The Diversity of NORTHERN CALIFORNIA BOTANY Challenges and Opportunities

THE TENTH SYMPOSIUM
PRESENTED BY

NORTHERN CALIFORNIA BOTANISTS
at California State University, Chico
13-15 January 2020

The Diversity of Northern California Botany: Challenges and Opportunities

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Cover photos courtesy of Linnea Hanson. Photographs of McNab cypress (*Hesperocyparis macnabiana*) at what is known locally as The Magalia Serpentine, or by the U.S. Forest Service as the McNab Cypress Proposed Special Interest Area. All of the McNab cypress trees at this site, such as those on the left, were killed by the Camp Fire of November 2018. Hundreds of seedlings, such as the one on the right, are now present at this site thanks to the required fire-stimulated release of seeds. Prior to the Camp Fire there were virtually no seedlings or young cypress trees here. 6 February 2019 (left), 24 July 2019 (right).

WELCOME!

Northern California Botanists

welcomes you
to our tenth 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 7; index to authors on page 36)

MONDAY, 13 JANUARY 2020

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: Species Boundaries

9:00 – 10:20 a.m.

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

2. **Teresa Sholars**
   Lupinus circumscription challenges, indiscriminate outcrossing, and sheer numbers of taxa create the nightmare known as Lupinus
3. **Israel Borokini**
   Variation in the nuclear genomic size in Ivesia from western North America and its taxonomic implications
4. **Chenjiao Deng**
   Investigating the identities of populations of Sidalcea (Malvaceae) in the North Coast Ranges in California
5. **Tom Kaye and Geraldine Allen**
   Species boundaries and the conservation of rare asters (Eucephalus, Asteraceae)

10:20 – 10:40 a.m. **Break**

Session 2: Fire in Managed Landscapes

10:40 a.m. – 12:00 p.m.

Session Chair: Jennifer Gibson, National Park Service, Whiskeytown National Recreation Area

6. **Eamon Engber**
   Fuels treatment effectiveness? Gaining perspective from the Carr Fire in an era of megafires
7. **Abigail Jones and Jeffrey Kane**
   Long-term effectiveness of fuel treatments to wildfire in a chaparral ecosystem
8. **Michelle Agne**
   Effects of a short interval reburn on knobcone pine regeneration in the Carr Fire
9. **Zeke Lunder**
   Fire behavior on industrial timberlands during 2018 Northern California fires

12:00 – 1:20 p.m. **Lunch**

Session 3: Restoration

1:20 – 2:40 p.m.

Session Chair: Daria Snider, Madrone Ecological Consulting

10. **Brooke Wainwright**
    Does source population impact performance in created vernal pools for Contra Costa goldfields or Burke's goldfields?
11. **Justen Whittall**
    Experimental reintroduction of the Ben Lomond wallflower (Erysimum teretifolium) at the Bonny Doon Ecological Reserve
12. **Cara Clark**
    Restoring dunes in the Monterey Bay: Ecosystem processes and experimental treatments
13. **Kristen Kaczynski**
    Short- and long-term vegetation changes following wet meadow restoration in Drakesbad Meadow, Lassen Volcanic National Park

2:40 – 3:00 p.m. **Break**

Session 4: New Discoveries

3:00 – 4:20 p.m.

Session Chair: Julie Kierstead, Shasta-Trinity National Forest, retired

14. **Naomi Fraga**
    How many monkeyflowers are native to California? Recently discovered monkeyflower diversity in northern California, named and unnamed species, a story of what lies ahead
15. **Alexa DiNicola**
    Something old and something new in the Trinity Alps: An expedition, a resurrection, and Potentilla millefolia var. algida

16. **Amanda Snodgrass**
    A roadside botany adventure: the intriguing tale of the discovery of a new Nasturtium in northern California
17. **Julie Kierstead**
    A startling new Phacelia from the Carr-Delta Fire footprint in the Eastern Klamath Ranges of western Shasta County

Session 5: Lightning Talks

4:20 – 5:00 p.m.

Session Chair: Kristen Kaczynski, California State University, Chico

18. **Rob Thoms**
    Get your GED in GDEs
19. **Rob Irwin**
    California Species Mapper
20. **Adam Schneider**
    Using phylogenomics to shed light on the classification controversy in Arceuthobium (dwarf mistletoes)
21. **Katelin Pearson**
    Using Notes from Nature to digitize California herbaria
22. **Tim Miller**
    Creating long-term monitoring projects in a field course setting
23. **Rachelle Boul**
    The Vegetation Classification and Mapping Program: Our standards, goals and data
24. **Cecile Shohet**
    Geranium lucidum, an Early Detection-Rapid Response invasive from southern Oregon

* * * * *

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.

Keynote Speaker

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

25. **Eric Knapp**, U.S. Forest Service, Pacific Southwest Research Station
    Fire trends, causes, and consequences for the native plants we love

TUESDAY, 14 JANUARY 2020

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

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 21; index to authors on page 36)

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

Session Chair: Barbara Castro, California Department of Water Resources, retired

Poster presenters will be available to answer questions.

Coffee and breakfast snacks will be available, free to attendees.

Second Day Opening Remarks

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

Linnea Hanson, President, Northern California Botanists

Session 7: Pollinators

10:10 – 11:30 a.m.

Session Chair: Kirsten Bovee, Lassen National Forest

26. **Jerry S. Cole**
Plant selection by bumble bees in montane riparian habitats of California
27. **Katie Heineman**
Center for Plant Conservation pollinators of rare plants database and its applications for research, management, and outreach
28. **Erin Wilson Rankin**
California hummingbird foraging ecology: The effects of migration and non-native plants
29. **Kirsten M. Bovee**
Penstemon personatus has its day in the sun: Forest thinning results in increased flowering, pollinator visitation, and predicted seed set

11:30 a.m. – 12:50 p.m. **Lunch**

Raffle, Auction, and Awards

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

Session 8: Plant Biotic Interactions

1:20 – 2:40 p.m.

Session Chair: Jackie Shay, University of California, Merced

30. **Jackie Shay**
    Endophyte communities in the cut-leaf monkeyflower (Erythranthe laciniata) respond differently to drought conditions above and belowground
31. **Callie Chappell**
    Nectar-inhabiting microbes: Bridging ecology and evolution in the field and laboratory
32. **Don Miller**
    The ecological apparency hypothesis and spatial distribution can explain colonization of Arctostaphylos host plants by Tamalia gall aphids
33. **Lorena Torres Martinez**
    Rapid evolution of specialization in a plant-microbial mutualism

2:40 – 3:00 p.m. **Break**

Session 9: Now the Good News

3:00 – 4:20 p.m.

Session Chair: Russell Huddleston, Applied Technology and Science

34. **Michelle Stevens**
    Good news at the Bushy Lake eco-cultural restoration: Restoring culturally significant native and fire resilient plants in a highly disturbed urban environment
35. **Len Lindstrand III**
    Post-fire response of Shasta snow-wreath
36. **Cynthia Powell**
    Postfire, rare plant, and restoration data collection forms on Calflora, and negative data!
37. **Justen Whittall**
    Reintroduction of endangered mustards in northern California

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 to the herbarium

POST-SYMPOSIUM WORKSHOPS

WEDNESDAY, 15 JANUARY 2020

Workshop 1: NEPA for Botanists

Time: 9:00 a.m. – 1:00 p.m.
Location: Chico State Campus, Bell Memorial Union, second floor Room 210
Instructor: **Danika Carlson**, Environmental Coordinator, Salmon/Scott River Ranger District, Klamath National Forest

Opportunities exist for incorporating enhancement and protection of botanical resources into project design throughout the NEPA process. Discussion will move through all three sides of the "NEPA Triangle" making this a useful refresher or intro NEPA workshop in addition to the focus on botanical resources. Discussion will also include the use of analysis indicators for framing a focused effects analysis, with clearly defined thresholds for determinations of significance.

Highlights will include:

- How NEPA applies for plants that are not federally listed
- Opportunities for botany related input and participation throughout the NEPA planning steps
- Focused effects analysis and determining significance
- How NEPA applies to projects on private lands with federal funding

Workshop 2: Field trip to Big Creek Creek Ecological Reserve – Tour of Fall 2019 Prescribed Fire Areas

Time: 9:00 a.m. – 1:00 p.m.
Location: Big Chico Creek Ecological Reserve Headquarters Office
www.csuchico.edu/bccer/public-use/directions.shtml
Instructors: **Dr. Don Hankins**, CSU Chico, Geography and Planning Department
Mitch Bamford, Chico State Enterprises, Ecological Reserve Land Steward

The trip will tour areas burned during the Fall 2019 prescribed fire season. The burns will likely be about 2 months old at the time of the tour. These areas will be mostly oak savannah and grasslands, but may possibly include some mixed oak woodland. The tour group will meet at the Big Chico Creek Ecological Reserve (BCCER) Headquarters Office in the morning at 9 a.m., and then be shuttled to the burn areas by the BCCER staff. There will be a moderate amount of hiking through the burn areas as well. The details of the tour are subject to change if heavy rains make the road impassable. The burn areas and acreage are also subject to change based on conditions during the burn window in the fall. If the details of the tour change, the BCCER staff will reorganize the tour to provide the best tour of the BCCER prescribed burn program possible allowed by the conditions. The tour should last approximately 4 hours.

ABSTRACTS OF TALKS

Abstracts are in chronological order; index to authors is on page 36
See also the List of Common Acronyms on page 35

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

Welcome to our Tenth Northern California Botanists Symposium

I'd like to welcome all of you to our tenth symposium, *The Diversity of Northern California Botany: Challenges and Opportunities*. We hope you will enjoy the program that we have organized for you this year with great speakers and posters. Our keynote speaker, Eric Knapp, will address *Fire Trends, Causes and Consequences for the Native Plants we Love*. 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.
P.O. Box 2340, Mendocino, CA 95460. tsholars@mendocino.edu

Lupinus circumscription challenges, indiscriminate outcrossing, and sheer numbers of taxa create the nightmare known as *Lupinus*

Lupinus is a very recognizable genus. It is how to define the species boundaries that is the problem. In North America over 1,000 species basionyms have been published. Circumscription is difficult, made problematic by the vast number of species recognized, then lumped and split in various ways by different taxonomists. Many of the original protologues are so old they lack complete morphological descriptions. In addition to this, large numbers of the perennial species lack any barriers to crossing with other sympatric lupine species. Molecular research that would help define phylogeny of lupines has also been difficult, as there often is a large diversity of genetic differences within current taxonomic circumscription of "a species." Crossing has also taken place between what has been thought of as different branches of phylogenetic trees. In order to write the keys and description for *Lupinus*, my challenge was to find morphological characters that could be used to differentiate taxa. I used a very simple criterion to define species boundaries: if I could differentiate most individuals in a taxon and could write a key to that taxon, then I recognized it. I used the following characters to accomplish this challenge: habit (erect, prostrate, shrub, herb), leaf position (basal or cauline), leaflet size; persistence of flower bracts, hairs on the banner back, keel, wings and upper leaf surface. This strategy results in a treatment that works 90%+ of the time and will tide us over until future systematists can solve the phylogeny of this complex group.

3. BOROKINI, I.T.[+1], and PEACOCK, M.M.[2]
[+]NCB 2016-2017 and 2018-2019 Research Scholarship awardee
[1]Program in Ecology, Evolution and Conservation Biology (EECB), Department of Biology, University of Nevada, Reno, Reno, NV 89557. tbisrael@nevada.unr.edu
[2]Department of Biology, University of Nevada, Reno, Reno, NV 89557. mpeacock@unr.edu

Variation in the nuclear genomic size in *Ivesia* from western North America and its taxonomic implications

Genome size is expected to be constant within a species, as predicted in the narrow species concept and genome size constancy theory, but exhibit interspecific variation. We tested intraspecific genome size

variation in 11 *Ivesia webberi* populations, and investigated significant interspecific nuclear genome size variations in 32 accessible taxa in *Ivesia*. Nuclear genome size was estimated using flow cytometry of propidium iodide-stained nuclei, determined from 10,000 counts from fresh leaf samples collected from three individuals in sampled populations and taxa, while nuclei of five species were used as internal standards. Genome size for all sampled taxa was tested for correlation with morphological traits, based on predictions of the nucleotype theory. Nuclear DNA content for the *I. webberi* populations narrowly ranged from 0.76 to 0.9 pg/2C, thus supporting genome size constancy within a taxonomic unit. Additionally, a 7.8-fold variation in nuclear DNA content was observed within the genus, ranging from 0.73 pg/2C in *I. baileyi* var. *beneolens* to 5.73 pg/2C in *I. lycopodioides* var. *megalopetala*. Also, overlaps in genome size of several *Ivesia* taxa, and two representatives from closely-related *Horkelia* and *Potentilla* were noted. Based on existing knowledge showing that 11 *Ivesia* taxa were diploid with 28 chromosomes (2n = 2x = 28) and karyotyping test, we hypothesize that all taxa in the genus are diploids, and may have speciated by adaptive radiation. Nuclear genome size may become an important taxonomic indicator for reviewing *Ivesia* taxa as distinct biological species if crosses among taxa with genome size homogeneity produced viable F_1.

4. DENG, C.[1], and POTTER, D.[2]

[1]Horticultural and Agronomy Graduate Group, University of California, Davis, Department of Plant Sciences, 1 Shields Avenue, Davis, CA 95616. cjdeng@ucdavis.edu

[2]Department of Plant Sciences, University of California, Davis, 1 Shields Avenue, Davis, CA 95616. dpotter@ucdavis.edu

Investigating the identities of populations of *Sidalcea* (Malvaceae) in the North Coast Ranges in California

We investigated the taxonomic identities of populations of *Sidalcea* found on serpentine soils in the North Coast Ranges (NCR) in California. Although the plants are potentially assignable to the federally endangered species *Sidalcea keckii*, originally described from the southern Sierra Nevada foothills (Tulare County), the distinctions between that species and *S. diploscypha*, which is common on serpentine in the North Coast Ranges, are not always clear. To study the relationships among the unidentified *Sidalcea*, *S. keckii*, and *S. diploscypha*, we collected 282 samples from 10 counties across California. Analyses of nuclear ITS nucleotide sequences divided all individuals into three distinct groups corresponding to the three morphotypes, and sequences of the unidentified *Sidalcea* were more similar to those of *S. diploscypha* than those of *S. keckii*. Only minimal variation was detected in the chloroplast *trn*L-*trn*F nucleotide sequences. Our analyses suggested that the populations of unidentified *Sidalcea* found in the NCR are closely related to, but genetically distinct from, *S. diploscypha* despite morphological similarity to *S. keckii*. Further studies of additional molecular markers and morphological characters are in progress.

5. ALLEN, G.A.[1], KAYE, T.N.[2], and KIERSTEAD, J.A.[3]

[1]University of Victoria, Department of Biology, PO Box 1700 Station CSC, Victoria, BC, Canada V8W 2Y2. gallen@uvic.ca

[2]Institute for Applied Ecology, 563 SW Jefferson Avenue, Corvallis, OR 97333-4602. tom@appliedeco.org

[3]P.O. Box 491536, Redding, CA 96049. daffodil.jones@gmail.com

Species boundaries and the conservation of rare asters (*Eucephalus*, Asteraceae)

Taxonomically difficult species groups present a conservation challenge, requiring detailed understanding of genetic and phenotypic variation to identify taxonomic units of concern. A good example is the genus *Eucephalus*, which includes several rare species (5 of 10 total species) and is especially diverse in the Klamath Mountains of southwestern Oregon and northern California. We investigated morphological and genetic characteristics of all *Eucephalus* in the Klamath region. Multivariate analyses of morphological data from field-collected and herbarium specimens showed that the species are not well marked morphologically, but form continuous series. Three species (*E. breweri, E. ledophyllus* and *E. vialis*) have broad regional distributions and are partly allopatric. Two others (*E. glabratus* and *E. tomentellus*) are localized in the Klamath region, where they intergrade with the first three. The taxa are differentiated by quantitative characters, including ray number (with variation from rayed to rayless), leaf size, leaf pubescence and

phyllary shape. We identified three distinct molecular groups based on sequencing of the ITS nrDNA region, but these did not correspond closely with morphology. One ITS group characterized *E. breweri*, a primarily Sierra Nevada species. The other ITS groups occurred in all remaining species and common ribotypes were shared among taxa, indicating little molecular differentiation. Molecular groups were not geographically distinct, although we observed some variation with latitude. In groups that lack strong genetic and morphological differences among species, a conservative taxonomic approach is recommended. Scarce conservation resources can then be directed preferentially towards species that are distinct as well as rare.

6. ENGBER, E.
Redwood National Park, Whiskeytown National Recreation Area, Oregon Caves National Monument, Six Rivers National Forest, 121200 Highway 101, Orick, CA 95555. eamon_engber@nps.gov

Fuels treatment effectiveness? Gaining perspective from the Carr Fire in an era of megafires

Lessons learned regarding fuels treatment effectiveness following a high severity wildfire will be discussed. Examples of both effective and ineffective treatments will be presented in a range of vegetation types including mixed oak shrubland, oak woodland, and mixed conifer forest.

7. JONES, A.J., and KANE, J.M.
Wildland Fire Laboratory, Humboldt State University; Department of Forestry and Wildland Resources, 1 Harpst Street, Arcata, CA 95521. aj212@humboldt.edu, jkane@humboldt.edu

Long-term effectiveness of fuel treatments to wildfire in a chaparral ecosystem

Protecting wildland urban interface communities within chaparral ecosystems is challenging, due to the likelihood of high severity fires in these fuel types. Fuel reduction treatments within chaparral ecosystems are an essential component in the protection of these communities; however, their long-term effectiveness is not well understood. In 2002 and 2003 an experimental fuel reduction treatment project was designed and implemented in Whiskeytown National Recreation Area. An assortment of treatments, including hand thinning, prescribed fire only, mechanical mastication only, and mechanical mastication followed by prescribed fire, were implemented to examine their impacts and effectiveness. In the summer of 2018, before the start of the Carr fire, the original plots were resampled. One year after the Carr fire, fuel loading, shrub density, and burn severity were resampled. Preliminary results show that fine woody surface fuel loading declined between 58.7% and 93.9% among all treatments, with the mechanical mastication treatment resulting in the greatest fuel reduction and highest burn severity. Lower consumption and severity was associated with hand-thinned units, suggesting this may be an effective way to reduce negative impacts following wildfire.

8. AGNE, M.C.[1,2], FONTAINE, J.B.[2], ENRIGHT, N.J.[2], and HARVEY, B.J.[1]
[1]School of Environmental and Forest Sciences, University of Washington, Anderson Hall, Box 352100, Seattle, WA 98195-2100. agnem@uw.edu, bjharvey@uw.edu
[2]School of Veterinary and Life Sciences, Murdoch University, Building 460, Murdoch, WA, Australia 6150. J.Fontaine@murdoch.edu.au, N.Enright@murdoch.edu.au

Effects of a short interval reburn on knobcone pine regeneration in the Carr Fire

Increased frequency of high-severity fire can potentially erode forest resilience, especially in forests dominated by serotinous species. A critical component of this potential is the minimum fire interval required to retain populations of serotinous forest species. The 2018 Carr Fire represents a powerful opportunity to test the relationship of seed availability at the time of fire to post-fire tree recruitment. In 2018, two months before the Carr Fire, we measured forest structure and canopy seedbanks of young (10 to 14-year-old) knobcone pine (*Pinus attenuata*) stands. We remeasured these stands ten months post-fire to ask: 1) Was there evidence of post-fire recruitment failure? and 2) How did cone abundance influence post-fire seedling recruitment? Post-fire recruitment exceeded pre-fire density in 33% of stands and ranged from 0.25 to 4x the pre-fire density. Pre-fire cone abundance was not strongly related to post-fire recruitment density, suggesting that site-scale factors (e.g., fire severity, topoclimate) may mediate the effect of seed

availability on post-fire recruitment. Importantly, there was no evidence of complete recruitment failure in year one post-fire, although most stands did not reach self-replacement densities. Furthermore, some stands exhibited both tree survival and post-fire recruitment. However, extrapolating future forest structure and persistence from these data may miss important dynamics. Whether these forests can persist as low density or multi-aged stands below the level of self-replacement depends on seedling survival rates and additional recruitment in subsequent years. Additional data collection is planned to understand seedling survival rates and to expand the sampling to include additional fire intervals.

9. LUNDER, Z.
Deer Creek Resources, 807 Moss Avenue, Chico, CA 95926. zeke.lunder@gmail.com

Fire behavior on industrial timberlands during 2018 Northern California fires

While industrial timberland managers are legally required to meet many different resource management objectives, their primary goal is maximizing timber production. Federal land managers have a mandate to manage for multiple objectives, including watershed protection, wildlife, recreation, and the health of other natural resources. Wildfire is an essential process in the maintenance of healthy ecosystems, and there is increasing interest in managing wildfires on public land for resource benefit. However, legacy patterns of forest land ownership, coupled with current silvicultural practices on private lands, make the use of managed wildfire nearly impossible across broad areas of mixed ownership in Northern California.

10. WAINWRIGHT, B.E.[1], and LA ROSA, R.J.[2], and EMERY, N.C.[3]
[1]University of New Mexico, Department of Biology, Castetter, MSC03-2020, 1 University of New Mexico, Albuquerque, NM 87131-0001. bwainwright@unm.edu
[2]California Department of Fish and Wildlife, P.O. Box 944209, Sacramento, CA 94244-2090. Raffica.LaRosa@wildlife.ca.gov
[3]University of Colorado Boulder, Department of Ecology & Evolutionary Biology, 1900 Pleasant Street, Boulder, CO 80309-0334. Nancy.Emery@colorado.edu

Does source population impact performance in created vernal pools for Contra Costa goldfields or Burke's goldfields?

Land development and conversion are some of the greatest threats to native species, especially for edaphic endemics with highly restricted distributions. In California, the negative effects of habitat loss are often mitigated through habitat protection, restoration, and creation. Historically, vernal pool habitat stretched across California, but the total area has been severely reduced due to past and ongoing urban development and agricultural expansion. Consequently, substantial resources are invested in projects that create vernal pool habitat to try to offset losses. A key step in this process is the "inoculation" of created pools with seeds and soil from existing pools to provide the founder populations of targeted taxa, in order to establish native communities. As with any seed translocation activity, practitioners must balance the goals of maintaining local genetic structure vs. maximizing genetic variation when identifying the source populations that are used to inoculate created habitat. The stakes for these decisions may be particularly high for vernal pool taxa, which are naturally patchily distributed and thus prone to both local adaptation and inbreeding. Our project compares the relative performance of different source populations of two endangered vernal pool plants, Burke's goldfields (*Lasthenia burkei*), which is state and federally listed, and Contra Costa goldfields (*L. conjugens*), which is federally listed, in artificially created vernal pool habitats. In the fall of 2018, we transplanted seeds from multiple remnant populations into recently-created vernal pools to identify the life history stages that serve as bottlenecks during population establishment, and to test if there are significant differences in the performance of different source populations in the early stages of population establishment. In this talk, we present results from this experiment. We expect to repeat the experiment in subsequent years to evaluate year-to-year variation in the relative performance of different populations in created habitats.

11. WHITTALL, J.B.[1], WILSON, A.[1], MCGRAW, J.M.[2], and KASTEEN, T.[3]
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[2]Jodi McGraw Consulting, P.O. Box 221, Freedom, CA 95019. jodi@jodimcgrawconsulting.com
[3]California Department of Fish and Wildlife. Terris.Kasteen@wildlife.ca.gov

Experimental reintroduction of the Ben Lomond wallflower (*Erysimum teretifolium*) at the Bonny Doon Ecological Reserve

The Zayante sandhills are home to numerous edaphic endemics including the Ben Lomond wallflower (*Erysimum teretifolium*) - known from less than ten occurrences. The population at Bonny Doon Ecological Reserve (BDER) has diminished from >10,000 individuals to less than 10 individuals in 20 years. Self-incompatibility and late-acting inbreeding depression may compound population declines caused by habitat conversion. Our experimental reintroduction examines the genetic effects and habitat conditions required to recreate a stable population at BDER. We planted ~72,768 seeds and ~1,200 juveniles into tilled and raked plots at eight sites in November 2018 and November 2019. Seed germination, seedling survival, juvenile survival and juvenile transition to reproduction were measured in winter, spring and summer. Seedings in November 2018 produced ~21,500 plants that survived until June 2019. There were 21% more seedlings in tilled plots than in raked plots and 3.5x higher seedling mortality in raked plots than in tilled plots. Plots nearest to the extant population had the highest proportion of surviving seedlings from April to June 2019 and the second highest number of seedlings surviving per plot. Juvenile survival from November to June was very high (96.5%), but few juveniles became reproductive in their first year (11.8%). Juveniles in tilled plots were ~3x more likely to transition to reproduction than those in raked plots. There were significant block effects for both seed germination and juvenile survival. We are analyzing soil chemistry and physical properties and quantifying self-incompatibility allelic diversity in hopes of establishing a stable wallflower population at BDER.

12. CLARK, C.J., STONER-DUNCAN, S., and CLARK, R.P.
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Restoring dunes in the Monterey Bay: Ecosystem processes and experimental treatments

The dunes at Salinas River State Beach are vulnerable to sea level rise, and they protect important farmland, communities, and habitats. Invasive iceplant (*Carpobrotus edulis* and *C. chilensis)* has degraded the dunes through eliminating native species and altering dune geomorphic processes. Iceplant facilitates erosion from storm waves by preventing natural sand movement, resulting in steep dune faces that eventually collapse. In contrast to iceplant, native dune plants grow deep, anchoring roots that help resist erosion while still allowing sand to shift with wind and waves. The dunes also have special status flora, including sand gilia (*Gilia tenuiflora* ssp. *arenaria*) and Monterey spineflower (*Chorizanthe pungens* var. *pungens*). We removed iceplant using herbicide and hand treatment. Over 10,000 native plants were out-planted from seed collected locally. We reinforced the structural integrity of the dunes through strategic planting in blowout areas and placement of logs and haybales to facilitate sand accumulation. We conducted experimental treatments to test restoration methods. Results show that higher density plantings result in higher native cover, and that leaving mulch in place results in lower live iceplant cover. The most common native species in the foredune were beach bur (*Ambrosia chamissonis*), dune grass (*Elymus mollis*), and beach pea (*Lathyrus littoralis*), while in the mid-dune beach sagewort (*Artemisia pycnocephala*), beach bur (*Ambrosia chamissonis)*, and seacliff buckwheat (*Eriogonum parvifolium*) were more prevalent. This project will serve as an example for future dune restoration efforts. As climate change brings more extreme weather, healthy dunes can provide defense against rising seas and stronger storms.

13. KACZYNSKI, K.M.[1], SCHOOK, D.M.[2,3], and COOPER, D.J.[3]
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Short- and long-term vegetation changes following wet meadow restoration in Drakesbad Meadow, Lassen Volcanic National Park

Historic and recent modifications have altered the hydrologic processes that sustain montane fens and wet meadows. Over the past 25 years, much progress has been made in fen and wet meadow restoration, but few long-term studies exist evaluating restoration success. We examined the long-term restoration success of Drakesbad Meadow, a fen-wet meadow complex in the southern Cascades within Lassen Volcanic National Park. In summer 2017 and 2019, we resampled 25 vegetation plots and monitored groundwater monitoring wells established in 2002, prior to the 2003 phase one of hydrologic restoration. In 2012, phase two of the hydrologic restoration occurred when ditch networks were filled with sediment and sedges were sporadically planted. Results from the hydrologic restoration were mixed as some plots shifted their dominance towards more facultative species while others shifted towards more obligate wetland species. These shifts were correlated with expected and unexpected changes in the depth to groundwater. Monitoring both the long term and short-term changes in vegetation after hydrologic restoration gives a more complete assessment when evaluating restoration success.

14. FRAGA, N.S.
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How many monkeyflowers are native to California? Recently discovered monkeyflower diversity in northern California, named and unnamed species, and a story of what lies ahead

Plants placed in the genus *Mimulus* L. (Phrymaceae), as traditionally defined, are commonly known as monkeyflowers. These charismatic plants are exceedingly diverse in western North America with over 150 of the nearly 200 species worldwide occurring here. Nearly 60% (ca. 110) of the species native to western North American occur in California. However, *Mimulus* has recently undergone significant changes in taxonomy leaving the name *Mimulus* virtually absent from the California flora. I will briefly overview these changes and provide information on how to identify the three genera in Phrymaceae that are now recognized in California: *Erythranthe, Diplacus* and *Mimetanthe* and how these differ from *Mimulus* in the strict sense. I will also provide an overview of new species of monkeyflowers that have been described, with a focus on new species in northern California. At least 66 species of *Erythranthe* and *Diplacus* or more than 40% of the western North American species are currently listed by U.S. government agencies and native plant societies as sensitive, rare, or endangered, making it a group of conservation concern. An evaluation of improved knowledge of species delimitation and its implications for conservation will be presented.

15. DINICOLA, A.C.[1], SYTSMA, K.J.[1], and ERTTER, B.J.[2]
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Something old and something new in the Trinity Alps: An expedition, a resurrection, and *Potentilla millefolia* var. *algida*

We searched the high meadows of the Trinity Alps for a missing cinquefoil and found it, at last, on an unexpected pack trip. *Potentilla millefolia* var. *algida* (Rosaceae) hadn't been collected since Jepson de-

scribed it in 1936; as of summer 2018, we have new collections from four well-documented populations. Now we can begin to determine the plant's place in the riot of diversity that is California *Potentilla.* Based on our preliminary results, it belongs more in *P. versicolor* than *P. millefolia,* which adds *P. versicolor* to the California flora. Another serpentine cinquefoil found in the search may be a new taxon entirely. Both groups would be rare serpentine endemics unique to northern California.

16. SNODGRASS, A.N.[1], and KIERSTEAD, J.A.[2]

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[2]P.O. Box 491536, Redding, CA 96049. daffodil.jones@gmail.com

A roadside botany adventure: The intriguing tale of the discovery of a new *Nasturtium* in Northern California

This talk presents the story of the discovery of a *Nasturtium* species found growing in a riparian roadside along a state highway in Siskiyou County, California. The specimen was obtained during an annual collection event for the Siskiyou Mother's Day wildflower show in May 2019. The mysterious flower stumped a group of botanists, until Julie Kierstead determined that the species was potentially *Nasturtium gambelii*, a federally listed species. After initially keying out the species and reaching out to U.S. Fish and Wildlife Service (USFWS) staff for information about *N. gambelii*, Julie and Amanda contacted Dr. Ihsan Al-Shehbaz at the Missouri Botanic Garden, mustard family expert and treatment author of *Nasturtium* in the Jepson Manual, to look at a voucher specimen of the mystery species. Several more specimens were collected to identify if the species was the endangered *Nasturtium gambelii* or *Nasturtium microphyllum*, or something altogether new. Tentative identification determined our specimen to be *Nasturtium microphyllum* based on the number of reticulations on the mature seed coat. *N. microphyllum* is a new record for California. The nearest documented occurrence of *N. microphyllum* is an 1887 specimen from Douglas County, Oregon; more recent occurrences are known to the north in the Pacific Northwest. We speculate that the plant was dispersed to California by migratory water birds or by vehicle transport. A specimen has been sent to the Missouri Botanic Garden for accession in to the herbarium collection and identification verification.

17. KIERSTEAD, J.A.[1], LENZ, M.[2], and LINDSTRAND III, L.[3]

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[3]Sierra Pacific Industries, P.O. Box 496014, Redding, CA 96049-6014. llindstrand@spi-ind.com

A startling new *Phacelia* from the Carr-Delta Fire footprint in the Eastern Klamath Ranges of western Shasta County

In July of 2019, a robust, perennial, distinctive *Phacelia* was discovered in the footprint of the 2018 Carr and Delta wildfires of western Shasta County. Field surveys from July-November of 2019 have documented several more occurrences, most often occurring with *Draperia systyla*, another multi-stemmed perennial in the same family. Most apparently suitable habitat, as judged by the presence of *Draperia*, is not occupied by the new phacelia. Initial molecular analysis shows the new taxon sitting conclusively in the clade with *Phacelia procera, P. hydrophylloides*, and *P. bolanderi*. Although the new phacelia has adaptations to avoid or recover from fire, it does not appear to require fire for reproduction, nor to have been stimulated or imported by the fires and related human activities.

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

18. **THOMS, R.**
Stillwater Sciences. rthoms@stillwatersci.com

Get your GED in GDEs

19. **IRWIN, R.**
Sacramento River Forum. rob@riverforum.org

California Species Mapper

20. **SCHNEIDER, A.**
Hendrix College. schneider@hendrix.edu

Using phylogenomics to shed light on the classification controversy in *Arceuthobium* (dwarf mistletoes)

21. **PEARSON, K.**
Cal Poly State University, San Luis Obispo. katelin.d.pearson24@gmail.com

Using Notes from Nature to digitize California herbaria

22. **MILLER, T.**
University of California, Santa Cruz. t1mill3r@gmail.com

Creating long-term monitoring projects in a field course setting

23. **BOUL, R.**
California Department of Fish and Wildlife. rachelle.boul@wildlife.ca.gov

The Vegetation Classification and Mapping Program: Our standards, goals and data

24. **SHOHET, C.**
U.S. Bureau of Land Management, Medford District. cshohet@gmail.com

***Geranium lucidum*, an Early Detection-Rapid Response invasive from Southern Oregon**

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25. **KNAPP, E.E.**
Keynote Speaker
USDA Forest Service, Pacific Southwest Research Station, 3644 Avtech Parkway, Redding, CA 96002.
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Fire trends, causes, and consequence for the native plants we love

Populations of native plants may be affected by too little fire, too much fire, or fire of an intensity to which the species is poorly adapted compared with its competitors. In forests where fire was historically frequent, the accumulation of fuels in the long-term absence of fire means that when fire occurs, it often burns hotter than it once did. Fire suppression policies have changed the type of fire likely to be experienced in other ways as well. During milder conditions, when fire behavior is moderated and effects to plants less pronounced, fires are generally quickly extinguished. Partly as a result, landscapes are increasingly burning in very large fires under the most extreme conditions. This trend has consequences for many native species and will tend to favor plants with traits such as the ability to resprout, serotinous cones, and/or seeds capable of long-distance dispersal that can rapidly colonize high burn severity environments. In this talk, I will focus on three species with varying relationships with fire – black oak (*Quercus kelloggii*), mountain ladyslipper (*Cypripedium montanum*), and knobcone pine (*Pinus attenuata*) – to illustrate past influences of fire and speculate about potential future trajectories. Black oak and mountain

ladyslipper both likely require lower intensity fire to thrive, but for different reasons. Knobcone pine, with its serotinous cones, is adapted to high intensity fire and quite resilient to the types of fires we have been experiencing. With increasing fire activity and intensity, the only certainty is vegetation change. Not all change will be negative.

26. COLE, J.S.[1], SIEGEL, R.B.[1], LOFFLAND, H.L.[1], ELSEY, E.A.[1], TINGLEY, M.B.[2], and JOHNSON, J.M.[3]

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[3]USDA Forest Service, Plumas National Forest, 159 Lawrence Street, Quincy, CA 95971. james.johnson2@usda.gov

Plant selection by bumble bees in montane riparian habitat of California

Many bumble bee species have declined dramatically across North America and the globe, highlighting the need for a greater understanding of the habitat required to sustain or recover populations. Understanding bumble bee plant selection is important for promoting valuable plant resources that will help populations persist. We sampled 413 plots within riparian habitat on Plumas National Forest in the Sierra Nevada of California for bumble bees during two summers following extremely low and normal precipitation years, respectively. We assessed the five most abundant bumble bee species' plant selection by comparing bee floral use to availability. Bumble bee species richness was constant between years (13 species) but abundance nearly tripled from 2015 to 2016 (from 1,243 to 3,612 captures), largely contributed to by a dramatic increase in *Bombus vosnesenskii*. We captured bumble bees on over 105 plant species, but only 14 of them were significantly selected by at least one bumble bee species. *Agastache urticifolia* was significantly selected by the most bumble bee species (3 of 5). The 14 significantly selected plant species had staggered blooming periods that spanned the majority of the bumble bee activity season and indicates that phenological diversity may be important for providing continuous food resources to bees. Plant blooming phenology, availability of flowers, and plant selection remained fairly consistent between the two study years, suggesting that maintaining, seeding, or planting with the 14 "bumble bee plants" we identified may benefit a broad suite of bumble bee species across years.

27. HEINEMAN, K.D.[1], DAVITT, J.[2], and MASCHINSKI, J.[1, 2]

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Center for Plant Conservation pollinators of rare plants database and its applications for research, management, and outreach

Native plant species rely on pollinators to sustain genetic diversity and reproductive success. Because the loss of native pollinators poses an extinction risk for many rare species, identifying the pollinators of rare plants is essential for developing successful management and reintroduction plans. Most publicly available pollinator references were constructed for public outreach, and, therefore, include almost exclusively common plant species. To build a tool more specific to rare plant management, we created a database documenting literature observations of pollinators of rare plants in the Center for Plant Conservation National Collection, through funding from the National Fish and Wildlife Foundation. We leveraged open source citation management software and web-based form builders to create a platform, which allowed volunteers to transcribe over 550 rare plant references. The current database contains over 13,000 plant-pollinator interactions from over 2,000 plant species including over 400 rare plant species and is freely available for download on the Center for Plant Conservation website (SavePlants.org). We used this resource to evaluate patterns of rare plant – rare pollinator interactions documented in the grey and academic literature. We found over 210 records of rare animals pollinating rare plants, including 111 plant species and 38 pollinator species. Our records indicate that wide-ranging, but vulnerable bumble bee species, *Bombus pensylvanicus*, pollinates 12 rare plant species in the CPC national collection, indicating that

conservation of *B. pensylvanicus* may be important for maintaining the health of North American plant communities. We encourage researchers and land managers to utilize this dataset to include pollinator availability in conservation decisions concerning rare plants.

28. WILSON RANKIN, E.E.[1], HAZLEHURST, J.A.[1,2], RANKIN, D.T.[3], MCFREDERICK, Q.S.[1], and CLARK, C.J.[3]

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California hummingbird foraging ecology: The effects of migration and non-native plants

Pollination is a key ecosystem service integral to both wild and agricultural ecosystems. In fact, an estimated 87% of flowering plants require pollinators. Pollination is particularly of interest in biodiversity hotspots, such as the California Floristic Province, which boasts high levels of endemic flowering plants. We investigate how factors such as migration and invasive species alter interaction networks involving some of our most charismatic pollinators: hummingbirds. While the importance of pollinators in shaping ecosystems and economies is well recognized, we do not have a clear understanding of how the diverse players visiting a flower interact. Migrant hummingbirds may compete with resident hummingbirds for resources, with implications for plant-pollinator networks. A detailed analysis of hummingbird diets at stopover sites will provide a baseline from which to assess how the interactions between different species of migratory hummingbirds and between migrant and resident hummingbirds affect their foraging and diet overlap. We used DNA metabarcoding to analyze the diet diversity and niche overlap of hummingbirds in the California Floristic Province before, during, and after the peak migration of the Rufous hummingbirds (*Selasphorus rufus*), a long-distance migrant. Because of the high amount of pollen found naturally in nectar, we can use metabarcoding to identify the plants visited during nectar feeding. Our data provide a unique, detailed view of hummingbird foraging ecology using non-invasive methods. We are able to assess the role of non-native plants in the hummingbird diet and how the incidence of non-native plant visitation shifts in response to migratory hummingbirds moving through the landscape.

29. BOVEE, K.M.[1], and MERRIAM, K.E.[2]

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***Penstemon personatus* has its day in the sun: Forest thinning results in increased flowering, pollinator visitation, and predicted seed set**

The northern California endemic *Penstemon personatus* (CRPR 1B.2, Region 5 Sensitive, closed-throated beardtongue) rarely flowers when shaded under a canopy of northern Sierra mixed conifer forest. We asked what environmental factors influence *P. personatus* flowering, and whether mechanical treatments would affect flowering or pollinator visitation patterns. Thinning and group selection treatments were completed on the privately-owned Collins Almanor Forest in early 2017, adjacent to control plots on Plumas NF lands. While density of *P. personatus* decreased where soil disturbance was high, the opening of the canopy and associated pulse in flowering resulted in a mean predicted seed set of 892 seeds/1-m^2 in group selection plots, relative to 232 seeds/1-m^2 in thinning plots and 12 seeds/1-m^2 in control plots. We conducted pollinator monitoring in 2018 and 2019, identifying 14 bee species (predominantly *Bombus* and *Osmia* species) visiting *P. personatus*. We found that unique visitors to plots and flowers visited per plot were associated with both plot shading at the time of sampling and the number of available plot flowers.

30. SHAY, J.E.[+1], BROOKS, L.[2], KAZE, M.[1], FRANK, A.C.[1], SEXTON, J.P.[1], and SISTROM, M.[1]
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Endophyte communities in the cut-leaf monkeyflower (*Erythranthe laciniata*) respond differently to drought conditions above and belowground

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 roles mediating stress. Further understanding of how endophyte composition shifts 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 for predicting species distribution shifts. Our overarching question asks if drought alters endophyte composition and diversity in the cut-leafed monkeyflower (*Erythranthe laciniata*). 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. Results indicate strong differences in endophyte communities from above and belowground tissues, suggesting that root communities are more impacted by the effects of drought than shoot communities. Diversity and species richness of endophytes are greater in the root communities than in the shoots, suggesting transmission of endophytes from their native soil.

31. CHAPPELL, C.R., KIESCHNICK, C., and FUKAMI, T.
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Nectar-inhabiting microbes: Bridging ecology and evolution in the field and laboratory

Bacteria and yeast that inhabit floral nectar can influence plant fitness and pollinator behavior. Our group studies the microbes that inhabit the nectar of *Diplacus aurantiacus* in the field and using experimental microcosms in the laboratory. While most research on nectar-inhabiting microbes has focused on how microbes interact with the host plant in the field, less attention has been placed on how nectar microbes interact with each other. Across a landscape, the outcome of microbial competition may modulate pollinator behavior and plant seed set. However, the mechanisms that underpin these microbial community dynamics are unknown. In the field, the order in which microbes arrive at a flower strongly influences the resulting community. The initial relative density of competing species can affect final species abundances in local communities, the phenomenon known as priority effects. Most studies assume that the species traits that determine the strength of priority effects are static, but these traits can evolve rapidly across a landscape of flowers. Using experimental microcosms, we found that historical exposure to priority effects can cause species to evolve resistance to priority effects. These results suggest that evolutionary processes can influence the outcome of microbial competition, which may have consequences for plant seed set and pollinator behavior.

32. MILLER, D.G.
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The ecological apparency hypothesis and spatial distribution can explain colonization of *Arctostaphylos* host plants by *Tamalia* gall aphids

Fire is an important ecological process in chaparral plant communities in California. *Arctostaphylos* shrubs (Ericaceae) typically germinate following wildfire, providing new opportunities for specialist *Tamalia* gall aphids (Aphididae) to establish populations on fresh growth. In the wake of wildfire at a study site in the Cascade foothills of northern California, I tested the hypotheses of ecological apparency and minimum dispersal distance to predict relative rates of colonization by a gall-inducing aphid (*Tamalia coweni*) and its inquiline aphid (*Tamalia inquilina*). Methods included mapping the spatial distribution of

500 host plants in a 1-hectare study population using a high-precision Trimble Global Positioning System (GPS) instrument, as well as Geographic Information System (GIS) software. These data yielded estimates of the frequency and timing of plants first colonized by gall-inducers, as well as the frequency of inquilines subsequently invading galls. Results show that, beginning in 2008, less than 4% of the 135 juvenile plants were colonized by *Tamalia* aphids. The proportion of plants with aphid galls has increased continuously: 40% had been colonized by 2018. Assuming *Tamalia* aphids establish galls on young plants (sinks) from existing populations on mature plants (sources), my results are generally consistent with a minimum dispersal distance hypothesis. Colonization rates of host plants are a function of their height, which is consistent with the ecological apparency hypothesis. Inquilines can disperse and colonize new habitats efficiently, in synchronization with their gall-inducing host aphids. These findings have implications for patterns of evolutionary diversification in both gall-inducer and inquiline lineages.

33. TORRES-MARTÍNEZ, L.[1], PORTER, S.[2], ROTHSCHILD, J.[1], ORTIZ, G.[1], LAMPE, M.[1], FARSAMIN, W.[1], LE,T.[1], and SACHS, J.[1]

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Rapid evolution of specialization in a plant-microbial mutualism

Specialization in species interactions is thought to be a major driver of diversification. Legumes are often specialized on lineages of nitrogen fixing rhizobia, but the drivers of specialization are poorly understood. We studied two sister species of legumes in the genus *Acmispon* that are closely related but thought to be specialized on rhizobia. We wanted to test alternate hypotheses of whether a more generalized host evolved to become specialized, or whether a switch in symbionts evolved. In each legume species we tested for specialization on conspecific and heterospecific symbionts using multiple host genotypes and two different rhizobial strains per host lineage. We also tested the host species capacity to invest in and benefit from symbiosis in each of these combinations. We found that each host was highly specialized to different rhizobial genera, with relatively little evidence of heterospecific associations or mutualism. However, we found that this pattern was asymmetric, such that one host species was able to gain benefit from both rhizobial lineages in some host genotypes. Moreover, we found segregating variation in specialization in both legume species, suggesting that natural selection can shape these traits in natural populations. We conclude that shifts in partners' specialization are driven by wholesale switches in symbiont partners, potentially driven by genomic or ecological changes in the host. However, the amount of segregating variation that we uncovered in the host populations suggests that these shifts can be reversible.

34. STEVENS, M.L., KOVET, M., and MIR, M.

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Good news at the Bushy Lake eco-cultural restoration: Restoring culturally significant native and fire resilient plants in a highly disturbed urban environment

The Bushy Lake Restoration Project is an eco-cultural restoration project that has provided five years of high-impact student-faculty research opportunities, referred to as "learning by doing" experiential learning, as well as participatory citizen science, community outreach and education. The Bushy Lake Project has recently been funded by the California WCB Lower American River Conservation Program to develop a conceptual restoration plan (CRP) for Bushy Lake. The CRP has the following goals: 1) protect, enhance and restore a sustainable habitat refuge for western pond turtles; 2) enhance habitat for culturally significant and fire resilient native flora and fauna; and 3) enhance the education and interpretation of resources in the American River Parkway, specifically showcasing tribal cultural use of the Parkway. We are experimenting with revegetation of culturally important native plants such as mugwort (*Artemisia douglasiana* or kachina in Mewuk) that have co-evolved with traditional fire management. Initial revegetation research results indicate that mugwort is not an umbrella or nurse plant species facilitating the germination and growth of companion native species. However, it does seem to exclude weedy species. We also present initial experimental results on competition between Western pond turtles (*Emys (=Actinemys) marmorata*), California's only native freshwater turtle, and the invasive red eared slider tur-

tles (*Trachemys scripta elegans*) (80% RES: 20% WPT). The ultimate goal of the CRP is to create a living culturally significant landscape of native species resilient to fire, a vibrant sustainable western pond turtle population, and to create wildlife-friendly public access, participatory citizen science and education.

35. LINDSTRAND III, L.[1], KIERSTEAD, J.A.[2], and TAYLOR, D.W.[3]
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Post-wildfire response of Shasta snow-wreath

Shasta snow-wreath (*Neviusia cliftonii*) is a rare shrub discovered in 1992 endemic to the southeastern Klamath Mountains in the general vicinity of Shasta Lake, Shasta County, California. The species currently holds a California Rare Plant Rank of 1B.2 and recent petitions have been submitted to the U.S. Fish and Wildlife Service and California Fish and Game Commission seeking species protection under the Federal and California Endangered Species Acts, respectively. Shasta snow-wreath is known to reproduce vegetatively and forms thickets of stems from its root system. Despite observations of developing achenes, no viable seed nor seedlings have been collected or observed. Little is known about the species' response to natural disturbances or land management activities. However, several populations include habitat subject to logging, a hiking trail, former roadways, and a small prescribed fire; this provides some insight regarding disturbance-related vegetative response. Habitats in the species' range have historically experienced frequent wildfires; however, while existing in a historically fire-prone landscape, no known Shasta snow-wreath populations have been subject to wildfire since its 1992 discovery. One of several wildfires occurring in northern California during 2018 burned two Shasta snow-wreath populations, including one in its entirety, and provided the first opportunity to monitor the species' response post-fire. Monitoring conducted during 2019 confirmed that Shasta snow-wreath responds to wildfire by vegetative reproduction; however, no seedling response occurred. Considering wildfire is the most common natural disturbance within the species' range, this evidence suggests that Shasta snow-wreath reproduction may be restricted to only vegetative reproduction.

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Postfire, rare plant, and restoration data collection forms on Calflora, and negative data!

Tracking how plant populations change over time is valuable information. Calflora's free customized data collection forms for restoration, rare plants, and postfire response make tracking change over time possible. Users may also now log negative data, or the absence of certain species, within a specific area. Calflora now has history stack capability, meaning that any observation may be re-visited again at a later date to re-assess the population, and the condition noted in the stack. Envision a stack of polygons, with the one on the bottom the root record in the history stack, the oldest observation. The newest or most recent observation and assessment is at the top. If the species has been extirpated, that can also be recorded as negative (absence) data in Calflora. Use Calflora to see how plant populations are changing after a fire, where rare plants are, during and after restoration, and in general.

37. WHITTALL, J.B.[1], THOM, A.[1], NIEDERER, C.[2], and WEISS, S.[2]
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Juggling jewelflowers – The role of flower color in determining taxonomic boundaries, conservation status and restoration priorities for Coyote Ridge *Streptanthus*

We provide updates on the "good news" of the reintroduced populations of the white-flowered Metcalf Canyon jewelflower (*S. albidus* ssp. *albidus*) atop Tulare Hill. In 2014, over 144,000 seeds were planted in grazed and ungrazed plots at four blocks in the serpentine grasslands of Tulare Hill in southern Santa Clara County. After two growing seasons, we recorded 1,160 reproductively mature plants that produced

4,050 siliques and ~137,700 seeds (95.6% seed recovery). There was high variation in silique production per plot. Approximately 50% of the siliques were produced by 4% of the plots and 90% of the siliques were produced by just 17% of the plots. Although there was a weak negative effect of grazing on survival from juvenile to adult stages, the widespread lack of significant correlations with other ecological variables suggest that unmeasured microsite characteristics are key to re-establishing Metcalf Canyon jewelflower at Tulare Hill. More recently, we have turned our attention to the closely related, and comparably rare, pink-flowered most beautiful jewelflower (*S. albidus* ssp. *peramoenus*). We have been investigating the evolutionary and ecological distinctiveness of this controversial taxon including hybridization studies, flower color quantification, flavonoid biochemical analysis and the first report of the sepal transcriptome in these rare taxa. The consistent differences in sepal color and geography between the Metcalf Canyon and most beautiful jewelflowers support continued recognition of these rarities as distinct taxa. Developing a field-ready tool for reliable taxon identification based on sepal color is our next challenge.

ABSTRACTS FOR POSTERS

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Desiccation Tolerance of Western Sword Fern (*Polystichum munitum*) Gametophytes across the Coast Redwood Forest Ecological Gradient

Ferns are an integral component of biodiversity and productivity in the coast redwood understory and canopy. Given that summer fog is expected to decrease and winter precipitation patterns are predicted to change, it is vital to understand the role of microclimates and adaptation strategies utilized by ferns in the coast redwood ecosystem in order to gauge how the distribution, community dynamics, and reproductive success of ferns may be affected in the coming decades. While fern sporophyte water relations are well studied, research is still needed to understand how microclimates influence sporophyte production and the water retention abilities of gametophytes. Little is known about the abilities of terrestrial fern gametophytes to tolerate and recover from desiccation. However, evidence suggests the degree of tolerance correlates to environmental moisture niches within the sporophyte generation and plays a role in water holding capacity. The specific aims of this study are (1) to compare desiccation tolerance (DT), recovery rates, and morphology of western sword fern (*Polystichum munitum*) gametophytes from different biogeographic regions and (2) to examine microclimatic differences for the biogeography of *P. munitum* within the coast redwood forest. We will rear gametophytes from spores collected from five regions and subject them to a series of drying intensities. We will measure photochemical efficiency (F_v/F_m) to compare DT and recovery ability across biogeographic origins. This novel project will illustrate how terrestrial gametophyte physiology relates to biogeography.

2. **BENTON, B.E. and SCHNEIDER, A.C.**
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Untangling a Mistaken Identity: Describing the Two Species within *Aphyllon fasciculatum*

A recent phylogenetic study of the western hemisphere broomrapes (genus *Aphyllon*) showed strong support for a non-monophyletic *Aphyllon fasciculatum*. Undescribed lineages correspond to unique host preferences, but similarities in overall morphology have hindered taxonomic revision. We collected and analyzed morphometric data from 95 herbarium specimens and 61 iNaturalist observations across the geographical range using principal component analysis and multiple correspondence analysis, respectively. Overall, we found a high degree of overlap in physical characteristics, but the plant coloration, shape of the corolla lobes, calyx cup depth, and calyx lobe length of the two species currently recognized as *A. fasciculatum* were distinctive. This information will support our forthcoming description of a new species within the genus *Aphyllon* and the creation of a field-appropriate dichotomous key.

3. **BERRY, M.[1], MONAHAN, C.[1,2], BYKERK-KAUFFMAN, A.[1], and WEIXELMAN, D.[3]**
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Water Table Height and Vegetation Composition of Wetland Obligate Species in Response to Restoration in a Montane Meadow, Northern California

Restoration of hydrologic function in meadows is a way to improve habitat and to ensure resiliency for climate change. Wet Meadows are groundwater-dependent systems that rely on shallow water-table depths and are more common in gradual sloped valley bottoms. A shallow water table is critical to meadow function and for a multitude of ecosystem services, such as flood attenuation, water quality improvement, water storage, habitat preservation, and nutrient cycling. This study investigates the linkage between water table height and vegetation composition, specifically the percent wetland obligate/facultative species. Real-time groundwater data and surface water stream gauge measurements will be coupled with vegetation transect data and high-resolution drone imagery. These data can be used to monitor the effectiveness of restoration techniques over time. The study area is in Red Clover Valley, CA, a ~1,250-hectare degraded meadow that has been grazed for over 100 years. Two types of restoration techniques were implemented in the study area in 2018 and 2019: Beaver dam analogs and grade control structures. Both techniques abate stream incision and subsequently reconnect the groundwater table to the floodplain. Post-restoration, an increase in wetland obligate/facultative species is expected, as is a significantly elevated water table, which should increase hydrologic connectivity and the amount of water available to the root zone. Additional meadow restoration sites with similar attributes will be assessed for similar post-restoration trends to inform future meadow restoration and restoration monitoring techniques.

4. **CARTER-ERVIN, R.M.[1], GREWELL, B.J.[2], FUTRELL, C.J.[2], and REICHOLF, R.A.[2]**
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Invasive Alligator Weed (*Alternanthera philoxeroides*) Expands Range in Northern California

Alligator weed (*Alternanthera philoxeroides,* Amaranthaceae) was discovered in the Suisun Marsh in late 2017. This population was the first in Northern California, and in 2018 several population patches were found in the lower Sacramento River and the Delta. Potential upstream source populations were unknown. In 2019, several new infestations of alligator weed have been discovered along a 23-mile section of the Feather River, from about 7 miles south of the Oroville Dam south to the city of Live Oak. The densest patch observed is near the Feather River Outlet Boat Ramp just south of Oroville, California. So far, a total of 44 locations have been mapped within the Feather River and it is assumed that there are many more. Alligator weed has a "High" Cal-IPC rating and an "A" CDFA Pest Rating. It spreads rapidly by clonal shoot fragments to invade lakes, streams, canals, ponds, and irrigation ditches and is fast growing. A rapid management response is needed to reduce negative impacts on flood conveyance, water deliveries, and endangered species habitat.

5. **CROWE, R.E., and PARKER, V.T.**
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The Morphological and Ecological Variation of *Arctostaphylos* (Ericaceae) Fruit: A Link between Plant Ecology and Animal Foraging Behavior

Persistent soil seed banks are characteristic of *Arctostaphylos* (Ericaceae) species in the Mediterranean-climate California Floristic Province. While most species are obligate seeders, regeneration of stands of

all *Arctostaphylos* species ultimately depends on post-fire seedling recruitment. *Arctostaphylos* seed banks are created, in large part, by scatter-hoarding rodents. Seeds produce sufficient rewards (nutritious mature embryo) to entice rodents to disperse and ultimately bury seeds in the soil. Hard seed coats increase the time required to extract the embryo, encouraging rodents to choose storage over immediate predation. Therefore, variation in fruit morphology should impact the *Arctostaphylos*-rodent interaction. We assessed the variation of fruit endocarp fusion and viability among *Arctostaphylos* species. Generalized mixed effects models were used to determine the factors contributing to variation in fruit endocarp fusion and viability. Factors such as latitude, elevation, life history, ploidy, and phylogenetic position were considered in our analyses. Our results indicate that fruit volume and shape are the most important variables affecting endocarp fusion and seed viability. Additionally, environmental factors show weak correlations and are not predicted to impact fruit endocarp fusion or viability. These findings provide insight into strategies used by plants to increase reproductive success via scatter-hoarding rodents. Our study benefits the conservation and restoration of *Arctostaphylos* stands by emphasizing the importance of animal-mediated dispersal and providing estimates of seed viability for fifteen taxa. The preservation of the relationship between plants and animal foragers is crucial for the continued survival of *Arctostaphylos* and California's evergreen chaparral.

6. ELWOOD, E.[1], ESKELINEN, A.[2], and GREMER, J.[1]
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The Role of Seed Traits in Determining Community Shifts Following Nutrient and Water Addition in a Serpentine Grassland

Global changes, such as climate change and nutrient enrichment are altering precipitation and nutrient dynamics, which significantly impact the composition and diversity of plant communities. Soil seed banks and dispersal strategies are important drivers of annual grassland community composition and may shift with environmental variability. Californian serpentine soils are home to endemic plant communities which maintain a high level of diversity. Past research in this system demonstrates that increased rainfall with nutrient addition alters the composition of both the above ground plant communities and the soil seed banks, leading to high species turnover and reduced diversity. Species traits that influence persistence and dispersal such as seed mass and shape may be key predictors for community responses. Here we ask how strongly shifts in community composition under nutrient and water addition correlate with seed traits. Results indicate that seed mass varies by habitat type where community weighted seed mass is higher in non-serpentine soils and increases in serpentine soils under nutrient and water addition. Understanding which traits are most important for predicting plant community responses to abiotic changes will inform restoration and conservation efforts.

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Species Boundaries in Two Northern California Monkeyflowers

Recently diverged taxa are thought to maintain species boundaries via the evolution of reproductive barriers. Pre-zygotic barriers such as divergent habitat, flowering phenology, and floral morphology work additively with post-zygotic barriers such as hybrid sterility or inviability to reproductively isolate species. The close relatives *Mimulus guttatus* and *Mimulus glaucescens* broadly overlap in range, have similar flower morphology, and flower at the same time. Thus, no barrier to interbreeding is apparent, and they freely interbreed in the greenhouse. However, the two species are not known to hybridize in nature. Previous research characterized fourteen potential barriers to reproduction, but did not find complete isolation. Thus, either unmeasured barriers exist or hybridization occurs in nature. I will conduct reciprocal transplant studies with parent species and hybrids to test the hypothesis that microhabitat is a reproductive isolating barrier. In addition, I will collect tissue from natural populations to test the hypothesis that intro-

gression occurs in nature. Finally, I will collect data on bract shape, glaucous coloration, and trichome density in greenhouse-grown parents and hybrids to determine the genetic basis of taxonomically informative traits. Ultimately, elucidating the relationship between *Mimulus guttatus* and *Mimulus glaucescens* will provide insight into the process of speciation as well as the evolutionary history of this diverse genus.

8. FINCH, B.
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Ecology and Distribution of a Disjunct Population of *Lewisia leeana* (Montiaceae), Eastern Fresno County

The purpose of the study is to determine the ecology and map the distribution of the disjunctive population of *Lewisia leeana* in eastern Fresno County. Mapping has been carried out during 98 hiking days in 2013-2019 which included photographing, establishing location with GPS, and posting to iNaturalist. The ongoing baseline study focuses on expanding the five areas where 15 observations of *L. leeana* were made from 1900 through 2006. I have posted a total 610 observations of *L. leeana* to iNaturalist. *L. leeana* is almost always found in soil of granitic origin on north facing slopes at elevations greater than 2600m, and it shows no consistent associations with any other organisms. An additional 3,151 other plants and fungi (180 species) have been identified during the study and posted to iNaturalist. Continued study of the distribution of *L. leeana* may help monitor effects of climate change. I recommend follow-up monitoring of key locations every five years.

9. GARAVENTA, J.M.
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Seed Rain, Seed Predation and Seed Bank Dynamics of *Adenostoma fasciculatum*

The principle chaparral dominant in California, *Adenostoma fasciculatum,* is broadly distributed and provides habitat and food resources for a large animal community. The effects of climate change, including increased temperatures, fire frequency and severity, have placed pressure on habitats in California. It is important to investigate the potential resiliency of *A. fasciculatum* by providing greater detail on the life-history phases and plant-animal interactions. In this study we focus on potential stand regeneration by seed using a series of experiments to document the length and quantity of seed rain and seed predation; by parsing the importance of the community of granivores; and by determining the connection between stand age and germination rate from persistent soil seed banks. Our research documented seed rain duration and multiple species of seed predators; our results point to the probability of native ants playing a role in the seed dispersal process. This is important given the recent advancement of the invasive Argentine ant (*Linepthema humile*) into Californian chaparral. We also documented that a mid-aged stand had higher germination rates than others, and showed how seed banks play a major role in assuring resiliency following fire.

10. GEARY, M.[1], ADAMS, J.[2], BERGERON, N.[2], BOYD, J.[1], DEGROOT, N.[1], EDINGFIELD, M.[1], GEARY-TEETER, A.[3], HERNANDEZ, T.[2], HO, J.[2], KONG, B.[1], LEONARD, H.[2], MARTINYAK, M.[4], MO, J.[5], NESQUIZ, U.[1], and SALICCIA, E.[1]
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Coast Redwood Seedling Survival in Extremes of the Species Range

As California's climate changes, patterns of coast redwood *(Sequoia sempervirens*) seedling survival will influence genetic diversity in populations at extremes of the species range. Understanding seedling toler-

ance of microclimate factors can also help inform restoration efforts and future range predictions. Climate envelope models for coast redwoods based on Climatic Water Deficit (CWD) do not include moisture contribution from fog. Additionally, these models are based on adult distributions and may not reflect factors important for juveniles. Our team is working on a redwood seedling climate envelope model. Canopy cover is an important variable for seedling survival in hotter, drier redwood populations. Observations at our study sites suggested canopy cover estimates acquired with densiometers and CanopyApp were insufficient: young redwood frequency was higher in understory areas with northern gaps rather than southern gaps, even when percent canopy did not significantly differ. To determine if this pattern would require a different canopy analysis approach, we ran a six-month-long growth experiment with different distributions of shade coverage. Seedlings with a N-facing gap had significantly higher growth rates (and lower mortality) compared to seedlings with a S-facing gap, although canopy cover measurements were the same. Seasonal climate patterns of temperature and humidity also seem to be critical in seedling survival. At Pepperwood Preserve (Sonoma County), in a post-fire (2017) location, we observed large numbers of new coast redwood seedlings in spring of 2019 in a semi-shaded NE facing site. Our preliminary seedling monitoring study showed significant seedling mortality that peaked in late summer and early fall.

11. GILL, P., ATHWAL, S., CANTU, M., and WASELKOV, K.
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Population Genetics of the Widespread Perennial Wildflower *Phlox speciosa* Using Microsatellite Markers

Phlox speciosa is a perennial wildflower native to western North America, ranging from the Sierra Nevada of California to British Columbia and into the mountains of Idaho and Montana. Plants of this species have notched petals that range in coloration from white to bright pink and bloom during the months of April-June. They grow in diverse environments such as dry rocky ridges, mixed conifer forests, and sagebrush slopes. Many species of the genus *Phlox* have shown variation in chromosome number (ploidy level) across their geographic range, but interestingly, *P. speciosa* shows little variation in ploidy level across its wide geographic range. Lack of ploidy level variation means there may be a different explanation for the huge range of variation in morphology and ecology in this species. This study is working with six microsatellite markers that have been selected for analysis in *Phlox speciosa*. Extracted DNA from 26 populations that have been previously collected is being genotyped with the six microsatellites. The goal of this experiment is to determine whether there are cryptic species within *P. speciosa* that allow the plant to spread across its geographic range and show great variation in morphological and ecological traits. On another note, this project is very important in this day and age where climate change is a big issue, especially for plants that grow at higher elevations. *Phlox speciosa* grows at between 250-8000 feet in elevation, with many populations living between 4000-8000 feet, meaning it is particularly threatened by the warming climate.

12. GUJRAL, A., and CARTER, B.
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Ecology and Reproductive Biology of a Rare Redwood Forest Specialist, *Pedicularis dudleyi*

Dudley's Lousewort is a rare plant endemic to central California. The species distribution is limited to populations in the Santa Cruz Mountains and Monterey County. The ecology and reproductive biology of *P. dudleyi* was not well known, and both populations appear to be in steep decline. The objective of this study was to collect data on the life history and reproductive biology in order to inform conservation management. Using pollinator exclusion bags, we determined that the species is an obligate outcrosser. The primary pollinators are two native bees, *Bombus edwardsii* and *B. sitkensis*. Our observations indicate that the two bees visit flowers with similar frequencies. The main seed dispersers of the plant still remain unknown; however, our observations indicate that a native ant species, *Formica argentea*, and a wasp are potential seed predators. Additionally a mammalian herbivore, possibly black tailed deer, appears to be a major predator of inflorescences. A population census was conducted at Portola Redwoods State Park to gather baseline information for distribution patterns and life history phases. A litter removal

experiment was implemented to determine whether leaf litter negatively affects seedling recruitment in the following year. This study builds the foundation for a long-term restoration study by tracking the development of select individuals across all age classes in order to determine mortality and growth rates across space and time. Data collected on the ecological and reproductive mechanisms of *P. dudleyi* serve as vital information for conservation efforts.

13. HAYNES, A.F.
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Nighttime Stomatal Conductance and Transpiration in *Castilleja*, a Genus of Root Hemiparasites

It is generally assumed that plants close their stomata at night to limit water loss when there is no carbon to be gained from photosynthesis. Despite this, nighttime stomatal opening and consequent nighttime transpiration has been observed across many taxa and ecosystems. The phenomenon is not well understood, with proposed explanations ranging from "leaky" stomata to nutrient acquisition. Parasitic plants may aid our understanding of this process because their unique carbon-water tradeoffs theoretically should lead to nighttime transpiration. Instead of relying solely on photosynthesis, xylem parasites also derive dilute carbon from their host xylem, a source unaffected by darkness. Their access to host xylem also reduces the need to conserve water. Indeed, nocturnal transpiration has been observed in some xylem parasites but it has never been investigated directly or at a broad scale. Here I measured nighttime stomatal conductance in eight species of *Castilleja*, a widespread genus of hemiparasites that access host xylem via the roots, and common neighboring plants at eight sites in California. All the plants measured displayed some nighttime stomatal conductance, but on average nighttime stomatal conductance in *Castilleja* was 235% higher than in non-parasites, with values often in excess of 500 mmol H_2O m^{-2} s^{-1}. Only one species of *Castilleja* had a lower average nighttime stomatal conductance than its non-parasitic neighbor. These data demonstrate that many *Castilleja* commonly transpire at night, adding these root hemiparasites to the growing group of plants understood to open their stomata at night.

14. JURJAVCIC, N.L.[1], HALL, B.[2], HINSHAW, G.[3], RODRIGUEZ, K.M.[1], SPURLIN, S.[2], THOMS, R.J.[1]
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Two Special-Status Plants of the Pine Hill Preserve: Seed Treatment and Outplanting Success

The Pine Hill Preserve (PHP) in El Dorado County, CA, is a site of national significance for species diversity, containing over ten percent of California's plant species in just 7.5 square miles. The PHP is centered in a 47-square mile area of unique Rescue soils (classified within gabbro), and therefore contains a multitude of special-status plants and unusual plant communities. The PHP was established in 2001 with the mission to protect special-status plants, most of which were described in the last 50 years; this area therefore presents rich and relatively new botanical research opportunities. Fires burned in multiple parcels of the PHP in 2016. The Bureau of Land Management (BLM) is working to restore these areas and ensure they are not colonized by invasive, non-native plants. One three-acre site was chosen as a candidate site for re-introduction of special-status plants and two special-status species were planted into the burned area starting in 2018. Prior to planting, a literature review was conducted, and subsequently seeds were treated with methods either reported to have high success or to fill data gaps. Multiple rounds of treatments have been conducted for both species over the past two years and the treatment methods have been adjusted in an attempt to achieve higher success rates. Similarly, outplanting has proven to be challenging both for seeds and container plants and therefore adjustments to methods of planting, timing of planting, and maintenance procedures have been required.

15. POORE*, J., KANG, H.*, DEAN, E., and BERRY, T.
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A Vascular Flora of Antone Meadow and Burton Creek Natural Preserves, Northern Sierra Nevada, Placer County

The UC Davis Center for Plant Diversity collaborated with California State Parks during the summer of 2019 to create a flora of Antone Meadows and Burton Creek Natural Preserves. The Preserves are located within Burton Creek State Park, north of Tahoe City in the northwestern region of the Tahoe Basin. Together with volunteers and Park staff, we visited the site eight times from May to August collecting plants throughout their flowering season. Samples from our collecting trips are vouchered at the UC Davis Center for Plant Diversity. The resulting plant list of 245 taxa includes two special status species: subalpine aster (*Eurybia merita*) CRPR 2B.3, which is otherwise only reported from Siskiyou County, and obtuse starwort (*Stellaria obtusa*) CRPR 4.3. We also found a very unusual hybrid, Cascade Lake ceanothus (*Ceanothus* x *serrulatus*) which is a new Placer County record. There is a statewide (and nationwide) effort to describe vegetation based on gross structure and dominant species present. This floristic inventory serves as an important resource for local botanists and broadens our understanding of what plant communities, habitat types, and plant species occur in the Northern Sierra Nevada range. Select families from this collection will be digitized and available to view online due to funding from the California Phenology Project. Herbarium specimens hold valuable datasets and DNA that prove to be especially useful in our changing climate. Floras like this Vascular Flora of Antone Meadow improve our understanding of the biodiversity in California and climate change.

16. KEEVER, M.E., and RODRIGUEZ, K.M.
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Protecting Groundwater Dependent Ecosystems

Groundwater is a vital water supply resource in California—it is essential to agriculture, urban uses, and our flora and fauna. Until recently, there has been little regulation of groundwater, resulting in groundwater withdrawals in portions of California that far exceed their rate of replenishment. Unsustainable groundwater use can reduce groundwater levels, streamflow, and water quality, and therefore adversely impact native species, habitats, and groundwater dependent ecosystems (GDEs). In 2014, California enacted landmark legislation, the Sustainable Groundwater Management Act (SGMA), which requires basins to plan for sustainable groundwater withdrawals over the course of 20 years. As part of SGMA, local agencies also need to consider groundwater dependent ecosystems (GDEs). GDEs include nearly 400 mapped natural communities, many of which are habitat for rare plant, fish, and wildlife species. For example, coast redwood alluvial forests are a GDE that provides habitat for the endangered marbled murrelet, California giant salamander, and coho salmon. As part of Groundwater Sustainability Plan development, basins must identify GDEs in the basin and consider the effects of groundwater use on GDEs. Evaluating GDEs is a multidisciplinary effort that synthesizes hydrologic data, information on water quality, and ecological conditions of vegetation, fish, and wildlife. During this process, Stillwater has found that the quality of input data is critical to accurately assess GDEs. In particular, high quality vegetation maps, high resolution data or models of groundwater depth, and understanding groundwater-surface water interactions are crucial to protect ecological resources through SGMA.

17. LAMPE, L.
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Investigating How Climate-Related Phenological Shifts Affect Plant-Pollinator Interactions in Two Northern California Habitats

Phenology, or the timing of life history events, is often cued by climate and, in many species, has shifted in recent decades with climate change. Furthermore, many interactions between species are dependent on alignment of their respective phenologies. Plant flowering, for example, must occur during pollinator flight periods in order for pollination to be successful. It is also thought that alpine habitats may be especially sensitive to climate change; therefore, climate-related changes in communities may be unique in alpine areas. I will compare historical plant and pollinator collections with contemporary collections to evaluate whether phenological shifts associated with climate have occurred in selected Northern California bees and animal-pollinated plants, and whether any changes in phenology suggest that misalignment may be a concern. In addition, I will compare collections from alpine and low-elevation habitats to evaluate whether shifts in phenology or potential misalignments vary between these habitats. Finally, I plan to visit selected plant populations during their flowering periods to test whether the phenological changes as predicted from studies of collection records are also observed in the field. Further understanding of the potential for phenological misalignment, especially in communities at risk of habitat loss, will aid in predicting future impacts on species interactions and, by extension, biodiversity.

18. LAUDER, J.[1], REYNOSO, C.[2], STEPHENS, M.[3], LOMMEL, Y.[1], MORAES, O.[4], SANCHEZ, T.[5], SANTOS, A.[1], REYES, T.[6], DICKMAN, G.[7], GHEZZEHEI, T.[1], and SEXTON, J.[1]
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Small Beginnings: Implications of the Post-Fire Seedling Niche for Conservation and Management of Giant Sequoias (*Sequoiadendron giganteum*)

Giant Sequoia (*Sequoiadendron giganteum* [Lindl.] Buccholz) is an iconic fire-dependent California endemic tree species that has shown depressed recruitment over the last century, presumably due to altered fire regimes. Fire opens the serotinous cones and clears canopy gaps for successful seedling germination and growth. With prescribed fire increasingly being used as a management tool, identifying the ideal post-fire *S. giganteum* seedling niche can improve management outcomes. We leveraged the prescribed backburn in Tuolumne Grove in Yosemite National Park during the Rim Fire to examine post-fire *S. giganteum* seedling recruitment and define the post-fire seedling niche. We modeled counted seedlings and measured seedling height in canopy gaps as a function of measured burn severity, soil moisture, total insolation, duff depth, soil stable isotopes (^{15}N and ^{13}C), and percent cover of bare ground, small trees, moss, herbaceous vegetation, shrubs, woody debris, and rocks. Seedling density varied significantly across plots, and was best predicted by Sequoia cone presence, moss cover, burn severity, duff cover, and temperature. Seedling density was highest in plots with high burn severity, high moss cover, and high Sequoia-specific duff cover. Soil moisture and light environment were not significant predictors. Seedling height was best predicted by burn severity, woody debris and tree cover, and duff depth, and was not density dependent. Soil ^{15}N and ^{13}C did not predict seedling density or height, but varied relative to burn severity. Results demonstrate the significance of micro-habitat variation – including micro-topographical "seed collection zones" and litter recharge – in determining post-fire *S. giganteum* seedling success.

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A Case of Unusual Seedling Presence and Growth 10 Years after Fire in the Southern Coast Redwood Range, Santa Clara County, California

Coast redwoods (*Sequoia sempervirens*) predominately reproduce through basal sprouting. Seed viability and germination are typically low. In Mt. Madonna County Park, 103ha burned in 2008. Lazzeri-Aerts and Russell (2014) found an unusually high number of seedlings one year post-fire. In 2018, the same area was re-sampled to quantify seedling growth and ongoing germination. There were significantly ($p=0.035$) fewer seedlings in 2018 than 2009. However, there were significantly ($p=1x10^{-8}$) more redwood seedlings than those of associated tree species. The only factor that had a significant – but weak – relationship with number of seedlings was percent canopy cover ($p=0.003$, $r^2=0.322$). No relationship was found between number of seedlings and slope, aspect, soil moisture, percent ground cover, duff depth, number of redwood trees, and number of trees of any species. In 2009, all seedlings sampled were <0.5m. In 2018, 47.96% were <0.5m, 20.14% of seedlings were 0.5-1.0m, and 31.89% were >1.0m. When examining the tallest seedling of each sample plot, redwood made up 71% of tallest seedlings in 2009 and 59% in 2018. However, the mean height of the tallest redwood seedlings significantly increased ($p=3.45x10^{-5}$). While the overall number of redwood seedlings declined 10 years post-fire, many of the seedlings are flourishing and more continue to germinate. We know that coast redwood forests are highly variable with differences throughout the north-south, coast-inland, and elevation ranges. While this study provides no definitive answers on the cause of prolific seedling germination and growth at this site, future investigations may reveal important information for species conservation and climate adaptation. Seed germination and genetic analysis are suggested next steps.

20. LUONG, J.C.[+], HOLL, K.D., and LOIK, M.E.
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What Happens to Restored Coastal Grasslands?

Large economic and labor investments are dedicated towards grassland restoration. Despite this investment, restoration projects often self-identify as fund limited and do not have funds to monitor the restoration project post-implementation. Due to a lack of funding, little is known about the trajectory of grassland recovery after restoration. Between March – June, I surveyed 32 restored coastal grasslands ranging ~1000 km along the California Coast from Santa Barbara to Humboldt counties. Grassland restoration sites were only surveyed if they employed active planting or seeding methods. Sites ranged from 1-35 acres and 3-32 years in age since implementation. At each site, I collected plant community data using quadrats every 5-m along multiple transects (dependent on site acreage). I collected soil samples along each transect to determine soil texture, macro- and micronutrient concentrations, and soil carbon storage and respiration. I compiled project documents from all sites when project documents were available to determine project-specific goals and management practices. I created metrics for both project-based and standardized success to compare restoration success. In spring 2020, I will revisit the sites to determine productivity, carbon flux and interview restoration practitioners.

21. MACKEY, H.E., Jr.

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Digging up Dirt on Growth and Reproduction of *Dicentra uniflora* and *Dicentra pauciflora* (Papaveraceae), Both Ephemeral Geophytes, in Their Natural Environments in Northern California

Growth and development of *Dicentra uniflora* Kellogg and *Dicentra pauciflora* S. Watson (Papaveraceae), two ephemeral geophytes, were studied in the Cascade Mountains of California for a 10-year period from 2009 to 2019. In both plants, emergence is immediately after snowmelt and disappearance is usually within four to six weeks. Percent seed set in *D. uniflora* was high, but seed production was not observed in *D. pauciflora*. Field plantings of *D. uniflora* demonstrate that germination can occur in the winter, below the snow, with seedlings bearing a single cotyledon blade in the spring. These seedlings produce a tiny, below-ground bulblet before disappearing with the Mediterranean climate summer drought. Second-year plants produce a new bulblet and sometimes a tiny tuber, but only a single leaf. Mature flowering plants have one or two fusiform tubers, a cluster of numerous whitish bulblets, and one or two compound leaves which change in size and number of leaflets with increasing age. Field data indicate that it may take up to 20 years before an individual reaches flowering stage in *D. uniflora. Dicentra pauciflora* reproduces by rhizome growth and production of lateral bulblets along the rhizomes. Plantings of bulblets and rhizomes and field data suggest that it may take 10 years for *D. pauciflora* to flower. Thus, both of these geophytes are unique among the *Dicentra* with respect to the extended time required for them to reach flowering maturity.

22. COMPTON, R., CRAIG, D., DECKART, A., DYKSTRA, R., GREANEY, D., GRISSOM, K., LEDGER, D., LIVINGSTON, J., MARSH, P., MCCRARY, M.*, NELSON, J., PLAGA, T., and REBOL, P.

*presenter
www.nsclimateaction.org/about/contact

North State Climate Action

North State Climate Action (NSCA) is a new (15 month-old) group of citizen volunteers who want to facilitate the expeditious reduction of greenhouse gas (GHG) emissions from northern California. NSCA's Mission is to promote solutions addressing the climate crisis through education, collaboration and action in our communities. NSCA's Vision: North State governments, businesses, groups, and individuals weigh climate impact in all their activities. They support clean, renewable energy to create an environment that minimizes heat waves, drought and wildfires. Their actions promote a vibrant economy, and strong, healthy, resilient communities for ourselves and our children.

What you can do --

- Talk about it…by working together we can reduce the harm
- Choose to cut your GHG footprint to the max before 2030
- Be informed…visit www.nsclimateaction.org
- Express your concern to your elected officials
- VOTE in all local and national elections

No matter where we live climate change is affecting us and our beloved California native plants and ecosystems today.

23. MONAHAN, C., WEINBERGER, H., and KACZYNSKI, K.

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Post-fire Woody Seedling Regeneration: Impacts from Dozer Lines

With an increase in the frequency of large wildfires across California, questions are arising around how this impacts the recovery and regeneration of vegetation communities. Likewise, fire suppression techniques can lead to unintended ecological consequences. This project examines post-fire regeneration of

woody species and recovery in a dozer line. The studied species have adapted to fire, and some require fire for regeneration. We hypothesized that the dominant woody species in the burned areas will regenerate and communities in the dozer line will not recover. Excluding stump-sprouters, we counted the number of woody species seedlings that regenerated 18 months post-fire within three different vegetation communities within a dozer line, a burned area, and an unburned reference. Our results indicate that *Arctostaphylos viscida* and *A. manzanita* regeneration was high within the Manzanita communities. Within California Black Oak communities *Ceanothus integerrimus* and *Lonicera interrupta* were the dominant regenerating species, with an absence of *Quercus kelloggii* seedlings. The Wedgeleaf communities did not have *Ceanothus cuneatus* seedlings and instead were dominated by *C. integerrimus* and *L. interrupta*. Additionally, in both the California Black Oak and Wedgeleaf vegetation communities the abundance of *C. integerrimus* and *L. interrupta* seedlings was greater compared to the other woody species present. Within the dozer line, vegetation communities are not making an apparent recovery that resembles the pre-fire community composition. This suggests that the woody vegetation communities are not on track to regenerating into the communities they once were, indicating that dozer lines can have a large impact on the post-fire woody vegetation community.

24. MOUNTS, I.R., and BAXTER, J.W.
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The Role of Common Mycorrhizal Networks in Ameliorating Drought Stress in *Pseudotsuga menziesii*

Although mycorrhizal fungi connect plants belowground via a common mycorrhizal network (CMN), it is not known whether these networks can transport water from nurse trees to receiver seedlings under drought conditions. I examined the role of a CMN in ameliorating plant drought stress by testing the hypothesis that *Pseudotsuga menziesii* (Douglas-fir) connected via a CMN will experience reduced effects of drought compared to trees not connected to a CMN. To test this hypothesis, I compared photosynthetic, transpiration, and stomatal conductance rates of Douglas-fir seedlings connected via a CMN to a nurse tree during an experimental dry-down. Mesocosms were constructed to apply four water pathway treatments: 1) Mycorrhizal+Soil; 2) Mycorrhizal only; 3) Soil only; and 4) No pathway. No significant differences in transpiration, stomatal conductance, and net photosynthetic rates of Douglas-fir receiver seedlings during dry-down were observed within or among the four treatment pathways. A significant decline in stomatal conductance and net photosynthesis was detected, but no difference was found in transpiration rate. There is circumstantial evidence that a CMN did not establish between trees. Consequently, the results of this experiment are inconclusive. Although these results may indicate that CMNs do not function to reduce drought-stress in plants, numerous unforeseen contingencies probably masked the detection of treatment effects. These issues could be addressed with methods to confirm the establishment of a CMN, the use of mycorrhizal spores more likely to form a CMN, an increased sample size, the use of a different tree species, and modifications to experimental design.

25. PENNINGTON, L.K., and SEXTON, J.P.
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The Effects of the 2013 Rim Fire on White Fir Seedlings in the Sierra Nevada Range

Fire is important for forest health and regeneration, but the effects of prescribed fire on forest regeneration after a wildfire is still poorly understood. The Rim fire started in mid-August 2013 and wasn't fully contained until late October that year. In that time, it burned over 250,000 acres of land in the Sierra Nevada with varying severity due to the differing amount of fuel loads across the mountains. Fire combusts organic material, returning nutrients like carbon and nitrogen to the soil in a form that is useable by plants; immediately following a fire, there is an increase in foliar nitrogen. The summer following the Rim Fire I looked at white fir seedling recruitment in burned areas with different burn histories (prescribed burned and then burned in the Rim Fire, and unburned before the Rim Fire) and burn severities (lightly to severely burned in the Rim Fire) to address two questions: (1) Is seedling recruitment different

among burn histories and severity? and (2) Does fire severity and history affect seedling nutrient uptake? I found that although burn severity had a significant effect on seedling recruitment, burn severity and history did not have a significant effect on nitrogen and carbon uptake, nor on the amount of C13 and N15 in seedlings. These results suggest that the ability for forests to regenerate after fire depends on the severity of burn experienced, and that prescribed fires may become more important as wildfires become more prevalent, to reduce fire severity.

26. POWELL, R., FERGUSON, K., and LAZAR, K.
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Submitting Data to the California Natural Diversity Database

The California Natural Diversity Database (CNDDB) is a program in the California Department of Fish and Wildlife (CDFW) that tracks the status and locations of rare plants and animals in California. We are only as good as the data we receive which is why it is so important for us to receive data from those on the ground (including federal and state agencies, private consultants, non-profit organizations, and the general public). CNDDB tries to make data submission as easy as possible by providing multiple ways of submitting data to us. This poster provides an overview of our data submission options, highlighting two of the newest ways that data can be turned into CNDDB via Calflora and iNaturalist. While data from Calflora and iNaturalist is not directly submitted to CNDDB at this time, data entered into Calflora can be extracted and submitted to CNDDB, while data on iNaturalist can be added to the CNDDB iNaturalist project thereby giving CNDDB access to the data.

27. RINKERT, A.[+1], SALMAAN, A.[2], MISIEWICZ, T.M.[3], CARTER, B.E.[1], WHITTALL, J.B.[2]
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Bird Nests as Botanical Time Capsules for Lost Habitat

Transitional habitat, the gradient between the tidal marsh and adjacent uplands in the San Francisco Bay estuary, is an important refugium for many threatened species. This habitat is only inundated by saltwater during annual extreme tides, which creates unique edaphic conditions that support both halophytic and upland plants. By the early 1900s, all transitional habitat was lost from drastic changes in land use. As a result, there are no extant reference sites. Few herbarium specimens were collected from this habitat and only one historical description exists. This knowledge gap is limiting the effectiveness of ongoing restoration efforts across the estuary. Fortunately, early naturalists collected bird nests from transitional habitat before it was lost. The ancient nests constructed by tidal marsh subspecies of Song Sparrow (*Melospiza melodia*) and Savannah Sparrow (*Passerculus sandwichensis*) comprise plants from transitional habitat. The irreplaceability of the ancient nest specimens precludes traditional methods of analysis. Previously we used Sanger sequencing to identify plants in nests collected in 2003 and 2018. We have applied this same approach to identify plant species from two sparrow nests collected in the estuary in 1904. Preliminary results have identified plant material from a clade of closely related Old World *Rosa* species. However, our results have revealed the plant DNA in ancient nests is highly degraded, which prohibits PCR amplification of the nrITS region used to identify species. These preliminary results identify a technical challenge that will need to be overcome to access the rich ecological information contained in ancient nests.

28. ANDERSON, S.[1], BIRKER, C.[2], BURKE, M.[3], FORBES, H.[4], FRAGA, N.[2], GURNOE, T.[5], HALL, B.[6], HEINEMAN, K.[1,7], HORN, C.[1], HANDLEY, V.[4], MAGNEY, D.[8], MEYER, E.[9], MASCHINSKI, J.[1,7], O'BRIEN, B.[10], PATTEN, A.[8], SCHNEIDER, H.E.[11], SIMS, A.E.*, and STILL, S.[3]

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California Plant Rescue: A Collaborative Program to Safeguard the Diversity of the California Flora

California Plant Rescue (CaPR) is a collaboration of not-for-profit botanical institutions with a collective goal of conserving the wild plant species of California and the California Floristic Province primarily through field work and long-term seed banking. Our long-term goal is to secure the entire California flora in conservation collections, with an emphasis on seed banking. For the year 2020, CaPR is actively working to meet the conservation goals outlined in the Global Strategy for Plant Conservation of the Convention for Biological Diversity. Our principal focus is to fulfill Target 5 of the Strategy, which is to secure at least 75% of threatened plant species in secure ex situ, or off-site, collections, with at least 20% available for recovery and restoration programs. Within California, 1,177 vascular plant taxa have been ranked as rare, threatened or endangered in California and elsewhere (California Rare Plank Rank 1B) in the *CNPS Inventory of Rare and Endangered Plants* and form the basis of this target for the state. With approximately 63% of taxa already conserved in ex situ collections, Target 5 is within reach for California – a significant achievement in one of the world's biodiversity hotspots.

29. STEWART, S.[+], and BYRNE, K.

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The Impact of Invasion and Removal of *Lupinus arboreus* on Seed Abundance in Coastal Sand Dune Environments

Coastal sand dunes along the Pacific Northwest are a unique environment with harsh conditions for plant survival. Dune vegetation has adapted to the low nutrient levels and constantly shifting sands of the coastal sand dunes. The invasive plant species, *Lupinus arboreus*, has modified conditions to be more favorable to a wider variety of plants, mostly other invasive species. This study examined how *L. arboreus* has impacted forb and graminoid abundance within the dune seedbank, germination rates of each morphology type, and the percentage of samples containing each morphology. We collected samples from three sites: a *L. arboreus*-invaded site, a restored site, and a non-invaded site. Results of the study indicated that there was no significant difference in any of the morphological abundances at each site except when compared to each other ($p<0.001$). Forbs were much more plentiful than graminoids. Future studies should be aimed at species abundances and not just morphological abundances. This study is aimed to help restoration ecologists determine what coastal vegetation can be expected to grow and how fast the vegetation recovers after restoration of coastal sand dunes.

30. LUU, L.[1]*, WEAVER, T.D.[1]*, EDLUND, M.[2], ROBISON, T.[3], SIMENC, M.C.[1], BONILLA, E.[1], SOSA, J.[1], SU, H.[4], NEUBIG, K.[5], PETERSEN, G.[2], NICKRENT, D.L.[5], and DER, J.P.[1]
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Chloroplast Genomes in the Parasitic Sandalwood Order

Parasitic plants exploit their hosts for water and nutrients, often resulting in a decreased reliance on photosynthetic processes. Increased levels of parasitism and relaxed evolutionary constraint often result in dramatic changes to the chloroplast genome (i.e. plastome). We sequenced plastomes in Santalales to explore the evolution of parasitic plant genomes. Santalales is an order of angiosperms containing over 2000 species in 18 families, with species representing all ranges of parasitism, from nonparasitic to hemiparasitic and holoparasitic. We hypothesize that species with increased specialization and host dependence (e.g. mistletoes and holoparasites) will have lost more plastid genes compared with non-parasitic or generalist root parasites in the order. We used Illumina shotgun sequencing to extract and assemble plastomes for 50 representative species in Santalales. Preliminary assembly and gene annotations were used to construct a phylogeny of 45 species and to examine chloroplast gene loss across the order. A secondary assembly constructed using NovoPlasty resulted in a higher quality genome sequence and was used in subsequent analyses. Genomes were aligned to existing Santalales plastomes using Mauve (implemented in Geneious) and used to manually annotate genes. Our phylogenomic analyses show strong support for major clades in Santalales and are consistent with previously published results; however, relationships among some clades remain unresolved. There is a strong pattern of *ndh* gene loss associated with increasing levels of parasitism. We present complete plastome assemblies and detailed gene annotations for five species in Santalales.

31. WEINBERGER, H.S., and KACZYNSKI, K.M.
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Dozer Line Post-fire Plant Community Recovery

As wildfires increase in extent and intensity and threaten local communities, active suppression tactics are important, including creation of dozer lines. Post-fire rehabilitation of these sites primarily focuses on erosion control, and minimal research exists on the plant community trajectory. We studied the 32 Fire located east of Chico, CA. To assess recovery, we established plots in four vegetation types: Annual Grassland & forbs, California Black Oak, Manzanita and Wedgeleaf Ceanothus. Locations were stratified randomly based on three levels: burned, unburned reference, and disturbed dozer line. In the dozer line 18-months post-fire, Manzanita and Wedgeleaf Ceanothus vegetation types did not have primary species found in similar unburned or burned sites. Bray-Curtis Index results comparing similarities of species cover 6-months and 18-months post-fire, respectively, indicate Wedgeleaf dozer line was only 8.2% and 6.5% similar to unburned Wedgeleaf plots. Manzanita dozer line was only 5.1% and 9.3% similar to unburned Manzanita. Dozer line had a higher percentage of non-native species cover, compared to respective burned and unburned areas. Post-fire regeneration of Manzanita and Wedgeleaf species on site occurs from seedbank, so future recruitment in these areas is unlikely, suggesting that dozer line sites are on a trajectory away from original vegetation type.

LIST OF COMMON ACRONYMS

Found in Abstracts of Talks (starting on page 7)
and Abstracts for Posters (starting on page 21)

C13 or ^{13}C	isotope of carbon with molecular weight of 13
Cal-IPC	California Invasive Plant Council
CDFA	California Department of Food and Agriculture
CNPS	California Native Plant Society
CPC	Center for Plant Conservation
CRPR	California Rare Plant Rank
GDEs	Groundwater Dependent Ecosystems
GED	General Education Diploma
GPS	Global Positioning System
ha	hectares
ITS	Internal Transcribed Spacer
mmol H_2O m^{-2} s^{-1}	milli-mol (1/1000 mol) of water per square meter per second
N15 or ^{15}N	isotope of nitrogen with molecular weight of 15
NCB	Northern California Botanists
ndh gene	gene for making NAD(P)H dehydrogenase; found in chloroplast DNA
NEPA	National Environmental Policy Act
nrDNA	nuclear ribosomal DNA
nrITS	Nuclear Ribosomal Internal Transcribed Spacer
PCR	polymerase chain reaction (method of making multiple copies of a DNA segment)
pg/2C	pg = picogram [one trillionth of a gram] (of DNA); 2C = twice the C-value. C-value indicates "DNA amounts of nuclei by multiples of the DNA amount in a complete chromosome set in a non-replicated haploid nucleus, which has the class C DNA amount" (from online source). So 2C is twice that amount of nuclear DNA.
RES	Red-eared slider (a type of turtle)
WCB	Wildlife Conservation Board
WPT	Western pond turtle

INDEX OF AUTHORS

Talk abstract page numbers in **bold**; poster abstract page numbers in *italics*

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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.

California Department of Conservation
Representatives: Carol E. Atkins and Claire Meehan
Website: www.conservation.ca.gov • Email: carol.atkins@conservation.ca.gov
The Department of Conservation's Division of Mine Reclamation provides a measure of oversight for local governments as they administer the Surface Mining and Reclamation Act (SMARA) within their respective jurisdictions. While the primary focus is on existing mining operations and the return of those mined lands to a usable and safe condition, issues relating to the abandoned legacy mines are also addressed. Environmental Scientists and Geologists with the Division review and provide written comments on mine reclamation plans, as well as conduct field investigations as needed to evaluate the practicality of proposed reclamation. Additionally, the Division is charged with locating, inventorying, and assessing the State's abandoned (pre-1976) mines, as well as remediating hazardous abandoned mine features.

California Department of Fish and Wildlife
Representatives: Jeb Bjerke and Raffica La Rosa
Website: www.wildlife.ca.gov • Email: nativeplants@wildlife.ca.gov
The California Department of Fish and Wildlife (CDFW) is responsible for the conservation of California's vast and diverse botanical resources. Within CDFW, several programs are dedicated to achieving this goal. The Native Plant Program evaluates petitions to list plants under the California Endangered Species Act, issues scientific permits for state-listed plants, and coordinates statewide plant conservation efforts. The California Natural Diversity Database is a natural heritage program that curates location and natural history information on special status species and natural communities, which can be used for project planning. The Vegetation Classification and Mapping Program develops and maintains a standardized vegetation mapping system throughout California and implements it through assessment and mapping projects in high-priority conservation and management areas. Additionally, CDFW's regional offices are split among seven geographic areas, designated to protect localized sections of California. Each CDFW Region works locally to conserve natural resources by facilitating and regulating activities in their specific region.

California Native Grasslands Association
Representative: Michele Hammond
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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 degradation. 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 and Andre Clemente
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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.

F.M. Roberts Publications
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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 2019 California lilies (*Lilium*) design, my new eastern California mariposa lilies (*Calochortus*) T-shirt, and the always popular northern California mariposa lilies designs.

Friends of the Chico State Herbarium
Representative: Elena Gregg
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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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(530) 823-3151 • Website: www.garciaandassociates.com •
Email: sdewar@garciaandassociates.com
Garcia and Associates is an environmental consulting firm with more than 140 scientists, planners, GIS specialists, and support staff. We assist both public and private clients on a broad range of projects throughout the western United States and the Pacific. From planning, design, and permitting to implementation, we help move projects forward through the complexities of regulatory compliance, budgetary and schedule constraints, and conflicting stakeholder interests. We have completed projects that range from multi-year, million-dollar planning or impact studies for large facilities to focused field surveys with short deadlines and limited budgets. Headquartered in San Anselmo, we also have regional offices at Auburn, Oakland, San Francisco, San Rafael, Concord, Los Angeles, Lompoc, San Diego, Roseville, Bozeman, Guam, and Hawaii.

Hedgerow Farms
Representative: Patrick Reynolds
(530) 662-6847 • Website: 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, and sedge species, including many bioregional ecotypes. We also provide native grass transplants, native straw, project design assistance, and contract growing.

Mattole Restoration Council
Representatives: Veronica Yates and Lisa Hintz
(707) 629-3514 • Website: www.mattole.org • Email: mrc@mattole.org
The Mattole Restoration Council is one of North America's oldest community-led watershed restoration organizations. Established in 1983, the Council's primary mission is to understand, restore and conserve the ecosystems of the Mattole River watershed. The Council is a non-profit 501c3 that provides restoration design and implementation services, such as mapping, seed collection, and native plant materials for private landowners, resource management agencies, and other local conservation and education organizations.

San Francisco State University Sierra Nevada Field Campus
Representative: Diane Cornwall
Website: www.sierra.sfsu.edu • Email: dancingwildflowers@me.com
San Francisco State University Sierra Nevada Field Campus (SNFC) is dedicated to promoting an understanding and appreciation of the biological diversity, geosciences, hydrology, astronomy, plain air art and written word in the Gold Lakes Basin and Sierra Valley regions of the Sierra Nevada through education and research. Classes are open to the general public from late May to mid-August. Students enjoy rustic accommodations and tasty meals. SNFC is set at 5500', near Sierra Buttes and Lakes Basin. The North Fork of the Yuba River runs right through the campus. Registration for classes opens the first day of January.

Shasta-Trinity National Forest
Representatives: Lusetta Sims, Brenna Montagne, and Martin Lenz
Website: www.fs.usda.gov/stnf/ • Email: lusetta.sims@usda.gov • Facebook: @ShastaTrinityNF
The Shasta-Trinity National Forest is the largest National Forest in California managed by the U.S. Forest Service. The 2,210,485 acre combined-forest encompasses five wilderness areas, hundreds of mountain lakes, fens, and 6,278 miles of streams and rivers. The mission of the USDA Forest Service is to sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations. The Shasta–Trinity forests lie at the intersection of the Eastern Klamath Mountains and the Southern Cascades. The land is largely forested, though at low elevations there are areas of chaparral, woodland, and grassland. At high elevations in the Trinity Alps, Eddys, and Mt. Shasta, forest gives way once again to montane chaparral, subalpine woodlands, and ultimately to alpine rock and scree. The Klamath-Siskiyou Mountains are considered a center of diversity and endemism. Some species or species assemblages occur in this geographic area and nowhere else in the world. Much of the area's diversity is attributed to the extensiveness of serpentine landscapes and the endemic species they support.

- Botanical Special Interest Areas - The US Forest Service has established a series of Special Interest Areas (SIAs) to conserve unique areas of the National Forests. Botanical SIAs have been specifically designated to conserve and manage unique botanical communities, rare species, or other elements of biological diversity, and to provide for public enjoyment of these areas in a manner that is consistent with the values for which the area was established.

- Research Natural Areas - Research Natural Areas (RNAs) are a part of a national network of ecological areas designated in perpetuity for non-manipulative research and education, and to maintain biological diversity on National Forest System Lands.

SHN
Representatives: Sean Rowe and Joseph Saler
Website: www.shn-engr.com • Email: srowe@shn-engr.com
SHN is a California Small Business Enterprise that provides civil and environmental engineering, geosciences, surveying, planning, and biological services to public and private entities. From our offices in Arcata, Eureka, Redding, and Willits, California, and Coos Bay and Klamath Falls, Oregon, we specialize in assisting clients in rural communities. We understand the logistical challenges of working in remote locations and the financial and funding challenges that many small municipalities face. To get a more complete idea of who we are, please visit our website at shn-engr.com.

Siskiyou Field Institute
Representative: Kathleen Pyle
Website: www.thesfi.org • Email: programcoord@thesfi.org
Siskiyou Field Institute's mission is to provide environmental education about the Klamath-Siskiyou ecoregion. We offer natural history workshops at our headquarters in southwest Oregon and in California's northwest and northeast counties.

WRA, Inc.
Representatives: Rhiannon Korhummel and Aaron Arthur
Website: www. Wra-ca.com • Email: info@wra-ca.com
WRA, Inc. provides professional consulting services in plant, wildlife, and wetland ecology, regulatory compliance, mitigation banking, CEQA/NEPA, GIS, and landscape architecture. Formed in 1981, we are a certified small business (OSBCR ref. #13333) with more than 90 professionals who have completed projects for public agencies, non-profit, and private organizations. WRA has a wide range of project experience in a variety of region-specific habitats throughout California. Botanical surveys of sensitive plant species and vegetation communities for use in project initiation and planning is a core WRA service. Our team of botanists has extensive experience conducting plant surveys according to protocols required by state and federal agencies: we prepare Biological Resources Assessments, Mitigation and Monitoring Plans, and Long-term Management Plans for the U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, and California Department of Fish and Wildlife in compliance with state and federal Endangered Species Acts. Our team works in a variety of protected habitats across California including native needlegrass grassland, riparian, oak woodland, coastal scrub, tidal marsh, and more.

Evaluation of 2020 Northern California Botanists Symposium

We'd love to hear your thoughts about our 10th Symposium – we actively use ideas from these evaluations for planning future events! Please either

1) fill out this form and place it in the "Evaluations" box before you leave;
2) fill it out online with Survey Monkey at https://www.surveymonkey.com/r/CGTR5B7 or use the QR code; or
3) follow the link on the email you will receive.

Please circle the number that best fits your opinions. Space is provided in each section for comments:

GENERAL CONFERENCE

	Poor	Fair	Acceptable	Good	Excellent
Cost/Value:	1	2	3	4	5
Audio Experience:	1	2	3	4	5
Video Experience:	1	2	3	4	5
Break Refreshments:	1	2	3	4	5
Web Site and Registration:	1	2	3	4	5

Comments: _____

_____

SYMPOSIUM SESSIONS

	Poor	Fair	Acceptable	Good	Excellent
Species Boundaries:	1	2	3	4	5
Fire in Managed Landscapes:	1	2	3	4	5
Restoration:	1	2	3	4	5
New Discoveries:	1	2	3	4	5
Lightning Talks:	1	2	3	4	5
Poster Session:	1	2	3	4	5
Pollinators:	1	2	3	4	5
Plant Biotic Interactions:	1	2	3	4	5
Now the Good News:	1	2	3	4	5

Comments: _____

_____

OTHER ACTIVITIES

	Poor	Fair	Acceptable	Good	Excellent	Not Applicable
Keynote Speaker:	1	2	3	4	5	NA
Monday Reception:	1	2	3	4	5	NA
Banquet and Banquet Food:	1	2	3	4	5	NA

Comments: _____

_____

NEXT SYMPOSIUM

Please include any ideas for future topics that we should consider for the next symposium:

_____

_____

_____

Would you be willing to organize a session on your favorite topic? What is this topic? Do you know speakers who might be interested? Include your name and contact information.

_____

_____

_____

Timing of Next NCB Symposium. We have been timing our symposia to occur two out of every three years. For instance, we have held symposia in 2016 and 2017, then 2019 and 2020 (now).

Given that we plan to maintain the schedule of symposia every two of three years, which schedule Option below would you prefer? *Please consider other botanical conference dates when stating a preference. For instance, Cal-IPC every Oct-Nov, CNPS Fall 2021, Southern California Botanists every fall, California Botanical Society every spring, etc.* **(circle one)**.

Option A: January 2022, January 2023

Option B: January 2021, January 2023

Option C: No preference