Symposium Program
49th Annual Southern California Botanists Symposium

I'll Take My Plants Rare

Saturday, November 5, 2022
Pomona College—Seaver Auditorium
Seaver North, 645 N College Ave Claremont, CA 91711

8:00-9:00 am. **Registration**
9:00-9:10 am. **Annual SCB Business Meeting**
9:10-9:15 am. **Opening Remarks**

9:15-9:55 am. **The CNPS Rare Plant Inventory: Improvements in how we navigate, nominate, and review the conservation status of California rare plants; Aaron Sims**, Rare Plant Program Director, California Native Plant Society.

9:55-10:20 am. (Virtual) **Genomic diversity of the narrow endemic and endangered legume *Astragalus tricarinatus*; Lorena Torres-Martinez**, Department of Evolution, Ecology and Organismal Biology, University of California, Riverside.

10:20-10:50 am. **BREAK**

10:50-11:30 am. **San Diego County's regional rare plant monitoring program – Lessons learned from a decade of monitoring; Jessie Vinje**, SageVinje Biological & Conservation Biology Institute, Escondido, CA.

11:30-11:55 am. **How rare plants are listed under the Endangered Species Act; Vivian Negron Ortiz,** U.S. Fish and Wildlife Service, Florida Ecological Services Field Office, Panama City, Florida.

11:55 am-1:30 pm. **LUNCH**
12:10-1:00 pm. **CAREER PANEL**

1:30-1:55 pm. **California Plant Rescue: Securing the flora of the golden state through sustained conservation collaboration; Katie Heineman**, Vice President of Science and Conservation, Center for Plant Conservation.

1:55-2:35 pm. **The race against plant extinction; Wesley Knapp**, Chief Botanist, NatureServe.

2:35-3:00 pm. **Group delisting of rare plants on San Clemente Island: A success story; Sula Vanderplank**,

3:00-3:30 pm. **BREAK**

3:30-4:00 pm. (Virtual) **Evaluating the potential of genetic rescue using genomics for rare species conservation; Jill Hamilton**, Pennsylvania State University, Department of Ecosystem Science and Management, State College, PA.

4:00-4:25 pm. **Rarity, geography, and plant exposure in California; Brooke Rose**, Postdoctoral Scholar at San Diego State University

4:25-4:50 pm. **Carpe diem: CESA the day!; Raffica La Rosa,** Senior Environmental Scientist (Specialist), California Department of Fish & Wildlife

Evening events continue at Memorial Park
Location: 840 N Indian Hill Blvd, Claremont, CA 91711

5:00-8:00 pm Mixer at Memorial Park, open to everyone
5:30-6:30 pm Poster Session, Seaver South Auditorium
6:30-8:00 pm Dinner Service: Justvegana Catering ($18 meal ticket required)

Speaker Abstracts

9:15-9:55 am. **The CNPS Rare Plant Inventory: Improvements in how we navigate, nominate, and review the conservation status of California rare plants; Aaron Sims**, Rare Plant Program Director, California Native Plant Society.

Since 1974, the CNPS Rare Plant Inventory (RPI) has been a widely used resource guiding rare plant education, protection, conservation planning, land acquisition, and resource management in California. Starting as a set of index cards and several print editions, the recently upgraded online RPI allows updates and changes to be viewed live for immediate use in searches to help inform conservation priorities. New in 2023, the site includes the ability to search by microhabitat (e.g., serpentinite), California Plant Rescue seed collections, BLM and US Forest Service Sensitive, IUCN Red List, and over 30 different threat categories. There are currently over 2,450 plants in the RPI, and any of them can be nominated for rank change or deletion through a new online request form, which is also used to submit formal nominations for new additions to the RPI. When nominations are received, they are given a priority designation and placed in a backlog for later processing. As resources become available, proposals are researched and submitted through the CNPS Status Review Process, which allows Status Reviewers to submit comments and recommendations. Anyone interested in getting involved or being informed on status additions and changes in the RPI are encouraged to become a Status Reviewer by filling out the online CNPS Rare Plant Status Reviewer Form. A large and diverse group of reviewers helps ensure the RPI includes the most accurate rarity and threat designations for California native plants.

9:55-10:20 am. (Virtual) **Genomic diversity of the narrow endemic and endangered legume *Astragalus tricarinatus*; Lorena Torres Martínez**[1,2] *, Sweet L.[3], LaDoux, T.[4] , Fraga, N.S.[5], Heacox, S.[3], Davis, M.[3], and J.L. Sachs[1,6,7]

[1]Department of Evolution, Ecology and Organismal Biology, University of California, Riverside, California, United States

[2]Department of Biology, St Mary's College of Maryland, St Mary's City, Maryland, United States

[3]Center for Conservation Biology, University of California, Riverside, Palm Desert Campus

[4]Granite Mountain Desert Research Center, University of California Natural Reserve System, California, United States

[5]California Botanic Garden, Claremont, California, United States

[6]Department of Microbiology & Plant Pathology, University of California, Riverside, California, United States

[7]Institute of Integrative Genome Biology, University of California, Riverside, California, United States

The survival of species with narrow geographic ranges depends on the maintenance of genetic variation within populations and the promotion of gene flow across the species range. The rare and narrowly distributed California legume *Astragalus tricarinatus* (triple-ribbed milkvetch) was listed as endangered due to direct threats to the small number of individuals occurring along washes in canyon bottoms in the San Bernardino (SBM) and Little San Bernardino Mountains (LSB), which at the time (1998) comprised the core of its geographic distribution. Currently, such occurrences are now believed to be waif or deme populations, while the main populations are in canyon slopes. Through genotyping-by-sequencing (GBS) of 132 individuals we assessed i) whether populations of this short-lived perennial herb are genetically connected, particularly between the disjunct Santa Rosa (SRM) and San Bernardino Mountains, and ii) whether waif individuals are promoting gene flow among populations found in the canyon slopes. Genetic variation across the species range was relatively high (=0.17) with respect to other rare species. The disjunct SRM population had the lowest genetic variation, the highest divergence with respect to other locations (F ST =0.30-0.20) but is genetically similar to genotypes in SBM, suggesting that a long-distance dispersal event might have founded this population. Furthermore, the levels and patterns of admixture found among populations in the SBM and LSB areas indicate high genetic connectivity that is likely due to waif individuals. Our findings are the first genetic description of this dynamic system and indicate that the conservation of waif populations will be vital for the species survival.

10:50-11:30 am. **San Diego County's regional rare plant monitoring program – Lessons learned from a decade of monitoring; Jessie Vinje**[1]*, Kristine Preston[2] , Jenna Hartsook[3] , Diana Brand-Ramirez[3] , Spring Strahm[4] , Margie Mulligan[5], Yvonne C. Moore[6], and Sarah McCutcheon[7]

[1]SageVinje Biological Conservation Biology Institute, Escondido, CA
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[7]San Diego Management and Monitoring Program

Between 2014 and 2023, the San Diego Management and Monitoring Program (SDMMP) and partners developed and implemented a regionally funded rare plant "Inspect and Manage" monitoring program for 30 rare plant species on conserved lands in western San Diego County. Partners included consulting firms, federal and state wildlife agencies, local jurisdictions, non-profit organizations, private landowners,

military, and volunteers. SDMMP, in collaboration with the City of San Diego, Conservation Biology Institute, and The Nature Conservancy, developed the threats-based monitoring protocol in 2014. Since then, we have trained more than 200 individuals in the monitoring protocol through workshops, group, and one-on-one training efforts and 54 entities have collected monitoring data in San Diego County and northern Baja California, Mexico. Participants have collected monitoring data at 405 rare plant occurrences over ten years including species status, habitat attributes, threats, and have recommended management actions to mitigate threats. Preliminary data suggests that rare annual and geophyte populations generally tend to track with annual rainfall; however, other factors including timing of rainfall, temperatures, and nonnative plants also affect population sizes. Other notable threats include sea level rise, trails, trampling, altered hydrology, soil compaction, and urban runoff. While the program has been very successful, we would recommend the following steps before implementing a regional monitoring program: locate and secure a permanent source of program funding, conduct surveys over several years to establish species baseline conditions, monitor fewer species rather than all of the species, and ensure monitoring protocols are well vetted.

11:30-11:55 am. **How rare plants are listed under the Endangered Species Act; Vivian Negron Ortiz,** U.S. Fish and Wildlife Service, Florida Ecological Services Field Office, Panama City, Florida.

The U.S. Endangered Species Act (ESA) of 1973 is a powerful environmental legislation for saving species from extinction. It was launched by listing seven animal species, and to date 1,650 species are listed; plants are the taxonomic group with the most listed taxa and the least allocated expenditures. Of 940 listed plants as of 2023, 81% are “endangered” and are found in the Pacific, Pacific Southwest, or Southeast regions. Once a species is listed, it is protected under the ESA’s authority until it’s recovered, a process that takes on average 26 years. Of the 18 ESA sections, I’ll focus on “listing,” section 4, the legal process to determine whether to list a species as endangered or threatened, depending on the magnitude of threats. ESA allows any individual to petition to list, delist, or reclassify species, or to revise a critical habitat designation. Once a petition is received, the U.S. Fish and Wildlife Service (FWS) is required to make a finding within 90 days. The process can also be initiated by FWS, and this does not have the same statutory deadlines as the petition process. If the finding is positive, an “assessment “of the species status is conducted to determine whether the petitioned request is warranted. Then FWS publishes a “12-month finding”/proposed rule whether listing of this species is warranted. A “final rule” is published within one year of the date of the proposed rule; however, this time period may be extended under certain circumstances. Case studies will be discussed.

1:30-1:55 pm. **California Plant Rescue: Securing the flora of the golden state through sustained conservation collaboration; Katie Heineman,** Vice President of Science and Conservation, Center for Plant Conservation.

California is home to nearly one third of rare plants in the US, many of which are found nowhere else on Earth. To secure this tremendous biodiversity, California Plant Rescue (CaPR) was founded in 2014 to conserve the flora of the Golden State through long term conservation seed collections. A collaborative of nonprofit botanical institutions, CaPR partners act as a "state seed bank" through frequent communication about collections plans and maintenance of a shared collections database containing nearly all the rare plant seed collections in California. In 2019, CaPR received $3.6 million of state funding from the California Biodiversity Initiative to safeguard the remaining uncollected imperiled (1B) plant species in California in at least one seed collection. Here, I will share how this investment has reduced the geographic, phylogenetic, taxonomic, and functional bias in the species represented in conservation collection. Geographically, we have significantly increased the proportional representation of rare species from northern California and higher elevations. We have doubled the number of rare species in families not typically held in garden collections on display, most notably Orobanchaceae and Brassicaceae. This initiative, while successful, is only the first step in securing the immense biodiversity of the California Floristic province: one ex-situ collection per species is not enough to conserve representative genetic diversity especially in a region facing wide-scale threats from wildfire and development. We will present the population level bias in our current collections, wherein populations on public lands and with low threat classifications have higher proportional representation in collection than those on private lands and higher threat classifications. We hope future efforts for our groups can focus on strategically increasing the number of populations for each species in collection by maximizing the geographic diversity, and presumably the genetic diversity, of seeds in collections.

1:55-2:35 pm. **The race against plant extinction; Wesley Knapp**, Chief Botanist, NatureServe.

Extinction rates are expected to increase as we move through the Anthropocene (our current geologic era), yet we have a poor understanding of what plants have already gone extinct and the reasons for these extinctions. Every extinction is a conservation failure and identifying the reasons for past extinction events may help us prevent future extinctions. In 2021, I led an effort to document the extinct plants of the continental USA and Canada. In this paper, 65 plant taxa were documented of which 64% were single-site endemics. California leads the study area with 19 extinctions. During this

talk I'll give an overview of plant extinctions in the USA and Canada, give important and exciting updates since the 2021 paper, which include the rediscovery of two species, and discuss a new project to identify all the plant taxa of One Known Occurrence (OKOs) in the USA and Canada for priority on-the-ground (in situ) and off site (ex situ) conservation action to prevent extinctions.

2:35-3:00 pm. **Group delisting of rare plants on San Clemente Island: A success story; Sula Vanderplank,** Kimberly O'Connor, Bryan Munson, Dawn Lawson, and Jon Rebman.

San Clemente Island is the southernmost of the California Channel Islands, large, rugged and geographically isolated, with more than 8,000 years of human habitation and home to numerous rare plants. The island is owned by the US Navy and is the last continental US training range that supports simultaneous ship-to-shore, air-to-ground, and ground troop training. It also is home to 355 native plants, with 19 single-island endemics. Following a long history of over-grazing, six plants on San Clemente Island were federally listed under the Endangered Species Act of 1973: *Acmipson dendroideus* var. *traskiae*, *Castilleja grisea*, *Delphinium variegatum* spp. *kinkiense*, *Malacothamnus clementinus*, *Sibara filifolia* and *Lithophragma maximum*. Due to the eradication of feral mammalian herbivores, completed in the early 1990s, vegetation on the island rebounded and four plants (along with the San Clemente Bell's Sparrow) were recently de-listed due to their rapid recovery. This was the largest group delisting in the history of the Endangered Species Act, and it is particularly noteworthy that is was achieved on one of the most heavily-used and strategically significant Department of Defense training ranges. Two species (*S. filifolia* and *L. maximum*) remain listed due to their highly restricted occurrences and habitats. This talk will look at the prior successes and future challenges for rare plants on San Clemente Island and present conservation assessments that were developed as part of this process.

3:30-4:00 pm. (Virtual) **Evaluating the potential of genetic rescue using genomics for rare species conservation; Jill Hamilton**, Pennsylvania State University, Department of Ecosystem Science and Management, State College, PA.

Species evolutionary potential is tightly linked to both the amount and distribution of genetic variation available through which natural selection may act. Indeed, the genetic consequences of isolation and population size may be exacerbated in rare species, limiting species' ability to adapt to ongoing change. Thus, in a rapidly changing environment, maintenance of genetic variation within and across populations becomes an increasingly important target for species conservation. Here, we discuss the importance of understanding species' evolutionary history, and the role different

evolutionary processes may play influencing neutral and adaptive processes both across space and time. We discuss the importance of these data to establishing conservation collections and designing species management strategies that preserve species' evolutionary potential by evaluating the potential role genetic rescue may play to species' preservation. Providing a case study, we focus on Torrey pine (*Pinus torreyana* Parry) a critically endangered pine, endemic to California. The combination of small population size, extremely low genetic variation, and abiotic and biotic challenges associated with climate change indicate Torrey pine may have reduced evolutionary potential to adapt to change. Thus, Torrey pine may be a potential candidate for inter-population genetic rescue. Pairing genomic data with phenotypic data from natural populations and common garden experiments, Torrey pine provides an ideal system to evaluate the contribution of demographic history, gene flow, and natural selection to population differences. These data become essential to considering potential risks associated with management decisions and identifying short and longer-term conservation strategies necessary to preserve species' evolutionary potential.

4:00-4:25 pm. **Rarity, geography, and plant exposure in California; Brooke Rose**, Postdoctoral Scholar at San Diego State University

Habitat loss amplifies species' extinction risks, with some species being more vulnerable to environmental change than others. Predictive frameworks for identifying vulnerable species are urgently needed in the face of rapid global change to anticipate where, and for which taxa, the most pressing needs for management and mitigation arise. Rare species tend to be at greater risk of extinction than common species, while species' geographic position may also play a role in determining their exposure to future environmental change. Here, we explored the relationships between rarity, geography, and exposure to future climate and land use change for 106 plant species in the California Floristic Province. We used species distribution models (SDMs) to measure species exposure – predicted change in habitat suitability within currently occupied habitat – under end-of-century climate and land use change scenarios that varied based on different greenhouse gas concentration trajectories. We found that species with restricted range sizes and low topographic heterogeneity across their distributions were predicted to be the most exposed to climate change, while species at low elevations were the most exposed to habitat loss via land use change. However, even some wide-ranging species were projected to lose substantial habitat, particularly if they are distributed in geographically vulnerable areas (i.e., foothills with low topographic complexity and rapid environmental change), emphasizing the need to consider both species' rarity and geography in vulnerability assessments. In addition to presenting this research, I will discuss the available tools for modeling the distributions of rare species in the flexsdm R package.

4:25-4:50 pm. **Carpe diem: CESA the day!; Raffica La Rosa,** Senior Environmental Scientist (Specialist), California Department of Fish & Wildlife

How does a plant species become listed as endangered or threatened under the California Endangered Species Act (CESA)? Who can petition a species for listing? How do protections under CESA differ from protections under the Federal Endangered Species Act? When is a permit needed? How is the recovery of a listed species coordinated? I'll pull back the curtain on these questions and processes, address common misconceptions, provide resources for getting involved, and highlight the California Department of Fish and Wildlife's new foray into recovery planning.

Career Panel Bios

Genevieve Arnold serves as seed program manager at Theodore Payne Foundation for Wild Flowers & Native Plants. Previously, she was seed conservation program technician at California Botanic Garden. TPF's seed program houses a regionally-focused conservation seed bank, which is an integral component of their Local Source Initiative. Additionally, the seed program is active in collaborative seed banking and conservation efforts at regional and state-wide levels. Genevieve also oversees TPF's nonprofit retail seed operation, which helps the public create sustainable and ecologically inspired garden spaces. She is a frequent presenter and teacher, and has been a contributing author on topics relating to California native plant gardening and conservation.

Anthony Baniaga is the Curator of the UCLA Herbarium, and Adjunct Assistant Professor in the Department of Ecology & Evolutionary Biology at UCLA. He has developed and taught courses on Plant Systematics, Plants & People, and Natural History Collections for Biology. He is a field botanist by training and worked for the USFS on the Lassen National Forest as well as the USGS in southern California. He completed his dissertation at the University of Arizona in the EEB Department under the mentorship of Dr. Michael S. Barker on polyploidy, hybridization, and genomics of Selaginella. He also worked as a postdoctoral fellow under the mentorship of Dr. Michael Donoghue and Dr. Erika Edwards at Yale University on systematics of the *Viburnum dentatum* species complex of eastern North America. He currently calls Santa Monica home with his partner and two year old. They enjoy spending time on the ocean and exploring the plant communities of California.

Lauren Quon is a botanist on the Cleveland National Forest, where she enjoys planning and implementing various restoration and weed removal projects, surveying and monitoring rare plants, and exploring the forest. Lauren holds a Bachelor of Science degree in Environmental Biology and a Master of Science degree in Biological Sciences from Cal Poly Pomona. Aside from doting over her mini-patio garden, her other favorite pastime is meandering through montane meadows and marveling at Laguna aster (*Dieteria asteroides* ssp. *lagunensis*) in the Laguna Mountains.

Alejandra Soto is the Assistant Restoration Project Manager at California Botanic Garden. She has a B.S. in Environmental Biology with a minor in GIS from Cal Poly Pomona and seven years of experience in restoration work. She is involved in all aspects of restoration, from seed collecting and propagating to helping design and implement restoration out-planting experiments. The astonishing diversity of restoration work at the garden is one of the main reasons she loves her work so much. Beyond common restoration practices, she focuses on the implementation and instruction of best management practices to avoid the introduction of non-native plant pathogens from the nursery to the wild. Her favorite genus of plants is currently Calochortus, mariposa lilies.

Michael Viramontes is the Stewardship Manager at Rivers & Lands Conservancy (RLC), where he's worked for 6 years. At RLC, Michael works with the stewardship team to manage over 60 properties totaling over 3,000 acres of lands conserved for endangered species, water resources, and other conservation values. His current passions involves the experimental restoration of sand dune habitat benefitting the locally endangered Delhi sands flower-loving fly. Michael holds a B.S. in Environmental Science from San Jose State University with a concentration in Natural Resource Management.

Poster Abstracts

Surveys for two federally listed endangered island endemic plants: *Malacothrix indecora* and *M. squalida* (Asteraceae); Annie Ayers[1], John Knapp[2], Kristen Hasenstab-Lehman[1], and C. Matt Guilliams[1]

[1]Santa Barbara Botanic Garden, Santa Barbara
[2]The Nature Conservancy

Malacothrix indecora Greene and *M. squalida* Greene (Asteraceae) are each federally listed endangered plants endemic to the northern California Channel Islands. Both species are ephemeral, annual plants, occurring on shallow soils of ocean bluffs in open

rocky areas. *Malacothrix indecora* occurs in seven locations across the San Miguel, Santa Rosa, and Santa Cruz islands. *Malacothrix squalida*, less widespread than its congener, occurs in four locations on Santa Cruz and Anacapa islands. Although Greene described these species over 130 years ago, many aspects of the natural history of these rare plants remain poorly understood. On Santa Cruz and Anacapa islands, estimates or direct counts of individuals present have seldom been recorded for either taxon. In spring 2023, eight surveys were conducted—seven on Santa Cruz Island and one on Anacapa Island. At each population, numbers of individuals were counted, populations were mapped, and collections of tissue samples were gathered for future genetic studies. Herbarium vouchers—important permanent records of species distribution and morphology—were gathered at each population visited. The last herbarium voucher collected of either species occurred seventeen years ago, in 2006. Additionally, conservation seed banking resulted in the long-term preservation of 148 maternal lines of *M. indecora* and 90 maternal lines of *M. squalida*. In 2024, the populations will be revisited for mapping and sampling of leaf tissues, herbarium vouchers, and seed collections. Taken collectively, this survey effort will provide an important baseline for future conservation work.

Conservation Seed Banking on San Nicolas Island; **Sean A. Carson,** Heather E. Schneider, Santa Barbara Botanic Garden

California's Channel Islands archipelago is a well-known biodiversity hotspot. Taken as whole, the islands represent a unique and important assemblage of flora and fauna that harken to California's past (like ironwood groves) while also showcasing the evolutionary processes that result in high rates of endemism on islands (such as Santa Cruz Island Dudleya and island scrub jays). However, each island is unique in its history and conservation challenges and not all islands have received the same level of conservation attention as others. San Nicolas Island, the most remote island in the archipelago, has a history of research and conservation efforts focused on island foxes, snails, herpetofauna, marine mammals and birds, as well as a robust habitat restoration program. However, it was not the focus of conservation seed banking efforts until relatively recently. In 2017, Santa Barbara Botanic Garden's Rare Plant Conservation Team partnered with the U.S. Navy to initiate conservation seed banking efforts on San Nicolas Island. Over the subsequent years, more than 30 conservation seed collections have been brought into ex situ conservation in the Santa Barbara Botanic Garden Conservation Seed Bank. Several of the seed collections made on San Nicolas Island represent the first conservation seed collections for a given species, emphasizing the

importance of these collections not only to the island, but also to archipelago and state-wide conservation goals.

Bryophyte Flora of the Santa Clara River Watershed; Jordan Collins, California Native Plant Society

The Santa Clara River Watershed encompasses over two million acres of land that spans northern Ventura and Los Angeles Counties. This watershed is part of the Western Transverse Ranges Ecoregion and sits at the juncture of the San Joaquin Valley, the southern Sierra Nevada, the Mojave Desert, the South Coast Ranges, and the South Coast. The highly diverse vascular plant flora of this area is well documented, but very little is known about the bryophytes that inhabit this region. This work is focused on closing this knowledge gap. Prior to this study, there were only 137 bryophyte collections for the entire watershed, representing 82 taxa. The work conducted this year has greatly increased both of these numbers through focused surveys and collections in various habitats throughout the watershed. Hidden within the watershed are stories of relictual taxon distributions, new county records, locally rare species, and globally rare species. This pilot study lays the groundwork for understanding the distributions of these taxa. Bryophytes, in general, are an extremely understudied group of organisms, and especially so in Southern California. This foundational work is crucial for conserving and understanding the often overlooked sensitive and rare bryophyte species that inhabit this watershed and Southern California at large.

Splitting hairs: a micromorphological characterization of *Castilleja mollis*, *Castilleja affinis*, and putative hybrid leaf vestiture on Santa Rosa Island; Caitlin Hazelquist[1], Kristen Hasenstab-Lehman[1], C. Matt Guilliams[1], Kathryn McEachern[2], and Diane Thomson[3]

[1]Santa Barbara Botanic Garden
[2]United States Geological Survey
[3]Scripps College

Castilleja mollis Pennell (Orobanchaceae), is a rare Channel Islands endemic, historically found on Santa Rosa and San Miguel islands. Presently, it grows on stabilized dunes and marine terraces of Santa Rosa Island's Carrington Point and Jaw Gulch, in a fog-swept band within 300 m of the ocean. Grazing damage from ranching, increasing annual temperatures and aridity, and suspected hybridization with *Castilleja affinis* in parts of its range have contributed to its decline. The Jaw Gulch subpopulation is assumed to have mostly pure *C. mollis*, but putative hybrids of *C. mollis* and *C. affinis* have been noted at increasing frequency on Carrington Point since 1995. With

hybridization posing a potential threat to *C. mollis* at this location, we are pairing a micromorphological study of leaf vestiture, with genomic evidence to better delineate *C. mollis*, and putative hybrids in the field. *C. mollis* leaves sport a dense mat of almost exclusively dendritic, trichotomously-branched hairs. *C. affinis* leaves have a sparse covering of unbranched trichomes with reinforced bases, and variable size. Hybridization appears to increase diversity in trichome shape and size on the leaf surface. Increasing genetic influence from *C. mollis* in hybrids appears to increase branching and the presence of dendritic, trichotomously-branched hairs. Adding these trends to the existing identification characters aims to better inform targeted seed collection and outplanting efforts for the conservation of *C. mollis*.

Out with the mold, in with the goo: revising California Botanic Garden's germination protocol for microbial growth inhibition; I. Jordan, C. Birker, California Botanic Garden

The California Seed Bank at the California Botanic Garden (CalBG) has a robust germination program in which all incoming collections are tested initially for germinability, and follow-up germination tests are conducted throughout the storage term. The current protocol involves soaking the seeds in a sterilizing solution of bleach and Tween® for one minute before plating onto a 0.5% agar plate. Although this protocol has been relatively effective in mitigating microbial growth, it has been suggested that using sodium dichloroisocyanurate (NaDCC) could be a more effective approach to surface sterilization while also having a less harmful effect on seed embryos than commercial bleach. Partnering organizations have also been utilizing Plant Preservative Mixture (PPM), a broad-spectrum biocide, as an additive in the agar solution. Safer and more effective microbial inhibition could increase the overall accuracy of viability testing. In order to determine whether NaDCC and/or PPM should be incorporated into the germination testing program at CalBG, an experiment was conducted to compare the use of these chemicals against the current protocol. A set of germination tests using different methods for hindering microbial growth were conducted across three taxa: *Bouteloua barbata* var. *barbata*, *Dudleya lanceolata*, and *Xylorhiza tortifolia*. The results of this study will be beneficial for informing future germination protocols at CalBG and collaborating institutions.

Conservation genomics of an endangered Asteraceae (*Deinandra increscens* subsp. *villosa*) native to the Central Coast of California; Susan L. McEvoy[1], Milagros Guadalupe Rivera[2], Kristen Hasenstab[1], Oanh Nguyen[3], Ruta Sahasrabudhe[3], Rachel S. Meyer[2], C. Matt Guilliams[1]

[1]Santa Barbara Botanic Garden
[2]Department of Ecology and Evolutionary Biology, University of California Santa Cruz

[3]UC Davis Genome Center, University of California Davis, *Deinandra increscens* subsp. *villosa* (Gaviota tarplant), endemic to Santa Barbara County, exists in small and fragmented populations of the coastal and inland areas. It is a small, yellow, insect-pollinated, annual with disk and ray florets common to most Asteraceae. The Asteraceae family is large, comprising 10% of angiosperm species, but not well-represented in genomic studies. *Deinandra increscens* subsp. *villosa* is listed as Endangered under both the Federal and State Endangered Species Act. Since 2016, the Strauss Wind Project has been constructing a large turbine wind farm within the core of the distribution of *D. increscens* subsp. *villosa*. While this project will provide clean energy to 44,000 homes, turbine construction will directly impact some number of plants within the construction footprint and may impact ongoing biological processes (e.g., pollen transfer) through normal turbine operation potentially eliminating sources of adaptive genetic diversity. As part of the permitting requirements, regulatory agencies require a detailed genetic study of *D. increscens* subsp. *villosa*. As such, we are applying conservation genomics approaches to understand the genetic impact of development among the Strauss population and the broader native range. This will include population genetics, landscape genetics, and time-to-extinction modeling. Samples from almost 1,000 individuals were collected from across the range over the course of three years: 384 in year 1, and 288 in years 2 and 3. Ninety-six from each year will be sequenced at 30x with the remainder at 1-2x. Reference genome sequencing includes 40x of Pacific Biosciences HiFi, 60x of Oxford Nanopore Technologies PromethION (ONT), and 70x Dovetail OMNI-C for scaffolding. Estimates based on flow cytometry and k-mer profiling indicate that the plant is a diploid around 1.7-2.3 Gbp in length. We used the ONT reads in the Flye assembler to generate contigs which were scaffolded using the OMNI-C in 3D-DNA. The resulting genome is 1.67 Gbp in length with a contig N50 of 108 Kb and scaffold N50 of 75 Mb in 28.7 K contigs with a BUSCO completeness of 98.1% (embryphyta_odb10). Genes are being annotated using Easel and eight RNA-seq libraries from four individuals: 3 juvenile shoot and root, and 1 adult stem and leaf. We will conduct population genetics analyses to discern population structure, effective population size, and demographic history; levels of inbreeding and runs of homozygosity; and amounts of admixture and gene flow between populations. We will incorporate environmental metadata to examine the effects of landscape and climate on populations, and we will integrate genetics and life history traits to model time-to-extinction. Together, these analyses encompass a three-year plan of evaluation which will be followed by additional assessments in 10 years. Results will help inform conservation measure and ongoing development within the Strauss project footprint. This study will also have broader impacts on policies regarding endangered species in California by providing an exemplary study of implementing genomic analysis for conservation planning.

A vascular flora of the Owens River Headwater Area, Mono County, CA; Rachel Tageant, California Botanic Garden

The Sierra Nevada occupies ~20% of California's landmass yet contains more than half of the state's plant diversity. Many areas in the Sierra Nevada, however, remain unexplored botanically. The Owens River Headwaters Area (ORHA) is one such area. The ORHA is a "botanical black hole," an area with little to no documentation. A total of 1,157 historic vascular plant collections have been made since 1895, 997 of the collections were made by Helen M Constantine. The study area is approximately 52 mi^2 and includes the Owens River Headwater designated wilderness area in the Inyo National Forest. The study area is unique as it is located at a transition zone between the California Floristic Province and the Great Basin Floristic Province. The elevational range of the OHRA is 7,200-11,520 ft and is characterized by pumice flats, volcanic outcrops, forested mountain slopes, high elevation meadows, creeks, and alpine summits. Over the course of two field seasons (2023-2024,) a comprehensive floristic inventory will document the vascular flora of this biogeographically unique area and culminate in an annotated species checklist. Voucher specimens will be collected and distributed to several herbaria, including RSA, CAS, and JEPS. To date, one season of field work has been completed with a total of 980 specimens collected. So far, 32 families and 123 genera have been collected and identified. This study will establish important baseline data on the floristic diversity of the OHRA, which will in turn facilitate a greater understanding of the diversity and distribution of California's native plants, assess future change in light of potential threats, such as climate change and OHV activity, and contribute to conservation management strategies for the ORHA.

Botanical jeopardy: investigating California's Threatened and Endangered Plant Species; Georgina Thomas, Gabrielle Shen, Victoria Mendez, Brooke Rose, and Helen Regan, University of California, Riverside

Due to anthropogenic environmental change, California risks an immense loss of plant biodiversity. Understanding the magnitude and severity of threats to threatened and endangered (T&E) plant species is crucial to construct and implement adequate conservation and preservation plans. To address this research need, we have compiled a dataset for the 287 T&E plant species in California, along with the array of threats impacting their abilities to thrive. This dataset includes information pertaining to each species' life form, elevational and climatic distribution, habitat associations, and geographic range, as well as the prevailing threats using categories established by the International Union for Conservation of Nature (IUCN). Using this research, we aim to answer the following questions: 1) which habitat types are California T&E plant species associated with?, 2) which life forms tend to be the most threatened and endangered?, and 3) are certain life forms and habitat types disproportionately impacted by specific threats? Preliminary results indicate that most T&E plant species tend to be associated with chaparral and coastal scrub habitats. Additionally, annual herbs, perennial herbs,

and perennial evergreen shrubs are among the most threatened life forms, with species in these life form categories often experiencing between 9 and 12 unique threats. Some of the most prominent threats include development, human disturbances, invasive species, and overall small populations. The results of this research will allow for plant protection and management strategies to be created or updated to meet the current needs of California's T&E plant species.

Phenological and ecological observations of California jewelflower (*Caulanthus californicus*) during the 2023 super bloom; Matthew D. Wang, Heather E. Schneider and Melina Matheney, Santa Barbara Botanic Garden

California jewelflower (*Caulanthus californicus)* is an annual wildflower in the mustard family (Brassicaceae) that is state (California) and federally endangered. While once abundant in areas ranging from Fresno County to Carrizo Plain National Monument, there are now just 13 occurrences that have been seen within the last 20 years. Threats to jewelflower across its range have included habitat loss, grazing, drought and, potentially, loss of pollinators. In December 2022, we initiated a three-year demography study to understand the biology, ecology and population dynamics of California jewelflower at Carrizo Plain National Monument. Our first year of data collection coincided with a "super bloom." The abundant rainfall during the winter and spring of 2022-2023 provided ample opportunity to observe jewelflower phenology, growth and herbivory in a wet year. A total of 15 plots across three sites were periodically revisited between the time of seedling recruitment in December 2022 and senescence in April 2023. We collected data on stem height, herbivory, number of stems, buds, flowers, and fruits. During this time, we also set up wildlife cameras to observe plant-animal interactions related to jewelflower, particularly herbivory. Here, we share preliminary observations based on our first year of data collection. Our data suggest that California jewelflower is able to respond to abundant rainfall years and that extended access to moisture may make jewelflower somewhat resilient to herbivory. Despite repeated observations of herbivory by small mammals and insects, we observed a tremendous amount of stem growth and flower production, which suggests increased reproductive potential during a wet year. Over the long-term, we aim to characterize population dynamics and investigate the multiple factors that could impact the health and reproductive success of California jewelflower at these locations. This project is funded by and conducted in collaboration with the Bureau of Land Management, with whom we will share information and discuss future conservation and management actions at Carrizo Plain National Monument.