NORTHERN CALIFORNIA BOTANISTS

BOTANICAL LEAFLETS

ISSUE 27 FALL 2021

PRESIDENT'S MESSAGE

It is fall and hopefully everyone has finished their summer field work. Many of us have experienced the wildfires that seem to happen in every part of California. My extended family has been dealing with the loss of our family cabin from the Dixie Fire. It has been quite an experience! It is wonderful that we are starting to get some rain.

NCB will be having a virtual symposium rather than an in person event for 2022. We are busy planning our the Symposium which will be held on January 10 and 11, 2022 with Workshops on the 12th.

Samantha Hillaire has retired as a board member. We have added Cherilyn Burton with California Department of Fish and Wildlife. Thanks for all your hard work Sam and welcome Cherilyn.

Thank you for approving the slate of the Board of Directors and changing the by laws to have one or two student directors in the future.

Have a great fall and stay well during this pandemic. Hope you join us in January for the Symposium.

Linnea Hanson
President

WELCOME CHERILYN BURTON TO THE NCB BOARD!

Northern California Botanists is pleased to announce the appointment of Cherilyn Burton to the Board. Cherilyn is a Senior Environmental Scientist in the Native Plant Program at the California Department of Fish and Wildlife (CDFW). She works on a variety of issues related to native plant conservation, including reviewing California Endangered Species Act listing petitions and monitoring several federal and state-listed plant species on CDFW owned lands. She is also a member of the California Consulting Botanist Board of Certification and is a Certified Consulting Botanist, and presented at a previous NCB symposium. Welcome Cherilyn!

MYSTERY PLANT

Although known to some who spend time exploring high ridges in Wilderness Areas of northern California, this genus is unknown to most botanists in the area. While this low-growing sub-shrub is found in only scattered locations in northern California, farther north, particularly in Alaska, this species forms extensive carpets. The common name refers to the way that the basal leaves are divided (deeply dissected into three sets of linear leaflets), while the genus name for this monotypic genus honors a Russian sea captain.

Photo by Lawrence Janeway. Siskiyou County, Siskiyou Mountains, west of Cook and Green Pass near Kangaroo Mountain.

Answer on page 4

INSIDE THIS ISSUE:

NCB 2022 Symposium—Registration Will Open Soon!

Northern California Botanists will hold there 2022 Symposium on January 10-11, 2022 with optional workshops on the 12th. The 2022 Symposium will be an online event with pre-recorded talks and live question and answer time with the speakers following each session. The theme: "Tools for a New Decade of Managing Northern California Plants will include sessions on Pollination Research, Traditional Ecological Knowledge and Ethnobotany, eDNA, Great Basin Plant Life, Riparian Vegetation Issues, Lightning Talks, Now the Good News, and New Discoveries. Check our website for more information.

NCB 2022 Keynote Speaker

The 2022 Keynote Speaker will be **Frank Kanawha Lake.** His talk is titled ***"Indigenous Knowledge and Ethno- Botany: Tribal understandings and connections of plants and the environment."*** Frank has been immersed in the rich cultural and ecological heritage of California's northwestern Pacific coast since childhood. He was raised in a Yurok and Karuk family and learned about the natural world through cultural practices, which now inform his work as a research ecologist and fire scientist at the Forest Service Pacific Southwest Research Station. Dr. Lake received a BS degree from University of California - Davis (1995) in Integrated Ecology and Culture with a minor in Native American Studies and completed his Ph.D. in the Environmental Sciences Program at Oregon State University in 2007.

He currently works for the USFS-Pacific Southwest Research Station, Fire and Fuels Program, on tribal and community forestry and related natural resource issues. His research focuses on restoration ecology and the incorporation of Indigenous knowledge into landscape restoration strategies, wildland fire and forest management in the Pacific Northwest and northern California. He has a research interest in wildland fire and management effects on cultural resources and tribal values. He is a fireline qualified Resource Advisor and has worked with tribes, agencies, organizations, and Incident Management Teams on wildland fire assignments. He also serves as an advisor to The Nature Conservancy's Indigenous Peoples Burning Network.

Franks' talk will Monday, January 10th at 1pm.

2022 Symposium Sponsorships

Please help make the 2022 Symposium a success! NCB invites sponsorship for our 11th symposium. Your help is important and allows us to keep our registration rates low and supports our student scholarship program.

If you or your company would like to partner with us in this event or if you have questions about sponsorship, you may contact us at ncbotanists@gmail.com or visit our website at www.norcalbotanists.org.

Lightning Talks

This year we are offering a 5-minutes per talk session. Consider giving a talk if you: are working on a project and want to give an update, are aware of an issue of concern or growing need in the botanical community, want to promote something exciting, need to hire people for an upcoming botanical project, have discovered something novel and interesting, know of new laws or regulations that the community should know about, or want to update about what your organization is doing. These talks need to be presented as pre-recorded videos. If you are interested in giving a lightning talk, contact kkaczynski@csuchico.edu by December 3rd. Please see our website for more information.

Call for Posters

The NCB symposium planning committee invites you to share a poster of your work and knowledge of the biology, ecology, conservation and/or management of our Northern California plant life with others at the 2022 Symposium. This online symposium will include a dedicated poster session displaying the pdfs of the posters with a live chat throughout the session for questions and answers with the poster The Poster Session will be on Monday, January 10th following the Keynote Address. Poster authors need to be registered for the symposium and are requested to be present during the poster session. The deadline for submitting poster abstracts is December 13, 2021. Additional information can be found on the website at: www.norcalbotanists.org

NORTHERN CALIFORNIA BOTANISTS IN ACTION

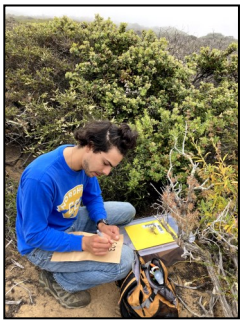
Charlie Russell received a Master's degree in Plant Pathology at U.C. Davis, which sparked his interest in botany. He has a strong interest and passion for photographing native plants, with a special emphasis on Northern California. He's a Certified California Naturalist, as well as a docent with the Jepson Prairie Preserve and Yolo Foundation. He also volunteers with NorCal Bats, helping with public education about the importance of bats. Currently he has a multi-year project photographing the recovery of native plants in the heavily burned serpentine hillsides of the McLaughlin Natural Reserve in Lake and Napa Counties. He publishes his photos on line at: https://www.facebook.com/CaliforniaWildflowerHikes, and if he ever finds the time to update it, his website at https://ibrakeforwildflowers.com/. Charlie is seen here on "a nice hillside of *Eschscholzia caespitosa* in a burned are of Sugarloaf Ridge State Park."

Michele Hammond is the botanist for the East Bay Regional Park District a special district with 125,000 acres of parkland in Alameda and Contra Costa counties. Michele's work priority is to assess and manage rare plants and their communities throughout the District. Recently, Michele was helping collect cones for the CalFire seedbank from the East Bay location for redwoods in Reinhardt Redwood Regional Park. She frequently does belly botany to look at *Atriplex* and *Extriplex* spp. and other plants in the alkali grasslands and vernal pools north of Livermore. Before working for EBRPD, Michele found her love for botany looking at grassland ecology and management for 20 years with the Range Ecology Lab at U.C. Berkeley. She earned both her bachelors and master's degrees from this same institution and is a Certified Rangeland Manager. Michele serves on the board of California Native Grasslands Association and is pictured here, in a field of *Lasthenia californica* in the Ohlone Wilderness.

2021-2022 STUDENT RESEARCH SCHOLARSHIP AWARDS

Northern California Botanists is pleased to announce the recipients of this year's research scholarship awards. As in the past, we received many worthy applications. This year we awarded 13 scholarships of $1,000 each. The Sacramento Valley and Shasta chapters of the California Native Plant Society have teamed up with NCB and are each funding one of the scholarships.

Anthony Balderas is an MS student at Cal Poly, San Luis Obispo.



The title of his research is **"An ecological assessment of an endangered lichen from Central California, Sulcaria isidiifera, the Splitting Yarn Lichen."**

Splitting yarn lichen (*Sulcaria isidiifera*) is a critically endangered lichen that occurs nowhere else in the world except a small pocket of maritime chaparral on the coast of California in San Luis Obispo County. It is estimated that the area of occurrence for this lichen is just 8 square kilometers. A recent assessment of the status of *Sulcaria isidiifera* found a decline in the extent of occurrence and the number of mature individuals present as well as numerous threats to the survival of this species from residential development and possibly climate change. Upon publication of this assessment, *S. isidiifera* was officially added to the International Union for Conservation of Nature Red List of Threatened Species, with a designation of Critically Endangered B2ab(i,ii,iii,iv,v). This study will provide a comprehensive ecological assessment of *S. isidiifera* in which species abundance and distribution along with lichen and plant community composition will be determined via systematic field surveys. Microclimate data will be gathered using temperature and humidity data loggers in key habitat. In addition, a transplant study will be carried out in which 30 individuals of *S. isidiifera* will be moved to new host shrubs in nearby suitable habitat to determine the viability of transplantation as a conservation method for this sensitive species. Data from this study will be used support a petition to the U.S. Fish and Wildlife service for listing of *S. isidiifera* as an endangered species under the Federal Endangered Species Act.

2021-2022 Student Research Scholarship Awards (Cont.)

Ashley Grupenhoff is a PhD student at the University of California, Davis.

The title of her research is **"Plant community response to increased fire frequency in northern California chaparral."**

Historically, fire was an important driver in maintaining species diversity in chaparral-dominated shrublands. However, fire frequency has increased exponentially in this ecosystem with the rise of urbanization and an extended fire season. This departure from the historical fire frequency has severe effects on biodiversity and species composition, leading to exotic invasion and type conversion of shrubland to grassland. The timing and mechanism of this process are poorly understood, especially in northern California. Although some studies have attempted to understand the effects of fire frequency on type conversion in southern California, these areas are too degraded to prevent further loss to carbon storage and ecosystem services. My study takes place on the LNU lightning complex in the coast range of northern California, one of the most frequently burned locations in the whole state. I will be examining how increased fire frequency affects the composition of herbaceous and woody species in northern chaparral as well as related species traits. Ultimately, the results of this project will provide empirical data to understand how and when chaparral communities lose resilience to invasion, thus informing management, planning, and restoration efforts in this region. It is critical that we make the appropriate management actions to prevent this largely intact community from following the same fate as southern California chaparral.

Anjum Gujral is an MS student at San Francisco State University.

The title of her research is **"Investigating leaf trait coordination and its role in determining habitat suitability under current and future climate."**

A major goal of plant ecology is to explain the distribution of species from their functional attributes, including physiological, morphological, and anatomical traits. Several leaf traits have the potential to describe plant strategies of growth and survival, particularly leaf traits that are related to carbon and water-use. Leaf traits that are indicative of carbon use strategies include leaf mass per area (LMA) and leaf lifespan (LL), while leaf traits that may be linked to water-use strategies include leaf hydraulic conductance (Kleaf), leaf hydraulic vulnerability or hydraulic safety (P50leaf), water potential at turgor loss point (ψTLP), leaf size (LA), and leaf vein density (VD). Trait coordination can be indicative of a species' strategies for growth and survival in a particular environment. This study assesses whether leaf trait coordination can inform species bioclimatic limits in current and future climates, as leaf traits may be under strong selective pressure with climate change. Most work in plant hydraulics has been conducted on woody plants with relatively little attention given to leaves of herbaceous species. The California Floristic Province is an excellent study system to elucidate the role of leaf trait coordination in predicting habitat suitability due to the rich functional and taxonomic diversity in herbaceous species that grow in vastly different climates across bioregions. Relying on a synthesis of previously published data and newly gathered data on herbaceous species, this study investigates the coordination of carbon and water-use leaf traits and the extent to which leaf traits are correlated with a species' climate envelope.

Answer to "Mystery Plant": Partridge foot - *Luetkea pectinata* (Rosaceae - Rose family)

2021-2022 Student Research Scholarship Awards (Cont.)

Emma Fryer is an MS student at Cal Poly, San Luis Obispo.

The title of her research is **"Community assembly of the vertic clay flora of the San Joaquin Desert."**

The goal of my project is to model community assembly for the unique vertic (>50% clay) clay endemic flora of the San Joaquin. The San Joaquin Desert hosts a high diversity of rare, endemic annual plants notable for their massive floral displays following high-precipitation winters. In such years, the blooms on the vertic clay soils of the San Joaquin Desert form a distinctive patchwork pattern that are associated with the heterogeneous pattern of soil texture and salinity. These soils are physically extreme due to high clay content, high shrink-swell, and sodicity. Like species endemic to other extreme substrates in California (e.g., serpentine), vertic clay endemic species appear highly adapted to these harsh soils. The non-native annual grass *Bromus madritensis* has invaded the vertic clay ecosystems in some areas and begun to displace the native vertic clay endemic species. My project will quantify edaphic (soil) factors determining fundamental niche for these species through a transplant study of twelve San Joaquin Desert native annuals across three soils (non-sodic, sodic, and extremely sodic vertic clay) and soil texture studies of five congener pairs reciprocally transplanted over contrasting soil textures. The role of *B. madritensis* as a competition factor acting on these species will be studied as a competition treatment in the same three vertic clay soil types. Results will be combined with field data on soil chemistry and local-scale species distribution to model the combined abiotic and biotic filters shaping the vertic clay endemic flora of the San Joaquin Desert. To date, there has essentially been no study of this vertic clay endemic flora, nor this form of edaphic endemism; my project will be the first to formally examine this plant community, its ecology, and this form of edaphic endemism, and my results will hopefully inform management and conservation of this unique flora.

Rosemary Frederick is an MS/PhD student at the University of Nevada, Reno.

The title of her research **is "The Maternal Effects of Production Environment on *Elymus elymoides* in Ecological Restoration."**

Genetic fitness is a crucial element of success in ecological restoration. In the Great Basin, extensive restoration efforts have been prompted by widespread high-intensity wildfires, invasion by introduced species, and the effects of climate change. However, restoration needs often outpace what can be collected in the wild, so seeds for many native plant species must be produced in agronomic fields. It is important to understand how these field conditions affect the genetic fitness of such seeds. In my project, I ask how the competitive ability of bottlebrush squirreltail (*Elymus elymoides*), a common restoration grass, is affected by its maternal growing environment. I will do this by growing two populations under maternal environments representing a range of conditions, from high resource with high intraspecific densities to low resource, high interspecific density conditions. I will test competitive traits in their progeny in a controlled greenhouse experiment, and compare seed traits in both generations. I expect to find lowered competitive ability and stress tolerance in individuals experiencing less stressful maternal environments, and decreased seed mass and germinability in individuals with more stressful maternal environments. By quantifying these effects in restoration populations, we can provide direct recommendations to restoration growers to improve seed characteristics by optimizing maternal environmental conditions.

2021-2022 Student Research Scholarship Awards (Cont.)

Kelli Thorup is an MS student at California State University, Chico.

The title of her research is **"Alleviation of thermal stress in *Pinus ponderosa* by plant-growth promoting rhizobacteria isolated from mixed-conifer forests."**

As climate change continues to elevate summer temperatures in the western United States, the successful establishment of conifer seedlings in Sierra Nevada, California, is predicted to dramatically decline. However, microbiota living in mutualistic associations with plant roots have been found to mitigate the effects of suboptimal environmental conditions. The goal of this research is to isolate native beneficial bacteria—plant-growth promoting rhizobacteria (PGPR)—that can alleviate heat stress in *Pinus ponderosa* and *Pseudotsuga menziesii* seedlings. Bacteria were isolated from the rhizosphere of *P. ponderosa* juveniles in located in mixed-conifer stand in Butte Meadows, California, and further characterized for PGP potential based on their ability to produce key growth regulatory phytohormones including auxin, cytokinin, and gibberellic acid. Out of ten soil samples taken, sixteen colonies were isolated and qualitatively confirmed to produce indole-3-acetic acid (auxin) using Salkowski's reagent. Future testing will be conducted to quantitatively assess phytohormone production in bacterial isolates. Furthermore, a bioassay will be used to determine if the isolates can ameliorate the adverse effects of thermal stress in *P. ponderosa* and *P. menziesii* seedlings. Upon completion of this research, PGPR could be utilized to support the growth and transplantation of conifer seedlings as summer temperatures continue to rise due to the effects of climate change.

Thomas Samojedny is an Undergraduate student at Cal Poly, San Luis Obispo. Shasta Chapter, CNPS, Awardee*

The title of his research is **"X-ray fluorescence of herbarium specimens: A path to the discovery of additional nickel hyperaccumulators in California."**

Hyperaccumulators are a rare subset of plants which uptake typically-toxic concentrations of metals. However, they are of increasing interest to scientists for their applications in phytoremediation and agromining since they can remove both toxic and valuable metals from soil. Nickel (Ni) hyperaccumulators are found on Ni-rich soils such as serpentine, which are found in isolated patches along California's ranges, but with particular abundance in Northern California. However, there are currently only 2 identified Ni hyperaccumulators in all of North America, both residing in Northern California: *Noccaea fendleri* and *Streptanthus polygaloides*. Other regions with serpentine soils have many more known Ni hyperaccumulators, including New Caledonia which has over 100 (Gei et al. 2020). I hypothesize that the low number of Ni hyperaccumulators in California is due to an understudy of these plants. Thus, my project utilizes a novel method, comprising X-ray Fluorescence (XRF) analysis of herbarium specimens accessed through the CCH2 database. Previous methods used to identify hyperaccumulators were costly, slow, and involved destructive chemical analysis of field-collected specimens. However, XRF allows non-destructive elemental measurement of herbarium specimens at a rate of thousands per week. This method has been proven effective through recent studies (Van der Ent et al. 2019; Mccartha et al. 2019) but has never been used before in North America. The hope is to discover new Ni hyperaccumulators using this method and raise awareness about serpentine landscapes as repositories of unique genotypes of plants.

2021-2022 STUDENT RESEARCH SCHOLARSHIP AWARDS (CONT.)

Reed Kenny is a PhD student at the University of California, Davis.

The title of his research **is "A phylogenetic analysis of the placement of Juncus Sections Caespitosi and Graminifolii."**

This project will test the current phylogenetic hypothesis that the genus Juncus is paraphyletic, meaning that species in other genera share a closest common ancestor with species of Juncus. This has been supported by previous molecular work but needs more sampling across the genus. The placement of the sections Caespitosi and Graminifolii, groups that are well represented in California, is of particular importance, as they are currently shown to be sister to three South American genera. The results of this work could potentially lead to the naming of a new genus, or the inclusion into *Juncus* of several small South American genera. If a new genus is named, knowing the placement of the Californian species in the phylogeny would determine whether they need to be included in a new genus. This work may also result in a revision of the sectional classification of Juncus as well as an updated taxonomy of Juncus species in California. To date, ten species in sections Caespitosi and Graminifolii have been collected, including the California Rare *Juncus luciensis,* and will be prepared for DNA sequencing in the coming months.

Justin Luong is a PhD student at the University of California, Santa Cruz.

The title of his research is **"Does drought facilitate competitive release for native species in a coastal prairie?"**

Drought and invasive species invasion affect how functional traits are expressed in native plant species. Optimal partitioning and environmental filter theory predict that water limitation could lead to high root allocation, low carbon assimilation, and resource conservative leaf traits. Responses to competition may complicate drought impacts depending on whether the invader is a stronger above- or below-ground competitor. In a glasshouse in Santa Cruz, CA, USA, we exposed five native California grassland species to episodic drought and competition (via five invasive species). We hypothesized that leaf morphology would be influenced more by competition, and leaf photosynthetic gas exchange by drought. We expected that traits would have trade-offs along a spectrum of resource conservatism vs acquisition. Bromus carinatus had greater photosynthetic recovery in drought when in competition, and Sidalcea malviflora had a higher root:shoot ratio. Stipa pulchra and S. malviflora gas-exchange were resistant to drought and adapted morphologically. Despite increased in Water-Use efficiency, the invasives, Geranium dissectum and Raphanus sativus, had reduced productivity under drought conditions. Native functional plant traits sorted onto two principal components related to drought escape vs tolerance and for stress tolerance above- vs belowground. The trait space was heavily partitioned by species identity and relatively unaffected by treatments. Morphological traits were primarily affected by invasive competition, whereas physiological traits like leaf-gas exchange were primarily affected by drought. Drought decreased plant carbon uptake rates across all species. The grassland plants we studied showed diverse responses to drought and competition with trait trade-offs related to strategies to deal with drought and stress. In our system, competition resulted in greater allocation to roots than shoots, consistent with optimal partitioning for semi-arid systems. Because certain native species (B. carinatus and S. malviflora) were resistant and resilient to drought, it may be resource efficient to use those species during dry years.

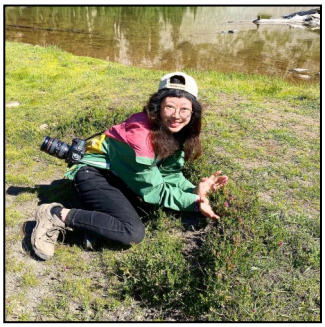
2021-2022 Student Research Scholarship Awards (Cont.)

Nora Bales is an MS student at Cal Poly, San Luis Obispo.

The title of her research is **"Investigating the relationship between biological soil crust and *Hooveria purpurea* var. *purpurea*, a rare plant on California's Central Coast."**

Purple amole, *Hooveria purpurea* var. *purpurea* is a threatened Californian endemic plant known from only four populations, all on Department of Defense lands. The largest of these four populations occurs at Camp Roberts, a California Army National Guard Training Site. Prior field studies of purple amole have observed greater purple amole plant density in populations associated with biological soil crusts. Biological soil crusts perform important ecological functions in arid ecosystems worldwide, including soil stabilization, water retention, and nitrogen fixation. The objective of this study is to understand the relationship between purple amole density and biocrust presence, level of development, and diversity. In 2020, we found a significant positive correlation between purple amole density and biocrust presence (R^2=0.45, $p<0.05$). Further data on purple amole density and biocrust percent cover collected in spring 2021 will help clarify if this trend persists despite interannual variation in climate and disturbance regime. Further, we will identify crust component organisms using microscopy and DNA sequencing and measure a suite of biotic and abiotic purple amole habitat parameters. We expect to find greater purple amole density in areas with more developed biological soil crusts. Previous management efforts have focused on strategies to increase purple amole reproductive output without considering other habitat parameters. If purple amole density is truly correlated with biological soil crust presence, then any future management, conservation, or restoration efforts for this plant must also consider biological soil crusts.

Chenjiao Deng is an MS/PhD student at the University of California, Davis.



Chenjiao Deng is an MS/PhD student at the University of California, Davis. The title of her research is "**Investigating the Identities of Populations of *Castilleja* (Orobanchaceae) in the Vicinity of Mt. Lassen."**

The taxonomic status of populations of *Castilleja lemmonii*-like plants from the vicinity of Mt. Lassen remains ambiguous. Some authors have considered these as conspecific with *C. lemmonii*, while others have recognized *C. lassenensis* at specific rank based on their consistent and visually striking morphological differences from the Sierra Nevada populations of *C. lemmonii*. In general, *C. lassenensis* can be differentiated by its unique floral coloration and endemism to volcanic substrates in the vicinity of Mt. Lassen, but the quantitatively low degree of morphometric distinction of *C. lassenensis* raises questions about its identity as a separate species. Further studies are required on the genetic variation of in this group to resolve these taxonomic doubts. This proposed study's primary goals are to analyze the genome of *C. lassenensis* to assess its identity as a separate species, resolve its controversial taxonomic status, and provide a better understanding of the nature of species within the genus *Castilleja*. Phylogenetic analyses of molecular data from chloroplast DNA sequences, simple sequence repeat (SSR) markers, and single copy nuclear loci will be used to address these questions. Sample collection is still in progress in collaboration with the National Park Service botanist Dr. Steven Buckley and his staff. Ultimately, our results will provide insight into the accurate taxonomic status of populations of Mt. Lassen *Castilleja lemmonii*-like plants.

2021-2022 Student Research Scholarship Awards (Cont.)

Sophia Lemmo is an MS student at Humboldt State University.

The title of her research is **"Tree Mortality and Regeneration Across Competitive and Geographic Gradients in Northern California."**

The 2012-2015 California drought was unprecedented and contributed to the death of millions of trees. My graduate research compares tree mortality and natural regeneration patterns before, during and after California's 2012-2015 drought, along with their associations with specific climate and habitat parameters. The study area includes the forested region of Northern California, centered on the Klamath Mountains. The Klamath Mountains are unique for their highly diverse plant taxa, with over 30 conifer species. 54 0.25 ha plots were measured, and dendrochronological methods are currently being used to date samples. Preliminary results indicate that most species had lower mortality rates in the drier parts of their range, compared to wetter habitats. Across plots, Shasta red fir (*Abies magnifica* var. *shastensis*) and white fir (*Abies concolor*) had 17% and 13% mortality rates, respectively, while Brewer spruce (*Picea breweriana*) had a 3% mortality rate, and sugar pine (*Pinus lambertiana*) and western white pine (*Pinus monticola*) had a 34% and 36% mortality rate, correspondingly. In terms of regeneration, there were more than 15 times the number of fir species in the understory compared to pine species. The average age for the seedlings and saplings is 33 years, with a mean height of 36 cm. Understanding forest demographic trends by tree species enables targeted management to conserve the diversity of Northern California forests and reduce mortality on the landscape. These findings also allow for enhanced forest modeling and inform future forest climate research needs.

Brook Constantz is a PhD student at the University of California, Santa Cruz.

The title of his research is **"Long-term recovery of Restored Forest Overstory and Understories along the Sacramento River, California."**

Historically, riverine floodplains supported vast expanses of riparian vegetation extending kilometers from the active channel. By the late 1980s, only about five percent of the approximately 324,000 hectares of the Great Central Valley Riparian Forests remained. Restoration of these forests started in 1989 and has completed about half of the 6,000-hectare goal. Previous research has studied these restored areas and the adjacent remnant forests to characterize the environmental factors influencing restoration. This research follows up on these studies to detail the recovery trajectory of different forest components overtime. Spring 2021 surveys of 35 forest plots provided data comparing the structure and composition of remnant and restored overstories and understories. Restored forest understories have more abundant woody species than remnant forests which are more herbaceous and graminoid. Importance values show both forests still have overstories dominated by *Populus fremontii* (Fremont's cottonwood), but it has declined since the last survey, where *Juglans hindsii* (Northern California black walnut) has largely made up this difference in remnant forests and *Quercus lobata* (valley oak) in restored forests. The tree-stem diameters in restored forests had a smaller mean and variance than remnant forests in prior surveys but have since converged. Future research will strengthen the ecological signal through a 2022 survey of the understories in another water year as well as completing the remaining overstory plots.

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Save the Date!

NCB 2022 Symposium
Online Event
10-11 January 2022

Registration will Open Soon!

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