict serpentine endemic on Red Mountain of northern Mendocino County. The plants on Red Mountain were previously identified as *Lomatium congdonii, L. tracyi*, and *L. engelmannii*. Examination of morphologic characters and DNA sequences showed that these plants match none of the previous identifications. They are described as a distinct species, *L. kogholiine*. The *L. caruifolium* group is a polyphyletic grouping, consisting of two main lineages. *Lomatium kogholiine, L. congdonii,* and *L. engelmannii* are part of one lineage, characterized by usually lacking bractlets (if present then linear to lanceolate). The other lineage consists of *L. caruifolium, L. marginatum,* and *L. tracyi*, characterized by consistently broad bractlets. In addition to morphologic and genetic differences, each taxon grows on a different type of ultramafic bedrock that formed at a different time and consists of different components.

32. WILSON, B.
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Lomatium – A Treasure Trove of Undescribed Variation

Want to describe unknown species of plants? Unwilling to travel to the forests of Brazil or New Guinea or Borneo? Local herbaria hide unclassified species, some of them in *Lomatium*. *Lomatium* is a diverse genus of carrot-family plants, and not all the variation has been named. I describe some recent discoveries in *Lomatium* and point out current mysteries that invite scrutiny. In addition, traits that help make a genus rich in species; *Lomatium* isn't the only one!

33. KAUFFMANN, M.
Educator, author, and ecologist. P.O. Box 777, Bayside, CA 95549. michaelekauffmann@gmail.com

Status and Distribution of Yellow-cedar (*Callitropsis nootkatensis*) in the Klamath Mountains

Yellow-cedar occupies a wide variety of habitats from Alaska, British Columbia, and south to northern Oregon. The species reaches its southern range extension in California represented by a few small, isolated groves in the Siskiyou Mountains. Here, yellow-cedars explore a unique and highly specific ecological niche. Currently we have identified 12 regions (some quite small in area) between 6,000-7,600 feet in north-facing cirques where the species still persists in California. Beginning in 2017 the CNPS Vegetation Program has worked with the Klamath and Six Rivers National Forests to map and inventory the species in California. The new distributions, understandings, and threats to this species have emerged in our surveys.

34. STANTON, A.E.[1], D.R. AYERS[2], S. BRITTING[3], and G. HINSHAW[4]
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The Story of the Pine Hill Preserve: Conservation Successes Old and New

Located near the center of a gabbro geologic formation in the Sierran foothills east of Sacramento, the Pine Hill region of El Dorado County stands as one of California's remarkable "ecological islands", possessing a rich floristic diversity and a high concentration of rare and endangered plants. An area of approximately 30,000 acres supports over 583 native and 158 introduced plant species and thus, Pine Hill is a true biodiversity hotspot, supporting 10% of the total California flora in 0.05% of the area. In response to rapid and extensive development in the area, the California Native Plant Society (CNPS) was instrumental in protecting Pine Hill itself as early as 1978-79. Local CNPS chapters promoted creation of a preserve beginning in 1990. In 1996, the five rare plant species endemics to Pine Hill were listed as threatened or endangered under ESA, with one other listed as a federal species of concern. The Pine Hill Preserve was formally established in 2001 to protect the suite of eight rare plants and their gabbro soils habitat in western El Dorado County in conjunction with development of a U.S. Fish and Wildlife Service Recovery Plan. A primary goal of the Recovery Plan is the acquisition of gabbro habitat from willing sellers for endangered plant conservation. To date, Federal, State and County agencies, and private non-profit organizations have worked together to acquire, protect and manage more than 4,900 acres within the Pine Hill Preserve. Most recently, the Pine Hill Partners collaborative working group worked with El Dorado County and the private land owners to acquire one of the larger remaining suitable parcels. The 52-acre parcel is contiguous with the existing preserve and supports six of the eight target plant species.

35. HULSE-STEPHENS, G.
Botanical Consultant, 915 East Hill Road, Willits, CA 95490. gerihs79@gmail.com

Pleuropogon hooverianus Relocation and Rehabilitation: The Willits Bypass Meets a Rare Grass

Pleuropogon hooverianus is known to occur in only three counties in Northern California. Results are presented of a three-year habitat study prior to the building of the Willits Bypass, a follow-up study of the impact of the bypass on site hydrology and six years of post-construction monitoring. The project involved relocating over 5,000 *Pleuropogon hooverianus* plants into an establishment area adjacent to the highway footprint and conducting a remedial replanting three years later from seeds collected on site. In addition, four parcels were purchased as part of the mitigation to rehabilitate and enhance native *Pleuropogon hooverianus* stands. Treatments that include woody understory species removal, targeted grazing, and seeding are being used to rehabilitate these stands. Results of these treatments are presented. Mitigation objectives for the establishment area are to achieve a 60% survival. After six years, preliminary findings reveal an 82.8% survival, 4,435 living plants, a combined total of original and remedial plants. In rehabilitation areas, frequency by *Pleuropogon hooverianus* in sampled plots increased by 10% between baseline year 2016 and 2018. Of the 20 new plots established after Year 1 seeding, *Pleuropogon hooverianus* was recorded in 16 plots in Year 2. Results suggest that the opportunity to conduct both a follow-up hydrology study and a remedial planting, along with a ten-year period to study results and adjust management practices are principal factors driving success.

36. PASQUINELLI, R.[1] and P. WARNER[2]
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[2]Consulting Botanist, 5381 Thomas Road, Sebastopol, CA 95472. phytopagan@sonic.net

Liberating Form and Function: Rehabilitation of a Coastal Dune Ecosystem

We report interim monitoring results from a project designed to facilitate ecological recovery of a northern California coastal dune ecosystem. Project objectives included removal of human-effected physical and biotic impediments – a paved road, stream culverts, and invasive plants – from a preserve in the California State Parks system. Long-term goals include the resurrection of ecologically historical physical, chemical, and biological processes, such as those expressed through dune formation, surface hydrology, and biotic diversity. Although requiring additional commitments of human resources, mandated project mitigation activities have augmented the recovery of native plant communities and the rehabilitation of wildlife habitat. We are optimistic that the short-term reconnaissance of several rare plant species provides a harbinger of the dune system's long-term ecological resiliency and integrity. While our meager attempts to promote recovery of ecological form and function at such a limited scale cannot adequately address pandemic global environmental crises, we believe that deliberate attempts to undo past environmental mismanagement – at any scale – are essential to our human ecological existence.

37. WITHAM, C.W.
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Introduction and Reintroduction as an Aid to Species Recovery

Members of the Orcuttieae tribe (Poaceae) are entirely endemic to vernal pools of the California Floristic Province. Both prior and subsequent to their listing under the California and federal Endangered Species Acts in the 1990s, numerous individual populations of these rare grasses have been extirpated through habitat conversion and other factors. As California continues to expand its urban centers and agricultural base, the vernal pool habitat that supports these and other species is becoming highly fragmented thereby reducing the chances of natural (re-)colonization. In 2014 and 2016, Sacramento orcutt grass (*Orcuttia viscida*) was planted into unoccupied suitable habitat within its natural range. These outplantings were intended to compensate for unregulated losses that occurred prior to listing. In 2015, Solano grass (*Tuctoria mucronata*) was replanted into Olcott Lake, its type locality. This population was probably extirpated due to stochastic events following overzealous herbarium specimen collecting. The plantings consisted of simply scattering seed collected from nearby donor sites. Both the donor sites and the newly established populations are being monitored annually for spatial distribution, population size and plant vigor. Since

the initial plantings, the rare grasses have occurred in the recipient vernal pools every year and the new populations appear to be relatively stable. For both species, these recently established populations will serve as a buffer against extinction. This research may also serve to illustrate possible conservation approaches for rare vernal pool plants in the face of both habitat fragmentation and climate change.

ABSTRACTS FOR POSTERS

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1. AGNERAY, A., T. PARCHMAN, and E. LEGER
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Mapping Traits of Three Perennial Grasses in the Northeastern Californian Desert

Identifying appropriate seeds for use in restoration is crucial to halting the spread of destructive annual species in northeastern California and the greater Great Basin Desert, an area spanning five states. Working with three perennial bunchgrasses (*Elymus elymoides, Achnatherum thurberianum,* and *Poa secunda*), we sought to identify the plant traits most associated with survival in a field common garden; determine if these traits were correlated with environmental conditions at the collection site; and predict where these traits occur in California. We collected seeds from 22 populations and established three common gardens in heavily-invaded areas in Nevada, Oregon and California; here we focus on the California garden. We simultaneously conducted a screening of seedling traits in a greenhouse. Using GLM model selection, we determined the traits most associated with field survival and asked whether they were associated with collection site environmental variables. Using the strongest models for each species, we created three maps across the region of important trait distribution and visually compared these areas to established transfer zone maps. We found populations differed significantly in traits, and these differences were correlated with site environmental conditions. For *E. elymoides,* total biomass, timing of emergence, and specific root length were strongly correlated with field survival. Climate and elevation were predictive of the distribution of these plant traits, and our predictive map followed established seed zones, with few exceptions. Furthermore, species from the same source displayed similar characteristics in several critical areas, indicating possible parallel evolution within these grasses of the Great Basin.

2. ALFORD, É.R.
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Mapping Rare Plant Hotspot Clusters in the Nine Bay Area Counties

This rare plant hotspot mapping project was undertaken with the goal to promote further understanding of the rare flora across the California landscape and to help identify important botanical areas for rare taxa. The ultimate goal is to map the state, but the current milestone presented here is mapping of the nine Bay Area counties. Based on a 2016 dataset query on 4,242 records maintained by the state in California Natural Diversity Database (CNDDB), the Bay Area is home to 303 rare plant taxa. The CNDDB records were analyzed in GIS using a clustering approach to identify areas called hotspots, which are places with a minimum defined density of rare plant records. This map shows the results of CNDDB rare plant records clustered as 234 hotspots across the nine counties. In the nine-county area, approximately 70 percent of records (2,994 of 4,242) are located in these hotspot clusters. The clustering analysis contains known extirpated records and thus also provides a historic context for the region. Additional data presented here for each of the nine counties includes the CNDDB record's reported health, the location of the record in relation to potential development risk status as defined by the Bay Area Greenbelt Alliance, and the location of records across the geographic subdivisions in the area.

3. BAMFORD, M.J.[+1] and K. SCHIERENBECK[2]
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Comparing Planting Methods of *Stipa pulchra* (Purple Needlegrass) in Competition with *Centaurea solstitialis* (Yellow Starthistle)

Purple Needlegrass occurs in grassland habitat in the Sacramento Valley and surrounding foothills. Much of this habitat has also been invaded by non-natives such as Yellow Starthistle. Restoration of this habitat will often involve reintroducing native species. This can be a daunting task, and success rates vary. This research examines which method of reintroducing Purple Needlegrass into invaded areas is the most effective. The methods are seeding and planting pre-grown grass plugs. Seeding is much cheaper and less labor intensive, allowing much larger areas to be treated much more affordably. Plugs are more expensive and usually must be done by hand, which can be labor intensive. The field portion of this study comprises an array of 60 small plots at three locations in the Sacramento Valley. The array consists of plantings of both methods over a range of densities. Additionally, another experiment was performed in pots, where Purple Needlegrass and Yellow Starthistle were grown from seed in different mixes showing how the two compete in a more simplified environment. In the potted experiment Yellow Starthistle germinated at much higher rates, and severely limited the biomass of the grass that did germinate. The Yellow Starthistle also germinated significantly earlier, which may have caused some of the effects seen in this experiment. The data from the field experiment is still being analyzed. It is likely some conclusions may be reached before the poster session that could be included later.

4. BOROKINI, T.I.[+] and M.M. PEACOCK
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Seed Germination and Viability Studies on *Ivesia webberi* A. Gray

Ivesia webberi A. Gray is a federally-listed threatened plant species narrowly distributed in northern California and Nevada. Both vegetative and seed regeneration have been observed in the field, but previous efforts to germinate the seeds were unsuccessful. In this study, I subjected 100 seeds each, divided into four replicates, to 34 different treatments based on combinations of chilling at 1˚C, varying photoperiodicity and different chemical treatments of varying concentrations and combinations. Thereafter, the seeds were subjected to moist cold stratified incubation at 5˚C for 16 hours and 1˚C for eight hours daily for 12 weeks. Seeds collected from different populations of varying sizes were also tested for viability. Results show that a mixture of gibberellic acid and potassium nitrate facilitated optimal dormancy release, and gave significantly highest germination. Results also suggest that optimal germination requires light exposure. This suggests that *I. webberi* seeds can be classified as having axile foliar embryos with thin mucilaginous seed coats, based on published seed classifications. This seed classification is new for Rosaceae, as previous studies do not classify Rosaceae seeds in this group. Also, from multiyear studies, population size seems to have little ecological or evolutionary effects on seed viability of *I. webberi*.

5. BOVEE, K.
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Rare Vanilla Grass (*Anthoxanthum nitens*) Expands Following Overstory Removal

Vanilla grass (*Anthoxanthum nitens*) is rare in California (CRPR 2B.3) but has a circumboreal range. Although this species is usually associated with meadow habitats, a two acre occurrence on the Lassen N.F. occurred as scattered patches under dense, even-aged lodgepole pine forest. Historical imagery and coring of lodgepole pine trees suggested that this occurrence was once within meadow habitat. In 2013, lodgepole pine was mechanically treated across half the occurrence, reducing canopy cover from 66% to 4%.

Vanilla grass was resilient to mechanical disturbance, with no significant drop in frequency one year post-treatment. After five years, vanilla grass frequency had doubled in treatment plots. In addition, flowering vanilla grass frequency was strongly correlated with canopy opening. These results suggest that mechanical treatment can be an appropriate tool to restore vanilla grass populations that are encroached by lodgepole pine.

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Can Herbicide Treatments of Cheatgrass Enhance Rare Susanville Beardtongue (*Penstemon sudans*) Occurrences?

In 2015, we began monitoring occurrences of rare Susanville beardtongue (*Penstemon sudans*, CRPR 1B.2) on the Lassen N.F. that were invaded by cheatgrass (*Bromus tectorum*). We found that non-invaded areas averaged three times the density of total and flowering *P. sudans* plants as invaded areas, suggesting that invaded occurrences may benefit from cheatgrass treatment. In 2017, we sprayed portions of invaded occurrences with the post-emergent, grass-specific herbicide fluazifop-p-butyl. We compared total and flowering *P. sudans* densities in sprayed areas against densities in invaded and non-invaded control areas in 2017 and 2018. One year post-treatment, cheatgrass cover was significantly lower in treated versus untreated plots. In addition, decreases in cheatgrass cover were significantly correlated with increases in *P. sudans* density. Preliminary analysis of environmental data suggests that both *P. sudans* density and cheatgrass cover are positively correlated with mean spring temperatures. Establishing which environmental variables best predict cheatgrass cover may help land managers prioritize high cheatgrass years for herbicide treatment. We plan to re-monitor and treat cheatgrass in spring of 2019.

7. BRODIE, E.[1] and H. SAFFORD[1,2]
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Patterns of Post-fire Diversity and Regeneration in Subalpine Forests of the Sierra Nevada

Climate-fueled changes in snow pack and growing season are increasing sapling density and changing stand dynamics in the subalpine forests of the Sierra Nevada, California. These changes will likely continue in coming years and may contribute to larger and more severe fire events in subalpine forests. Despite predicted changes in high elevation fire behavior, there is no published literature documenting how subalpine understory communities and regenerating tree seedlings respond to fire severity in a Mediterranean climate. We have sampled 7 fires so far across a range of 2-16 years post-fire and in three different National Parks or Forests. Analysis of this preliminary data shows that post-fire species richness increases with fire severity and is greatest in stands that experience >75% tree mortality by basal area. More data and further analyses are needed to understand how members of the high severity plant community differ from lower severity and unburned plant communities. Regenerating tree seedlings show a much different response to fire. When compared to unburned forest, tree seedlings are found in greater densities after low to moderate severity fire (25-50% tree mortality by basal area) and lower densities after high severity fire (>90% tree mortality by basal area). We hypothesize that, while conifer seedlings may benefit from the increased light and resources caused by reduced canopy cover after moderate severity burning, they are damaged by high severity fire.

8. GILBERTI, D. and C.T. IVEY
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Understanding Sweet Trophic Interactions between *Quercus lobata* and *Disholcaspis eldoradensis*

Trophic interactions provide insight into understanding the distribution and abundance of organisms. Predators and producers influence the abundance of other trophic levels, through sometimes unexpected and complex indirect interactions. The herbivorous cynipid wasp *Disholcaspis eldoradensis* induces galls on Valley Oak (*Quercus lobata*) trees, inside of which the larvae mature while consuming oak tissue. The galls are unusual for their secretion of nectar, which attracts ants, and the ants in turn may reduce mortality of the gall-inducing larvae caused by other parasitoid insects or inquilines with which they compete. I used a factorial experiment in which ant exclusion was crossed with a nectar treatment (removal, addition, or control) to test the hypothesis that ants and nectar availability influence survivorship of the galling wasps. I recorded gall visitation by ants and other insects, as well as nectar secretion rates by galls throughout the growing season. Galls were collected, and the number and identity of any emerging insects will be recorded. These data will help to reveal the role of these complex trophic dynamics in regulating this herbivore's distribution and abundance.

9. GRAHAM-BRUNO, R.[1,2], M. STICKROD[1,2], and V.T. PARKER[2]
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Life History of *Cirsium hydrophilum* var. *hydrophilum* (Asteraceae), a Federally Endangered Tidal Wetland Species

We are investigating the population dynamics of the federally endangered California endemic tidal marsh species, the Suisun thistle, *Cirsium hydrophilum* (Greene) Jeps. var. *hydrophilum* (Asteraceae) with the objective of enhancing populations. Our initial approach is to assess seed production, dispersal and recruitment at Rush Ranch Open Space in Solano County. We are collecting salinity, temperature, water level, and elevation data to determine if individual distribution patterns are correlated with the tidal flood regime. We have directly examined seed production and predation, indirectly measured seed dispersal, and have established permanent transects to monitor seedlings and rosettes. Our main finding so far is that Suisun thistle has issues with seed production, being somewhat limited by seed maturation and predispersal seed predation. Distribution patterns of adults and rosettes suggest recruitment is limited by light near channels and by salinity away from channels along a gradient of light and salinity conditions. The results of this work will inform the greater restoration efforts for these brackish marsh areas for successful persistence of these populations in the face of myriad effects associated with global climate change and sea level rise. Monitoring of these populations and habitat, as well as exploring relevant aspects of life history and population ecology is necessary in developing a comprehensive management plan for these areas.

10. HAYNES, A.
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N-Parasitism and Water Use Efficiency in *Castilleja applegatei*, a Root Hemi-parasite

The N-parasitism hypothesis posits that N(nitrogen) limitation drives high transpiration rates in parasitic plants. Xylem-tapping parasites acquire dilute N from the host xylem stream, but the low concentrations require profligate transpiration. Research on this hypothesis, however, has largely focused on stem parasites. Here I use stable isotopes to investigate the N-parasitism hypothesis in a root hemiparasite, asking: *how does parasitism alter N-status and water use efficiency (WUE) in a N-fixing host and a parasite?* I

established and surveyed 120 1x1m plots within Sagehen Creek Field Station, California. 50% included *C. applegatei* (a root hemiparasite). In a subset of plots, I collected leaf samples of *C. applegatei*, *Ceanothus prostratus* (a N-fixing shrub), and two non-N-fixing possible hosts. Leaf samples were processed for $\delta^{13}C$, $\delta^{15}N$ isotope signatures and C:N ratio. Availability of N-fixing hosts corresponded with a significant increase in leaf %N and WUE (signified by $\delta^{13}C$) in parasites. In addition, higher leaf %N in individual parasites corresponded to higher WUE. Parasites with N-fixing hosts available also had a distinct $\delta^{15}N$ signature in parasites, which was closer to the N-fixer's $\delta^{15}N$ signature, further suggesting that the increased leaf %N is derived from the N-fixing host. In N-fixing hosts, parasite presence was associated with a significant decrease in WUE. Parasite presence, however, had no effect on the two non N-fixing host species sampled. These results suggest that transpiration decreases with higher N availability, broadly supporting the N-parasitism hypothesis and indicating that host type affects parasite's physiology.

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Mapping Vegetation on the Wildland Urban Interface: An Oakland Case Study

Fire in the wildland urban interface is an increasingly present danger, and communities across California are planning for wildfire risk reduction. As part of a broader, multi-faceted approach to fire hazard reduction, the City of Oakland is developing a Vegetation Management Plan (VMP) to reduce the risk of catastrophic fire in the Oakland hills. To document existing biological conditions and to support predictive fire models, vegetation/habitats were recently mapped across more than 2,000 acres, including a park designated as a Botanical Protection Priority Area. The minimum mapping unit was 0.1 acre. Classification types were entered into ArcGIS 10.3 software to create a vegetation and land cover layer, based on field survey data and interpretation of aerial imagery. The vegetation maps have been used as a basis to develop site-specific vegetation management and fuel reduction treatment approaches. The maps have also been used as a very effective communication tool during public outreach to solicit feedback from stakeholders on current conditions and proposed treatments. The vegetation maps will also be used to analyze potential effects of the VMP through developing an Environmental Impact Report.

12. JURJAVCIC, N.L., M.E. KEEVER, K.M. RODRIGUEZ, and A.G. MERRILL
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The Response of Rare Natural Communities and Special-status Plants to Fire in Mendocino and Lake Counties

Mendocino and Lake counties cover over 3,500 square miles of California and host over 50 rare natural communities and 282 special-status plant species, approximately 65% of which are endemic to California. As is true for many of California's landscapes, these plants and communities are experiencing increased fire intensity at shortened intervals. Nearly 1,000 square miles in both counties have burned since 1980, half of which has burned in the last ten years. A number of these plants have fire adaptations including heat-resistant seeds, flammable seed coats, fire-resistant roots, and thick fibrous bark. Given the trajectory for increased fires under many climate change scenarios, some of these communities and special-status species may be impacted. Therefore, we examine fire adaptation characteristics for a suite of these rare natural communities and special-status plant species to try and predict how they may respond and implications for future landscapes.

13. KEEVER, M.E., R.J. THOMS, K.M. RODRIGUEZ, C.S. LYLE, and G.T. LEVERICH
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Novel Approaches to Vegetation Mapping in Muddy Places: Take to the Air!

In many of the tidally inundated habitats throughout the San Francisco Bay-Delta, traditional vegetation field mapping techniques have severe limitations. Tidal influence, soft sediments in mudflats, and dense

emergent vegetation pose field access challenges. To improve data quality and allow for more accurate extrapolation and classification in these relatively inaccessible environments, Stillwater Sciences has developed a habitat mapping methodology using remotely sensed aerial imagery vegetation interpretation. Methods include collecting nadir perspective and low-altitude aerial images, georeferenced ground-control points, and field verification sample points. The resulting aerial imagery and surface are used for conducting visual interpretation using heads-up digitizing techniques. We have calibrated these methods on projects in the lower reaches of the Napa River, in south San Francisco Bay, and in the western Delta. Results indicate that the use of high-resolution aerial imagery from small unmanned aircraft systems results in cost-savings and allows for easily repeatable vegetation sampling, especially in areas with challenging access. The methodology has multiple applications from coarse habitat mapping, to alliance-level vegetation typing, species-specific invasive weed mapping, and monitoring the success of invasive weed control efforts.

14. KENNY, R., S. FARROW, T. BUCHLOH, C. DOIRON, J. YOST, and M. RITTER
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Measuring and Monitoring the Vegetation of the Scott Creek Marsh

The Scott Creek Bridge, located adjacent to the Cal Poly Swanton Pacific Ranch, and crossing the Scott Creek estuary and saltmarsh, is due to be replaced in the next several years. Because the Scott Creek estuary was channelized when the original bridge was installed, the bridge replacement project will be accompanied by a restoration project aimed at de-channelizing the creek. This is a rare opportunity to observe the response of coastal wetland vegetation communities to a rapid shift in hydrologic conditions. To do this Cal Poly has implemented an ambitious species inventory, vegetation mapping and long-term monitoring program in the marsh. Over the summer of 2018, Cal Poly undergraduate students extensively sampled the northern portion of the marsh. We collected plant occurrence data at one meter intervals on transects that were spaced 5 meters apart and covered the entire sampled portion of the marsh. We are using this data as well as high resolution drone imagery to create data driven vegetation classifications for the marsh. As the restoration project progresses, we will use drone imagery to track the changes in vegetation composition, and we will resample individual vegetation types to assess whether the species composition has changed. So far we have recorded 111 plant species, and have sampled 12,041 points in the marsh. We will return in the summer of 2019 to complete sampling in the southern portion of the marsh.

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Can Functional Traits Explain Grassland Restoration?

Restoration is riddled with unpredictable outcomes especially in a changing climate in which the extremity of droughts is likely to increase. This is compounded by a narrow focus on restoring certain species. At a coastal prairie at Younger Lagoon Reserve, Santa Cruz, I will determine whether drought related functional traits of native and non-native species such as specific leaf area, leaf thickness, leaf C:N ratio, and leaf $\delta^{13}C$ carbon isotope signature, can explain the survival and growth of planted native plants. Twelve native species were planted in treatment types: shelter (60% natural rainfall reduction), control, and water addition (1/gal per week during the growing season the first year). After three years of treatment there are clear differential effects on survival from both treatment and functional traits. Planting survival is greatly increased in the third year with a small investment in watering in the first year. At our sites, plantings with conservative functional traits are more likely to survive in general, but generally have lower biomass.

16. MACKEY, H.E., Jr.

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Life in the Slow Lane by *Dicentra uniflora* (Papaveraceae): Can a Slow-Growing Ephemeral Geophyte Help Monitor Global Warming?

Historical phenology data collected from the Herbarium at Chico State University and from online data of the Consortium of California Herbaria indicate that in the northern portion of California, *Dicentra uniflora* may be emerging earlier by as much as 20 to 30 days since 1970, versus prior to 1970. In order to understand this possible shift, a series of phenology observations and growth studies were conducted in northeast Butte County and Lassen Volcanic National Park beginning in 2009 and extending through 2018. Flowering of *D. uniflora* was linked very closely with the end of snow cover. Fruit maturity followed 3 to 4 weeks later and senescence 5 to 7 weeks after flowering. Seed and bulblet plantings also demonstrated that this plant has a dual mode of reproduction and survival. Early data indicate that this geophyte could require more than a decade to reach maturity for flowering from seed germination and/or bulblet growth. Snow cover and wet winter soil conditions could decline with global warming in the thin Tuscan soils of Carpenter Ridge where *D. uniflora* is found at one of its lowest elevations in Butte County. A better understanding of the growth and survival characteristics of this ephemeral geophyte could serve as a means to monitor global warming in Northern California.

17. SCHLISING, R.A.

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Steer's-head (*Dicentra uniflora*, Papaveraceae): Fate of the Flowers in 2018

A mature plant of this ephemeral little geophyte has a single flower resembling a steer's head. Photos of the flowers abound, but little is published about the life cycle. Plants were studied in 2009 through 2018 in coniferous forests of the southern-most part of the Cascade Range in northern California, to document aspects of phenology and biology. A population survey on one important aspect of the steer's head life cycle—the "fate" of flowers—was done in 2018. During April through early June, hundreds of new flowers were staked at three sites in Butte County (at 1355, 1746, and 1945 m elevation) and followed to fruit maturation. Percent of ovules in these self-pollinating flowers that matured into seeds was high, ranging from 81-95 percent. However, the percent of the flowers that reached fruiting was not high at any of the sites. Only 27-43 percent of staked flowers produced mature fruits with seed; 23-24 percent had dried flowers; and 25-30 percent had flowers/fruits missing, often with pedicels remaining. Presently there is no explanation for the drying of many flowers (possibly related to features of microsite in the pebbly soil). Types of herbivores responsible for removal of flowers/fruits (that was recorded in all years) were not determined during numerous field observations, but black-tailed deer are suspected. An interesting lead concerning fate of flowers needing follow-up is possible green fruit consumption at higher elevations by larvae of the butterfly *Parnassius clodius*, elsewhere known to feed nocturnally (!) on *Dicentra* leaves.

18. OLLIFF YANG, R.L.[+1], T. GARDALI[2], and D. ACKERLY[1]

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Mismatch Managed? Strategies for Buffering the Impacts of Phenology Shifts

As the climate changes, organisms are altering their behaviors in response to changing abiotic conditions. Species-specific shifts in phenology (the timing of yearly life cycle events) are expected to occur, leading to changes in species interactions within and among trophic levels. Phenology duration and complementarity will be important in the resilience of ecosystems to these shifts; hence considering these when managing or restoring ecosystems may be critical for maintaining important species interactions (i.e. pollination

and seed dispersal), mitigating invasions, and maintaining ecosystem function. Restoration projects are beginning to incorporate phenology into planning, but there is a limited understanding of what techniques might be implemented. Extended flowering and fruiting time may allow for system resilience by buffering the impacts of timing shifts and allowing for both intraspecific and interspecific adaptive capacity. We explore potential strategies that could extend flowering resources, and discuss results from experiments testing these techniques in California grassland communities.

19. OLSON, A., S. LUCAS, and R. UNGER
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Regional Conservation Investment Strategies Program: A New Conservation Tool

On September 22, 2016, Governor Brown signed Assembly Bill 2087, establishing the California Department of Fish and Wildlife's (CDFW) Regional Conservation Investment Strategies (RCIS) Program. The RCIS Program encourages development of regional conservation strategies to identify opportunities for philanthropic investments and advance mitigation that would result in effective regional conservation. The RCIS Program uses a science-based approach to identify and prioritize region-specific conservation actions to help California's declining and vulnerable species by protecting, restoring, and reconnecting their habitats, and facilitating adaption and resilience to climate change, invasive species, and other stressors. These actions may include land protection, habitat restoration, protection and establishment of sensitive plant populations, and wildlife-specific actions. The RCIS Program consists of three components: Regional Conservation Assessments (RCAs), Regional Conservation Investment Strategies (RCISs), and Mitigation Credit Agreements (MCAs). Strategies are developed in an RCIS and actions may be carried out through an MCA, which create credits that may be used as compensatory mitigation for impacts under state and federal laws. This poster will further explain each of the Program components' benefits and uses in relation to conservation and recovery of sensitive species, including sensitive plants, and how the Program relates to other CDFW conservation planning instruments.

20. PENNINGTON, L.K., E. DICKMAN, and J. SEXTON
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Survival in a Drier World: A Study of Rapid Adaptation in Response to Drought in the Sierra Nevada Endemic Forb, *Erythranthe laciniatus*

Increased climate variability is a looming threat to plant populations—plants must respond with plasticity, adaptive evolution, or face extinction. The drought in California from 2012-2014 was historic and exceptional—the driest event in roughly 1,200 years—and gives an unprecedented opportunity to examine whether plants can rapidly adapt to changing climatic conditions. Seed collections of *Erythranthe laciniatus* dating back a decade provided the material for a resurrection study: by growing out seeds from before the drought and comparing them to plants grown from seeds produced during the drought, we can determine if plants experienced a rapid adaptive response to drought. In an initial growout, it was found that time to seedling emergence differed between drought and pre-drought generations, and days to first flower differed significantly by elevation, suggesting local adaptation to climate across the range. In a second growout, descendants from the initial growout were grown in common conditions. Measurements were taken of the same traits to verify differences between drought and pre-drought generations. Drought plants again emerged earlier than pre-drought, and days to first flower differed across the species' range. These results provide evidence of a rapid, genetic response to drought, and provide insight into the ability of natural populations to respond to rapid climate change.

21. RAETHER, C. and C.T. IVEY
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Plant Genotypic and Leaf Phenological Effects on Selection of Valley Oak (*Quercus lobata*) Host by Galling Cynipidae (Hymenoptera) Wasp Species

Within plant populations, herbivory varies among individuals. Secondary biochemistry, plant density dependence, leaf phenology, and plant genetic variation are among the factors that can explain this variation. The influence of plant genotypic variation in herbivory defense, however, is rarely explored in long-lived perennials, particularly with galling insects .We examine the variation in abundance and diversity of galling insects in a large (6,500-tree) replicated valley oak (*Quercus lobata*) provenance test to test for quantitative genetic variation in Cynipid wasp host selection. In addition, we explore relationships between leaf bud burst timing and cynipid gall density and diversity. Our study will be among the first to provide insight into explaining variation in Cynipid wasp herbivory within a single oak species and the influence of plant genotype on Cynipid wasp host selection.

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Variation in leaf shape in a *Quercus lobata* common garden: tests for adaptation to climate and physiological responses

Oak leaves are highly variable. Previous studies found leaf shape of some oaks covaries with climatic variables, and that leaf dissection may ameliorate water stress. Such patterns may reflect local adaptation of genotypes or plastic responses to local environments. We tested the hypotheses that (a) leaf dissection (perimeter:area ratio) in *Quercus lobata* was genetically based, reflecting adaptation to climatic regime and (b) variation in leaf dissection is associated with photosynthetic rate. We used a large provenance test involving 672 maternal families collected from 97 locations throughout the range of the species. We subsampled leaves from 54 trees grown from 27 maternal families (9 locations) representing extremes and median of multivariate climate phenospace. In addition, we measured carbon assimilation in 27 trees (27 families, 18 locations) representing extremes and median of leaf dissection. If variation in leaf dissection is due to adaptation to local climatic conditions, we predicted that trees originating from contrasting climates would contrast in leaf dissection while in this common garden. If leaf dissection ameliorates water stress via photosynthesis, we predicted that more dissected leaves would have higher carbon assimilation. Although highly variable, leaf traits did not differ among climate categories, suggesting phenotypic variation observed is shaped by local environment. However, we observed trends suggesting a positive relationship between leaf dissection and carbon assimilation.

23. KEELER-WOLF, T.[1], J. RATCHFORD[1], R. BOUL[1], D. HICKSON[1], R. YACOUB[1], B. FURNAS[2], and M. GOGOL-PROKURAT[1]
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A Study of Landscape-level Habitat Relationships between Birds and Vegetation on the Modoc Plateau

The California Department of Fish and Wildlife Vegetation Classification and Mapping Program has initiated research to examine the relationship between wildlife communities and vegetation. A long-held assumption closely ties wildlife to plant communities, yet this has not been widely tested. This research will compare high-density terrestrial bird surveys to fine-scale vegetation classification and mapping to explore the correlations between bird species occupancy and vegetation attributes in the Modoc Plateau. The

Modoc Plateau is an area of California with a low human population, yet it is strongly affected by human-caused disturbances and rapid changes in vegetation patterns. Vegetation classification and mapping of 1 million acres in this region began in 2016, providing quantitative spatially explicit vegetation information that will be co-analyzed with high-density bird survey data collected in the 2018 and 2019 field seasons. Beginning in April of 2018, field crews collected bird occupancy data using digital recorders in 158 sites. Sites were selected according to a stratified sample allocation covering 16 of the most common terrestrial and wetland vegetation types in the ecoregion. Additional sampling will be conducted in 2019 for a total of over 300 bird survey sites. These data will be used to build and test a series of occupancy models for birds of the area, including the declining Greater sage-grouse, in order to clarify landscape-level habitat relationships between bird species and regionally important vegetation types. This study is expected to have a significant impact on statewide wildlife habitat assessment, and will revise and refine current habitat modeling practices and assumptions state-wide.

24. RINKERT, A.[1] and J. WHITTALL[2]
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Bird Nests as Botanical Time Capsules for Lost Habitats

Transitional habitat between the tidal marsh and adjacent uplands of the San Francisco Bay estuary is important to many threatened species. This habitat is above the normal high tide line and is only rarely inundated by saltwater during annual extreme tidal events. Unfortunately, all transitional habitat in this estuary has been lost or severely modified by drastic changes in land use. Few herbarium specimens were collected in this habitat before degradation and only one habitat description exists from the early 1900's, limiting the effectiveness of ongoing restoration efforts. Fortunately, bird nests collected in the transitional habitat by early naturalists may serve as botanical time capsules. By focusing on birds restricted to nesting in transitional habitat in the estuary, we aim to reconstruct some of the plant species from this lost habitat. Morphological and anatomical analysis of nest materials does not provide the species-level detail we seek in reconstructing the transitional habitat. Instead, we used a molecular approach by extracting DNA, then amplifying and sequencing the nrITS region from two nests (contemporary Savannah Sparrow and 10 year old Song Sparrow nest). After comparing sequences to those in Genbank, we identified three plant species (*Cardamine hirsuta, Festuca rubra, Elymus triticoides*), including a native species not previously known from this habitat (*F. rubra*). Future studies utilizing additional contemporary and historical bird nests will inform ongoing restoration efforts which rely on knowing the plants in the transitional habitat surrounding the San Francisco Bay over the past 100 years.

25. SALER, J.
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Re-setting the Successional Clock: Does Woody Vegetation Removal Restore Early Successional Habitat within a Coastal Fen?

The project consists of studying the effects of woody vegetation encroachment on species diversity and cover within Big Lagoon bog as well as the effects of the removal of woody vegetation on species diversity and cover within the Big Lagoon Bog (bog). The bog (which is truly a fen) provides habitat for numerous rare plant species which rely on open, early successional fen habitat. Open, early successional habitat is rapidly disappearing from the bog with over 60% of the total area completely covered in dense shrub and tree cover eliminating habitat for rare species. This loss of fen habitat has been documented along the entire Pacific Northwest coast and needs to be scientifically addressed to prevent the complete loss of these rare habitat types. CNPS has partnered with Caltrans to remove woody vegetation from the bog in order to reset the successional clock and restore habitat for rare species still found within the bog. The study consists of pre-treatment species occurrences and cover data obtained using transects and evenly spaced plots to ensure consistent monitoring for 5 years as well as comprehensive data collection across the bog. Pretreatment data was collected July and August 2018; post treatment data collection will occur in July and August 2019 and will be used in conducting monitoring for five years following the treatment.

This study will allow for a comprehensive look at the effectiveness of shrubby vegetation removal as a tool for restoring rare fen habitat.

26. SCHWEITZTER, J.[1], H. FORBES[2], and R. RAICHE[3]
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[3]Planet Horticulture, 2875 Greenwich Street, San Francisco, CA 94123

Captive Propagation and Reintroduction of Large-flowered Fiddleneck (*Amsinckia grandiflora*) in Contra Costa, Alameda, and San Joaquin Counties, California

A team of botanists and horticulturalists from Vollmar Natural Lands Consulting, the University of California Botanical Garden, and Planet Horticulture has received a grant from the Central Valley Project Conservation Program to reintroduce large-flowered fiddleneck (*Amsinckia grandiflora*) into its historical range. This federally and State-endangered annual wildflower is known from only one extant natural population, located in southwestern San Joaquin County. The species is associated with grassland habitats with fairly neutral, rich, clay loam soils, and it therefore suffers from competition with introduced annual grasses that thrive in such habitats. It is also a relatively tall species that features shallow roots, and its affinity for excessively steep slopes increases its susceptibility to trampling and soil erosion by livestock. As such, large-flowered fiddleneck is emblematic of the vulnerability of native grassland forbs to historical and ongoing habitat change as well as habitat management. The current reintroduction effort is showing some promise, thanks to the availability of modern spatial analysis tools as well as increasing scientific documentation on the benefits and drawbacks of livestock grazing. The use of sophisticated GIS software to analyze high-resolution data has enabled the development of a precise habitat model, which in turn has facilitated the identification of optimal reintroduction sites. Additionally, strategic grazing regimes are being employed to reduce introduced grasses without the associated trampling or erosion. By refining the reintroduction methods for an extremely rare and highly vulnerable grassland species, the team seeks to more generally improve methods for reintroducing and sustaining rare grassland plant species.

27. SERKANIC, S. and V.T. PARKER
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Anchored in Time – Confronting a Cytoplasmic Assault and the Origin of a Sierran Tetraploid Manzanita

The Sierra Nevada is home to two broadly distributed diploid manzanita species, *A. patula* and *A. viscida*. A third Sierran species, *A. mewukka*, was demonstrated as the resulting allopolyploid from hybridization between *A. patula* and *A. viscida*. Genome duplication is a profound mechanism for reproductive isolation and hybrid speciation in sympatry. Recurrent formation and reciprocal parentage is typically observed among documented allopolyploids like *A. mewukka,* where hybridization events between respective progenitors yield an array of distinct and interfertile genotypes across the distribution of a recombinant species. This notion provided an opportunity to test for parentage and repeat origin of *A. mewukka* throughout its range with the use of maternally inherited cpDNA. Regions of nrDNA were also sequenced to address overall patterns of relatedness among taxa. Tissue was sampled from five locations throughout the distribution of *A. mewukka*. These samples also include tissue from each putative parent, and samples from throughout the distribution of *A. manzanita* – a broadly distributed tetraploid with six subspecies. Results characterize a stabile allotetraploid *A. mewukka* that may have formed during an earlier time, when genomes of each respective parent were more alike and amenable to exchange. Insights also depict ongoing interactions between *A. mewukka* and geographically non-overlapping tetraploid taxa, all while supporting a stronger understanding of this important Sierran species complex.

28. SHAY, J.E.[1], L. BROOKS[2], M. KAZE[1], A.C. FRANK[1], J.P. SEXTON[1], and M. SISTROM[1]
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Endophyte Community Shifts in Response to Drought in Monkeyflowers (*Erythranthe laciniata)* Grown in Native Soil

All plants have a community of asymptomatic microbes inhabiting their tissue known as endophytes. Increasing evidence suggests that microbes are an extension of plant host phenotype and can ultimately help them adapt in response to stress, including drought. Additionally, stressful conditions may select for distinct endophyte taxa with specific functions. Further understanding of how the structure of endophytes shift in response to drought is a potentially important avenue for identifying significant biotic interactions that may play a role in stress response to climate change and perhaps predicting species distribution shifts. The aim of this project is to examine changes in endophyte communities in plants suffering from drought. We ask, does drought alter microbiome composition, and if so, what part of the plant is changing and are there specific taxa that come into play? We sampled both roots and shoots of *E. laciniata* plants grown in native soil in laboratory 1) controlled and 2) drought conditions. Plant tissues were sampled at two time points in the plant life cycle to account for any shifts over time. All tissue was analyzed for bacterial and fungal taxa. Preliminary results indicate strong differences in endophytes between plant compartments (e.g. roots and shoots), suggesting that root communities are more impacted by the effects of drought than shoot communities. Diversity of endophytes was also greater in the root communities than in the shoot, suggesting transmission of endophytes from their native soil.

29. THORNTON, A.
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Modeling the Risk for *Phytophthora ramorum* with an Anthropogenic Focus in Northern California

Phytophthora ramorum is a plant pathogen found in North America that is commonly referred to as Sudden Oak Death (SOD). Since its initial detection in California in 1995, SOD has killed over a million trees, primarily tanoaks (*Lithocarpus densiflorus*), coast live oak (*Quercus agrifolia*), and California black oak (*Quercus kelloggii*). Northeastern California has thus far remained uninfected with the exception of one *Rhododendron* tree in Placer County. In order to contribute to the prevention of SOD spread to northeastern California, I created several models that depict where the risk for SOD development is highest based on four variables: host vegetation, climate suitability, proximity to roadways, and proximity to nurseries and lumber mills. I used a weighted overlay analysis to combine these variables at differing weights under five conditions. I applied the same analyses in Mendocino County, where sampling for SOD has resulted in 73 positive and 326 negative cases, to assess the accuracy of each condition. I calculated Cohen's Kappa coefficient to measure the agreement between each condition and the recorded cases. Though the Kappa values do not show strong agreement in the conditions, they do illustrate a trend of increase in agreement with the addition of proximity to roadways and nurseries. Suitable climate and host vegetation for SOD also exist along the coastal Pacific Northwest, and most of that area lies too far from SOD incidence for natural spread to be the primary concern. Similar risk models incorporating human introduction variables could be applied to all of this area.

30. TOEWS, D., D. RUIZ RAMOS, M. STEPHENS, and J. SEXTON
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Using an eDNA Approach to Quantify Biodiversity in California Vernal Pool Plant Communities

Understanding patterns of plant diversity and the processes that govern species distributions across environmental gradients is important for mitigating impacts of future environmental change. Quantifying bio-

logical diversity and individual species presence in plant communities is traditionally performed by visual surveys of aboveground species. However, detecting species presence using aboveground survey methods for annual plant communities is complicated by dormancy or the phenological stages of species at the time surveys are taken, temporal variance of flowering time, lack of botanical expertise, and time or logistical issues. Recent advances in environmental DNA (eDNA) metabarcoding techniques enable detection of trace amounts of species DNA present in environmental samples. eDNA gives researchers the ability to detect species that may be present but missed by aboveground assessment methods. Nevertheless, many methodological challenges remain. Here, we describe methods and research that combine traditional botanical surveys with eDNA metabarcoding techniques to study the spatial and temporal patterns of species diversity in vernal pool plant communities. We also describe a planned pilot study to evaluate the sensitivity of soil eDNA methods to input soil volume and soil processing method. Comparing eDNA assays and visual floristic surveys enables us to ground-truth our sampling methodology and determine similarities and differences in species detection between the two methods. Preliminary eDNA metabarcoding results show significant differences in the distribution of vernal pool plant species along pool inundation gradients (i.e. pool zones), consistent with our above-ground floristic surveys of the same vernal pools.

31. WEINBERGER, H.S. and K.M. KACZYNSKI
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Plant Recovery Trajectory in the Southwestern Cascade Foothills

Although fire is a natural ecological process, anthropogenic fire suppression has influenced changes in natural fire regimes. These changes are reflected in the rise in prevalence of large wildfires across the western US. This not only shows potential increase in fire severity, but may also have long-term ecological effects. In locations near human habitation, fire suppression is a top priority. Techniques include constructing fuel breaks and using fire retardant. Invasive species proliferate in these newly opened spaces and can in turn alter fire regimes. We studied the 32 Fire, located along Highway 32 near Chico, California. The site is comprised of chaparral vegetation, oak woodland, and open grassland. Fire-adapted plant species including *Arctostaphylos manzanita* and *Arctostaphylos viscida* occur on the site. A large fuel break was created on the north side to prevent fire from spreading. To assess recovery, we established thirty-nine 100 m^2 plots in the four vegetation types, stratified randomly based on three levels: burned, unburned, and disturbed fuel break. For each vegetation type, burned sites had similar vegetation composition when compared with unburned sites, having more native species present than non-natives. Burned Annual Grasslands and Forbs had more non-natives present and this was similar to the unburned sites. Manzanita and Wedgeleaf vegetation types within the fuel breaks had similar species composition, but did not have primary species of their respective unburned or burned vegetation type. This may indicate that fuel break sites are on a trajectory away from their original vegetation type.

32. WRUBEL, E.[1] and T. JONES[2]
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Sedges of Marin County: A Digital Guide

We present a new online diagnostic tool which harnesses the power of digital imagery to aid identification of 37 sedge species known to occur in Marin County, California. Sedges (*Carex* L., family Cyperaceae) comprise the largest genus of flowering plants in California (156 spp.). Yet comparatively little is known about the distribution, status, and ecology of many sedge species due in part to the taxonomic difficulty of the genus. While sedge diversity is high, many species are morphologically similar, differing by minute characters. The digital guide to Sedges of Marin County enables comparison of cryptic character states between *Carex* species. The guide includes multiple-entry text-based keys and high resolution imagery of diagnostic characters, allowing users to combine analytical and gestalt methods to identify sedges. A matrix of zoom-able pages contains imagery of each sedge species, and the text-based keys may be queried to sort species into ‘available’ and ‘discarded’ bins. An image-based glossary and tutorial may be consult-

ed to understand the specialized terminology of sedges and other graminoids. Sedges provide important ecosystem services in a wide range of habitats, especially wetlands, which have been disproportionately impacted by human activities throughout California. The species-rich *Carex* genus also has unrealized potential as model system for studies in diversification and niche differentiation. This digital guide provides new diagnostic tools for caricologists of all skill levels, thus improving our understanding and appreciation of the fascinating world of sedges. Available at: *www.sedgesofmarin.org*.

33. RICHMOND, M., S.GILLESPIE, and S. YARGER
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Mapping Dead and Dying Trees in Declining Bishop Pine (*Pinus muricata*) Forest at the Sea Ranch

Over the past decade, numerous private land owners and public land managers have become concerned with widespread decline in stand health in Bishop pine forest in the immediate coastal environments of Sonoma and Mendocino counties. WRA as the lead consultant to the Sea Ranch Association is collaborating with other consultants, public land managers, and academics to develop a forest management plan aimed at minimizing the spread of pathogens and impacts to Environmentally Sensitive Habitat Areas, and restoring tree removal areas with appropriate and viable vegetation. The initial step in developing the plan was to obtain a property-wide map of dead and dying trees over the approximately 10,300-acre property, in a timely and cost-effective manner. WRA deployed remote sensing, and GIS technology and analysis to do so. We acquired Normalized Difference Vegetation Index (NDVI) and thermal imagery, and Sonoma Lidar Project vegetation height data. Using the vegetation height layer we created a 3D tree layer. Using NDVI analysis on the image, vegetation health was classified into two categories: good health, dead/poor health/unvegetated. Extracting the dead/poor health/unvegetated layer, the 3D tree layer was clipped to it to create a dead/poor health tree layer. This layer was further refined by clipping out erroneous false positive areas. Field verification will be required to refine trees showing up with poor health indices.

LIST OF COMMON ACRONYMS

Found in Abstracts of Talks (starting on page 9)
and Abstracts for Posters (starting on page 22)

3D	three-dimensional
BIOS	Biogeographic Information and Observation System (a part of CDFW)
BLM	Bureau of Land Management
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CNDDB	California Natural Diversity Data Base (a part of CDFW)
CNPS	California Native Plant Society
C:N	carbon-to-nitrogen ratio
cpDNA	chloroplast DNA
CRPR	California Rare Plant Rank
ESA	Endangered Species Act
G1	Global Rank 1, Critically Imperiled (ranking generated by CNDDB)
G2	Global Rank 2, Imperiled (ranking generated by CNDDB)
G3	Global Rank 3, Vulnerable (ranking generated by CNDDB)
GIS	Geographic Information System(s)
GLM	Generalized Linear Model
n	sample size
NEPA	National Environmental Policy Act
nrDNA	nuclear ribosomal DNA
nrITS	Nuclear Ribosomal Internal Transcribed Spacer
OHV	off-highway vehicle
S1	State Rank 1, Critically Imperiled (ranking generated by CNDDB)
S2	State Rank 2, Imperiled (ranking generated by CNDDB)
S3	State Rank 3, Vulnerable (ranking generated by CNDDB)
VegCAMP	Vegetation Classification and Mapping Program

INDEX OF AUTHORS

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Ascent Environmental, Inc.
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Ascent Environmental is a dynamic environmental, natural resources, urban design, and planning consultancy headquartered in Sacramento, California, and with offices in the Bay Area, Lake Tahoe, and San Diego. Ascent scientists and planners offer a full suite of natural resources capabilities to support environmental decision-making and stewardship of land and water resources. Our work supports CEQA and NEPA documents, regulatory compliance efforts, and natural resources management assignments. We are experts in leading projects where protection, enhancement, management, and/or restoration of sensitive habitats or natural functions and processes are the primary objectives.

Backcountry Press
Representative: Michael Kauffmann
(707) 407-7686 • www.backcountrypress.com • email: mk@backcountrypress.com
Backcountry Press is an independent publisher of web and print media whose themes explore natural history, ecology, and the western landscape. In addition to our eight titles, watch for books in the future including *Geology of Lassen Country* (2019) and *The Klamath Mountains: A Natural History* (2020).

California Botanical Society
https://calbotsoc.org
The California Botanical Society was founded by Willis Linn Jepson in 1913 and serves a major role in advancing Western American botany with its five primary program services: scientific publications, an annual banquet, research support, graduate student support, and community outreach. The Society welcomes membership by all individuals interested in Western American botany.

California Lichen Society
Representative: Tom Carlberg
http://californialichens.org • email: president@californialichens.org
Dedicated to promoting the appreciation, preservation, and study of California lichens. The California Lichen Society was established as a nonprofit corporation in 1994. It has grown from the original nine founding members, and now includes roughly 200 members worldwide. We are an active group, and have set ourselves the goals of mapping the state's lichen flora, preserving its endangered species, and enhancing the knowledge and understanding of lichens throughout California and adjacent areas.

California Native Grasslands Association
Representative: Michele Hammond
(530) 902-6009 • https://cnga.org • email: admin@cnga.org
Established in 1991, the California Native Grasslands Association's mission is to promote, preserve, and restore the diversity of California's native grasses and grassland ecosystems through education, advocacy, research, and stewardship. We work towards increasing public understanding and appreciation of the value of native grassland ecosystems through workshops, presentations, advocacy, our website and quarterly journal, *Grasslands*. We offer a variety of workshops on topics such as grass identification, grazing practices that promote native grassland diversity, and appropriate practices and techniques to evaluate, prepare, and plant native grasses and other grassland plants. Our conservation committee members strive to ensure that threatened native grasslands are protected from conversion or degrada-

tion. Stop by the CNGA exhibitor booth to pick up a brochure and chat with Michele Hammond, CNGA Board Member.

California Native Plant Society – State Office
Representatives: Elizabeth Kubey
(916) 447-2677 • www.cnps.org • email: cnps@cnps.org
The California Native Plant Society (CNPS) has been the leading native plant conservation, advocacy, and education organization in California since 1965. A grassroots organization, CNPS has 35 chapters serving 10,000 members all over the state of California and Baja California, Mexico. CNPS maintains an online *Inventory of Rare and Endangered Plants* as well as *A Manual of California Vegetation*, the standard vegetation classification reference. CNPS also has an active horticulture program, supporting chapter native plant sales and demonstration gardens.

Carex Working Group
Representatives: Barbara Wilson and Mary Vance
www.carexworkinggroup.com • email: cwg@peak.org
Carex Working Group is a tiny botanical consulting firm. At this point, we work mainly on teaching serious botanists to identify plants, write field guides, and do taxonomic research. We specialize in diverse, challenging plant groups like sedges, grasses, *Sedum*, and *Lomatium*.

F.M. Roberts Publications
Representative: Fred Roberts
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F.M. Roberts Publications originated as a self-publishing source for botanical guides and checklists in southern California but has expanded to include wildlife and wildflower themed T-shirts, prints, and note cards based on gouache water color and acrylic paintings rendered by Fred M. Roberts. Displays will include my 2018 Thread-stem (*Nemacladus*) design and Oak Trees of California, always a popular design.

Friends of the Chico State Herbarium
Representative: Elena Gregg and Colleen Hatfield
(530) 898-5381 • www.friendsofthechicostateherbarium.com
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The Friends of The Chico State Herbarium is an all-volunteer organization that promotes botanical education and community outreach. Our mission is to provide support for the Chico State Herbarium and demonstrate and publicize the value of the Herbarium to the community.

Garcia and Associates (GANDA)
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Garcia and Associates is a natural and cultural resources consulting firm specializing in cultural and paleontological resources compliance, state-of-the-art aquatic and terrestrial ecology, and natural resources policy and planning. Garcia and Associates' staff is committed to meeting our clients' needs with the highest professional standards. We have completed projects that range from multi-year, multi-million-dollar planning and impact studies for large facilities to small, focused studies with short deadlines and limited budgets. Headquartered in San Anselmo, we also have regional offices at Auburn, Oakland, San Francisco, Los Angeles, Lompoc, Oceanside, Palm Springs, Bozeman, Guam, and Honolulu.

Hedgerow Farms
Representative: Patrick Reynolds
(530) 662-6847 • www.hedgerowfarms.com • email: info@hedgerowfarms.com
Hedgerow Farms is a native seed production farm specializing in California native grasses, sedges, rushes, and wildflowers. We offer seed for more than 100 grass, forb, sedge species, including many bioregional ecotypes. We also provide native grass transplants, native straw, project design assistance, and contract growing.

Native Orchid Conference
Representative: Linnea Hanson and Judy McCrary
www.nativeorchidconference.info • email: nativeorchids@gmail.com
The purpose of the Native Orchid Conference is to foster the study, conservation, and enjoyment of the native orchids of the United States and Canada. Membership is open to anyone who is interested in wild orchids. Members have a wide range of experience and include both scientists and hobbyists. The Fred Case Grant Fund offers support for research projected related to native orchid conservation.

Sierra Pacific Industries
(530) 378-8117 • www.spi-ind.com • email: llindstrand@spi-ind.com
Sierra Pacific Industries (SPI) is a family-owned forest resource company based in Anderson, California. The company owns and manages nearly 1.9 million acres of timberland in California and Washington, and is among the largest lumber producers in the United States. SPI is committed to managing its lands in a responsible and sustainable manner to protect the environment while providing quality wood products and renewable power for consumers. To SPI, sustainable forest management means more than just planting trees. SPI operates numerous mills, cogeneration, remanufacturing, and windows facilities. We have invested in state-of-the-art equipment to optimize every fiber of each tree, and we are a certified participant in the independent Sustainable Forestry Initiative (SFI) to help ensure our forests are here for future generations. The expertise of our professional foresters and natural resource specialists assures that wildlife habitat, water quality, and other forest values are protected.

Siskiyou Field Institute
Representative: Kathleen Pyle
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Siskiyou Field Institute is dedicated to increasing understanding of and connection to the Klamath-Siskiyou ecoregion through education, scientific research and public engagement.

Stillwater Sciences
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Stillwater specializes in science-based, technical approaches to environmental issues. By integrating geomorphic and biological research to understand critical ecosystem processes, we work to identify effective measures for restoring and managing rivers and their floodplains as functioning ecosystems. Our areas of expertise include fish and aquatic ecology, geomorphology, botany and riparian ecology, water quality, wildlife, and spatial analysis/GIS. Our botanical services include rare plant surveys and monitoring; revegetation, restoration, and habitat planning; planting plan design/implementation; riparian habitat mapping; modeling of riparian-vegetation dynamics; development of invasive weed control measures; and jurisdictional wetland delineation and Section 404 permitting.

The University and Jepson Herbaria, UC Berkeley
Representative: Staci Markos
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The mission of the Jepson Herbarium is to understand and conserve the California flora through systematic, floristic, and conservation biology studies and to communicate knowledge of the flora through publications and instructional programs. Through all of the programs of the Herbarium, we strive to be a liaison between the scientific community and the interested public and support conservation efforts around the state. Primary resources include the Jepson eFlora and the Consortium of California Herbaria. Educational opportunities for both amateurs and professionals are available through the Jepson Workshop Series.