

UC Santa Barbara Newsletters

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UCSB Restoration Register - May 2024

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Authors

Bender, Jeremiah

Stratton, Lisa

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UC **SANTA BARBARA**
Cheadle Center for Biodiversity
& Ecological Restoration

Restoration Register

May 2024



California Poppy (*Eschscholzia californica*) and Bush Lupine (*Lupinus arboreus*) on Lagoon Island.

Updates

[Ellwood Bioblitz](#)



Staff member Andy Lanes showing a gopher snake to young students.

The Cheadle Center kicks off its partnership with the City of Goleta's restoration of the Monarch Groves at Ellwood with a bioblitz! Community members found everything from snakes to tiny mushrooms, but mostly invasive plants during their exploration of the site's biology. You can find out what they saw by joining the project [here](#), and you can contribute your observations from the site and then participate in the transformation of the site over the next few years.

Ellwood Marine Terminal



The restoration of the highest point on Ellwood Mesa has begun! This view of the tanks will be fleeting, as they are scheduled for removal by the end of summer. During this summer, you'll also have an opportunity to participate in visioning for public access to the site. Visiting the site will help you develop a sense of the views and connections between the islands and the mountains that the site will provide for the community. If you wish to participate, please contact ncos@ccber.ucsb.edu. We have a list of those who have already RSVP'd and will be sending out additional public invitations.

Spring Weeding Efforts at NCOS

Two heavy rain years have resulted in an explosion of invasive plants at the North Campus Open Space, particularly Bur Clover (*Medicago polymorpha*). We've had all hands on deck over the past couple of months to help deal with this invasive plant. Our weeding strategy has focused first on halo weeding, which involves groups of student workers, interns, and volunteers removing all invasive plants in an approximately 1-foot buffer around native species that staff have identified. Following this, staff can come back through these areas and remove all the remaining invasive plants using electric string trimmers. Additionally, we have been removing the trimmed plant material in order to prevent it from stifling native plant growth. You can see the results right now along the eastern arm of the NCOS Marsh Trail where we've been hard at work over the past couple of weeks.







We're even getting a little help from the wildlife - this California Ground squirrel is feeding on a Bur Clover seed pod.

Wildflowers

As spring nears its end, native wildflowers continue to provide a colorful show at Cheadle Center management areas. At Henley Gate, you can see Miniature Lupine (*Lupinus bicolor*) and California Poppy (*Eschscholzia californica*) in abundance.



Miniature Lupine (*Lupinus bicolor*)



California Poppy (*Eschscholzia californica*)

The show continues on Lagoon Island, where the burn plots are still displaying a variety of native wildflowers. In addition to the aforementioned species, you can see common Popcorn Flower (*Cryptantha clevelandii*), Miniature Suncups (*Camissoniopsis micrantha*), Blue Toadflax (*Nuttallanthus texanus*), Nuttall's Snapdragon (*Antirrhinum nuttallianum*), and Common Phacelia (*Phacelia distans*), among others.



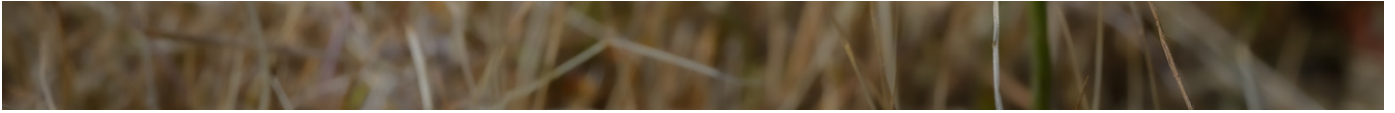
California Poppy (*Eschscholzia californica*), Common Phacelia (*Phacelia distans*), and Bush Lupine (*Lupinus arboreus*)

At the North Campus Open Space, we've observed several new species germinating in the Mesa Grassland area, including Cluster Lily (*Brodiaea jolonensis*), Common Goldenstar (*Bloomeria crocea*), and Common Popcorn Flower (*Cryptantha clevelandii*). These species were among those in the native wildflower mix that was spread after the cultural burn that took place in Fall 2023, which we believe assisted in their germination.



Cluster Lily (*Brodiaea jolonensis*)





Common Goldenstar (*Bloomeria crocea*)



Blue Dicks (*Dipterostemon capitatum*)



Owl's Clover (*Castilleja exserta*)



Winecup Clarkia (*Clarkia purpurea*)



Common Popcorn Flower (*Cryptantha clevelandii*)

Rare Plants

Some of the rarest plants at NCOS are germinating and re-sprouting. Salt marsh bird's beak (*Chloropyron maritimum* ssp. *maritimum*) is a state and federally endangered annual plant in the Orobanchaceae, or broomrape family. A hemiparasitic plant, it derives most of its nutritional needs from the roots of host plants such as saltgrass, which it steals through structures that wrap around the host's roots called haustoria. Salt marsh bird's-beak occurs naturally in Southern California salt marshes from Carpinteria down into Northern Baja, but oddly was never observed or collected in the Goleta or Devereaux sloughs. Since all the distinct wetlands in Southern California that support salt marsh bird's-beak bear different local forms of the plant, the seed we introduced to NCOS was from the nearest occurrence to campus, the Carpinteria salt marsh.

In the spring of 2023 these seeds were introduced into numerous experimental sites around the newly restored marsh in collaboration with Tidal Influence and the USFWS. This experimental trial with 5,000 seeds allowed us to identify the sandy zone on NCOS as the most successful. Based on those results we experimentally distributed more than 50,000 seeds in the winter and spring of 2024 and are monitoring natural and augmented seed regeneration this year and finding thousands of seedlings that will develop their classic purple/pink flowers this summer. Check out our new Rare Plant sign on Venoco Road and look into NCOS for the blooming flowers in the next 3 to 6 months.



Salt Marsh Bird's Beak (*Chloropyron maritimum* ssp. *maritimum*) growing alongside Saltgrass (*Distichlis spicata*) in the southeast salt marsh at NCOS.

NCOS is also home to one of the world's largest populations of the endangered Ventura marsh milk-vetch (*Astragalus pycnostachyus* var. *lanosissimus*), once thought to have gone extinct in the 1960s and rediscovered in 1997. This short-lived perennial shrub in the Pea family (Fabaceae) is a disturbance follower that makes its home in coastal wetlands. Beginning in March 2019, we began work on the outplanting and propagating of Ventura marsh milk-vetch at NCOS. The largest population is currently in the sandy area of the eastern salt marsh.

We are about to embark on researching a phenomenon we have observed: dense colonization of invasive rabbit's foot grass (*Polypogon monspeliensis*) in areas previously inhabited by Ventura Marsh Milk Vetch. We hypothesize that this colonization may be attributed to the Fabaceae family's capacity to fix nitrogen from the air and deposit it in both the plant and the soil. This nutrient pulse could potentially create a feedback loop that does not benefit this endangered plant.



Ventura marsh milk-vetch (*Astragalus pycnostachyus* var. *lanosissimus*) in the southeast salt marsh transition.

Ocean Meadows Housing Project

The grading occurring on the eastern edge of NCOS is part of a new private housing development that will include student housing for approximately 300+ students. Additionally, there will be 6 affordable units built in the fenced-off area next to the ROOST parking lot. These projects are due to be finished at the

end of 2024 for the affordable housing and at the end of 2025 for the student housing.



This area directly east of NCOS will be developed into the student housing project.

Feature Story

Unveiling Insights: Cheadle Center Presentations and Projects

Cheadle Center staff members and student researchers have been diligently conducting research across various fields and are currently showcasing their work at conferences, symposiums, and science fairs. This week, several staff members from the Cheadle Center will present at the California Society for Ecological Restoration (SERCAL) conference in Redlands, California. SERCAL, a non-profit membership-based organization, is dedicated to facilitating the recovery of damaged California ecosystems through conferences, field tours, workshops, and more. Chris Berry, Wayne Chapman, and Claire Wilhelm-Safian will share the unique insights they've gained from their various projects during the conference.

Chris Berry's presentation focuses on the integration of prescribed fire and grass-specific herbicides in annual wildflower restoration on Lagoon Island. The practice of prescribed fire on Lagoon Island began in 2006, following the research conducted by graduate student Alice Levine. Her findings revealed that an intense, hot fire burning at 200 degrees Celsius could reduce the Ripgut Brome (*Bromus diandrus*) seed bank by an impressive 99%. Furthermore, it was determined

that the addition of supplemental woody fuel is essential to attain a fire hot enough for effective reduction. Subsequent weeding and planting of native shrubs were identified as crucial steps for the successful transformation of invasive grassland into native-dominated shrubland.



Pre-burn area dominated by Ripgut Brome (*Bromus diandrus*).



Post-burn area with native shrubs such as Bush Sunflower (*Encelia californica*)

Chris discusses a shift in restoration tactics in 2016, moving from planting California Sage Scrub species after fires to spreading thousands of seeds of locally sourced wildflower species and

allowing shrub species to naturally fill in over time. This approach, involving meticulous seed collection and bulking, resulted in the creation of impressive wildflower fields, showcasing native forbs that bloomed for multiple years post-burn. Various wildflower species were included in this seeding strategy, such as *Calandrinia menziesii*, *Camissoniopsis micrantha*, *Nuttallanthus texanus*, *Cryptantha clevelandii*, *Eschscholzia californica*, *Acemison strigosus*, and *Antirrhinum nuttallianum*. The establishment of this diverse native plant communities not only enhances the aesthetic appeal but also provides resources for native fauna throughout the year, supporting numerous native pollinators.

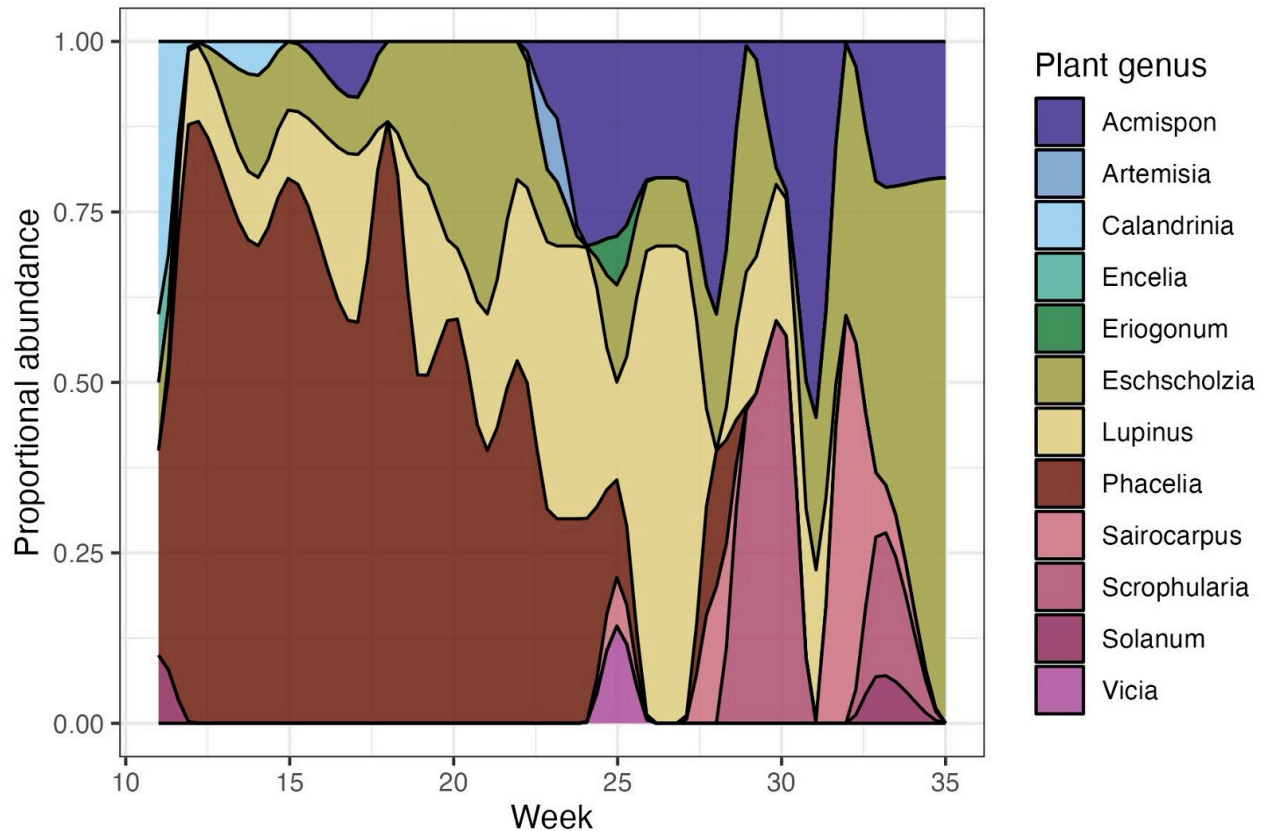


Burn area immediately following the fire.



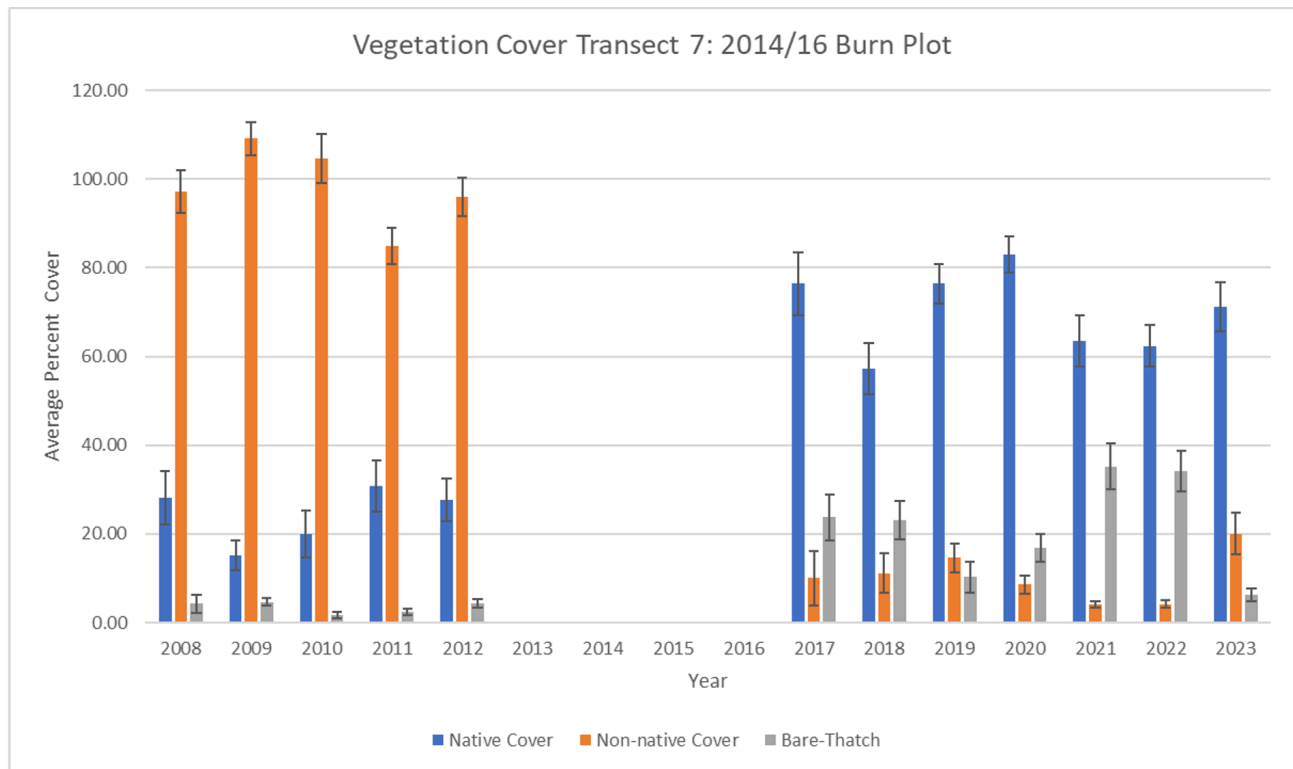
Post-burn area that was seeded with native wildflower mix.

These wildflowers zones on Lagoon Island support ongoing research activities, including monitoring the timing of blooming species and studying native pollinator behavior. Currently, students are monitoring the timing of blooming species on a weekly basis and observing the foraging preferences of Yellow-face bumblebees (*Bombus vosnesenskii*). In addition to these observations, they are actively capturing bees, collecting their pollen sacks, and testing the DNA within to determine precisely which groups of plants these native, generalist pollinators are choosing to visit.

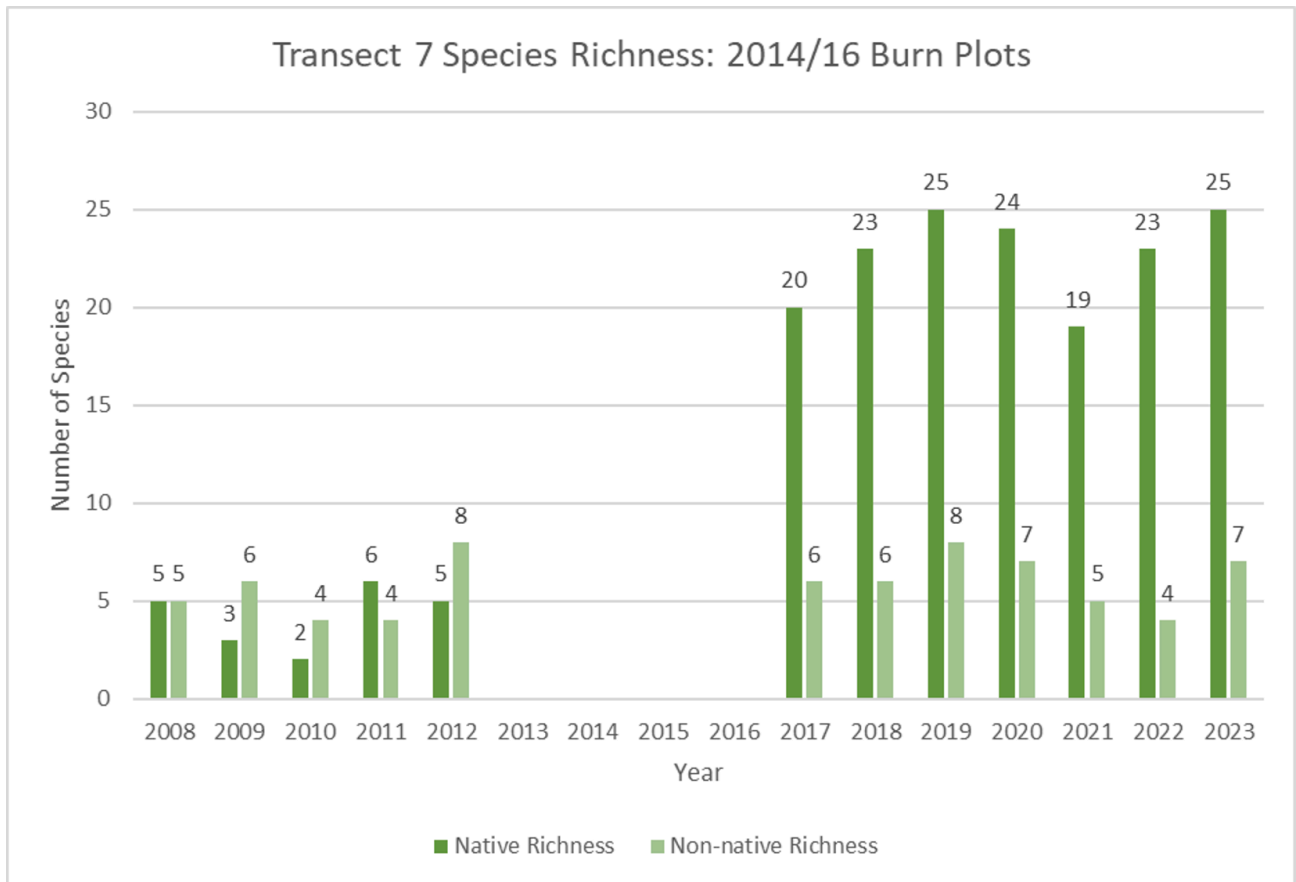


This graph shows the proportional abundance of plant genera detected in the collected pollen sacks of Yellow-face bumblebees (*Bombus vosnesenskii*).

Challenges such as managing remaining grasses and controlling invasive forbs are acknowledged, with the use of grass-specific herbicide Clethodim identified as a valuable tool in managing invasive grasses without harming native plants. The restoration efforts on Lagoon Island have burned approximately 3.5 acres to date, with plans for further burns in the future. The island serves as a living laboratory for students and faculty, providing opportunities for hands-on learning and research in native ecosystems and habitat restoration.



This graph shows the increasing native cover in the 2014/2016 burn plot from 2008-2023.



This graph shows the increasing diversity of native plants in the 2014/2014 burn plot from 2008-2023.

Wayne Chapman's SERCAL presentation emphasizes the importance of maximizing restoration opportunities and promoting objectivity in environmental management efforts. He focuses on the need to consider the existing biodiversity in natural areas when implementing restoration strategies,

advocating for a place-based approach that accounts for genetic and taxonomic diversity. Wayne also addresses the potential risks associated with subjective citizen involvement in restoration projects, such as the unintended consequences of planting non-native species like Mexican milkweed for monarch butterflies or feeding wildlife. He suggests viewing restoration sites through the lens of the area's rarest organisms and identifying micro-sites or subtle niches that can support these rare taxa, both plants and animals.



Ventura marsh milk-vetch (*Astragalus pycnostachyus* var. *lanosissimus*) is an example of an exceedingly rare species that occupies a very specific niche.

Highlighting the significance of small-scale impacts, Wayne explains how even tiny micro-sites, no larger than a king-sized bed, can play a crucial role in conserving rare plants. He also discusses innovative approaches, such as pioneering artificial burrows for burrowing owls, to address the specific needs of rare organisms in the area. Overall, Wayne advocates for nuanced and tailored restoration efforts that go beyond generic messages, like "plant more trees," to address the unique challenges and opportunities presented by each ecosystem.



This burrowing owl is taking shelter in an artificial burrow built by Wayne Chapman on the NCOS Mesa.

Claire Wilhelm-Safian's presentation dives deep into the collaborative research and conservation endeavors focused on the endangered Nipomo Lupine (*Lupinus nipomensis*). The Nipomo Lupine, a small annual herbaceous plant endemic to a small portion of the Guadalupe-Nipomo Sand Dune Complex in San Luis Obispo County, faces an array of threats that have led to its decline and endangerment. Collaborative efforts involving multiple organizations, including the Cheadle Center, California State Parks, the Land Conservancy of San Luis Obispo County, and research affiliates such as Dr. Justin Luong, have been pivotal in studying and conserving the Nipomo Lupine. These initiatives have spanned over a decade and encompassed various aspects, including habitat restoration, population monitoring, and research on ecological interactions.



Nipomo Lupine (*Lupinus nipomensis*)

A primary concern highlighted is the encroachment of perennial veldt grass (*Ehrharta calycina*), which has aggressively invaded the lupine's habitat. Originating from its introduction as cattle feed, veldt grass has proliferated, transforming the once open sandy dunes into dense grasslands. This invasion has altered the landscape but also poses challenges such as outcompeting native vegetation, altering microclimate conditions, and increasing the risk of wildfires. Claire also delves into the impacts of drought and climate change on the lupine population. The Nipomo Lupine relies on cool, wet winters for germination and survival, making it particularly vulnerable to changes in climate patterns. With projections indicating potential increases in drought severity and frequency due to climate change, the lupine's habitat faces further jeopardy.



Perennial Veldt Grass (*Ehrharta calycina*)

Detailed studies have revealed the lupine's habitat preferences, with swales and north facing slopes identified as consistently preferred microhabitats. Furthermore, protective measures such as the use of cages to mitigate herbivory have been implemented and shown to be effective in safeguarding lupine populations. Recent endeavors have included the establishment of augmentation plots seeded with lupine to bolster population numbers. These efforts have yielded promising results, with significant increases in lupine populations observed in recent years.




A 10'x10' augmentation plot containing 500 Nipomo Lupine seeds.


However, challenges such as predation by granivorous birds and rodents persist, necessitating ongoing research and management efforts. Claire's presentation underscores the importance of continued collaboration and the contributions of various partners and funding agencies, emphasizing the collective commitment to conserving this endangered species and its unique habitat. While the Nipomo Lupine faces daunting threats, the collaborative research and conservation initiatives outlined in the presentation offer hope for its preservation.

In addition to providing research opportunities for staff members, Cheadle Center management areas are an invaluable resource for UCSB students interested in ecological research. Last month, UCSB student researchers presented multiple research projects at the EEMB symposium on April 20th.

has been a great source of support for me during this process!"





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Analysis of Algae and Aquatic Vegetation Abundance at the Devereux Slough

Sophia Rose Cabral, Delaney O'Donnell, Emma Cardoso, Alison Rickard
University of California, Santa Barbara

UCSB EEMB

Introduction

The Devereux Slough is a temporary open/closed estuary (TOCE) that provides increased buffer area for storm surges and sea level rise and a wildlife corridor connected to other protected lands. As a TOCE, water quality metrics vary greatly over the course of the year and with distance from the ocean.

The Slough is divided into Coal Oil Point Reserve (COPR) and North Campus Open Space (NCOS). While restoration efforts at the former began in 1970, efforts to restore NCOS began in 2017. We sought out to understand trends in algae and aquatic vegetation growth at the Devereux Slough via close-range and satellite imagery.

Understanding algal growth through close-range photography involves analysis of the red, green, and blue (RGB) values to determine algae abundance. We subsequently quantify the temporal shifts in abundance in relation to water quality variables given by constant water loggers. Our investigation of photosynthetic activity at the Slough involves analysis of satellite imagery from 2018-2023. We hope to elucidate the different trends in aquatic vegetation and algal growth between COPR and NCOS. Understanding the relationship between the nutrient pulses, algal blooms, and aquatic vegetation growth is important for evaluating how the wetland is functioning for filtering nutrients and supporting wildlife.




Figure 1. NCOS Study Sites.
A. Satellite imagery areas of interest (AOIs)
B. Bridge sites with camera stands

Results

Mean NDAVI values tend to increase with distance from the ocean, with the highest values at NEC and NPB and the lowest values at COPR. While seasonal fluctuations in NDAVI are reflected, monthly NDAVI values may not capture all spikes and dips (percent frequency of algae abundance is variable over the course of one month). Linear regression equations reveal that photosynthetic activity is decreasing over time at COPR but increasing over time at NCOS.

Average percent frequency of algae abundance varied greatly over the sites, with low frequencies occurring during the periods of time when the estuary was open. Water quality variables are in the process of analysis, however, the water temperature seems to have a role in algae abundance at the Veneco Bridge site. The spikes in temperature correlate with spikes in algae abundance at Veneco Bridge.

Methods




Figure 2. 3D printed camera stand model deployed at NPB, NEC, and NVBR

$$\frac{\rho_{NIR} - \rho_{BLUE}}{\rho_{NIR} + \rho_{BLUE}}$$

Figure 4. NDAVI formula quantifying photosynthetic activity via surface reflectance (ρ) of blue and near-infrared spectral bands

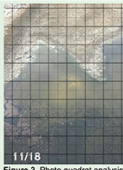


Figure 3. Photo quadrat analysis

As close-range photography has a limited capacity for spatial analysis of algal and aquatic vegetation growth, we analyzed satellite imagery sourced from Planet Labs. We used ArcGIS to create four shapefiles/areas of interest (AOIs) with boundaries slightly inward of the slough's maximum water level to account for bordering terrestrial vegetation (figure 1A). We used these files to download monthly imagery from January 2018 to April 2024, selecting for maximum area coverage, minimum cloud cover, and highest resolution. We created a code in RStudio that extracts the blue and near-infrared (NIR) spectral bands and applies the normalized difference aquatic vegetation index (NDAVI) formula. This index, derived from the NDVI formula using red and NIR bands, exploits chlorophyll absorbing blue and reflecting NIR spectral bands; it uses blue rather than red spectral bands to correct for water/wet soil as background rather than dry land. The NDAVI indicates maximum photosynthetic activity at a value of +1 and no activity at a value of -1. NDAVI values for individual pixels were calculated and averaged over the given site.

Conclusions

Algae abundance across the multiple sites varies greatly, and the correlation of the algae abundance with differing water quality variables is currently being analyzed. Preliminary findings indicate that the opening and closing of the estuary seems to play an important role in algae abundance across all the sites. Future applications of this aspect of the project include long-term data collection and incorporating other organisms into future photoquadrats, such as aquatic vegetation.

Mean photosynthetic activity trends higher in NCOS than COPR and is increasing over time in NCOS; this may indicate intensified and increasing eutrophication in NCOS. These results present an avenue for future research to determine what water quality metrics correlate with this trend, which is currently being explored.

Acknowledgements & References

This project was inspired by Steve Senese, funded by the Santa Barbara Audubon Society (SBAS) and the Steinmetz family foundation. S.R.C. gives special thanks to the Gene and Susan Lucas Undergraduate Fund for additional support and funding. Thank you to Alison Rickard and the members of the NCOS Aquatic Invertebrate Laboratory for assistance throughout this project.

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Students Sophia Rose Cabral, Delaney O'Donnell, Emma Cardoso and staff member Alison Rickard conducted research on the abundance of algae and aquatic vegetation in the Devereux Slough. They utilized close-range and satellite imagery to analyze trends in algae and aquatic vegetation growth. Their findings revealed significant variability in the average percent frequency of algae abundance across different sites, with lower frequencies observed during periods when the estuary was open. While water quality variables are still being analyzed, preliminary observations suggest that water temperature may play a role in algae abundance, particularly at the Veneco Bridge site, where spikes in temperature correspond to spikes in algae abundance.



Shedding Light on Campus: Improving Student Safety and Energy Efficiency through Light Pollution Analysis

Kaitlyn Briggs, Hibah Ganie, Owen Crosby, Arianna Huang, and Dr. Lisa Stratton



Introduction

- Previous work conducted by UCSB students, Lux Ray and Justin Park, highlighted the negative impact that lights can have on wildlife in natural areas around UCSB.
- This study continues that work, but focuses on how excessive light negatively impacts humans through reduced safety due to glare, disturbances in circadian rhythms, and diminished opportunities for stargazing.
- Our circadian rhythm is impacted by exposure to lights during the night, which impedes on our natural sleep cycle.³ Lower academic performance is associated with disrupted sleep and light exposure.⁹
- Light glare reduces visibility of surrounding areas and objects, which decreases safety.¹⁴ There have been many cases of excessive lights increasing crime as victims cannot see criminals in the shadows (Fig. 10).
- Lights without covers, such as "Johnny Balls" contribute to light pollution and reduce visibility of the night sky.¹ Shields can reduce light pollution, light trespass, over illumination, and glare for students in their residence and during night-time campus activity.
- LEDs use significantly less energy than incandescent bulbs, resulting in LEDs lowering electricity costs. The duration of LEDs outlives incandescents along with customizable color temperature to emit warmer light and reduce physiological effects on our circadian rhythm.²

Methods

- Identified problematic lights around 12 campus residential areas and took field measurements of light intensity and color temperature. Visual examples of problematic lights shown in Figures 1 & 2.
- Generated an ArcGIS Online map to visualize color temperature gradient measured by kelvin and the amount of light overlap measured by lux intensity. Buffers were used to find the amount of light overlap.
- Quantified sky light pollution with the Unihedron Sky Quality Meter at 6 zones around residential and natural area zones mapped out in ArcGIS Online.
- Created 6 versions of attention-grabbing info flyers with a QR code for a student engagement survey about specific problematic lighting around their residences. Flyers were posted around campus, displayed on digital screens in residential lobbies and dining commons, and sent out through residential email list servers.
- Calculated average annual cost of outdoor lighting with provided estimates of the quantity of 3 main light types on campus and a rate of \$0.15 per kilowatt-hour.
- Utilized cut sheets sourced from UCSB's Long Range Development Plan to assess different types of shields that could be used to reduce light trespass into residential rooms and into the night sky.



Figure 1. Campus Standard with glare and shining into dorm rooms.



Figure 2. Campus Standard taped by students to block light shining into dorm windows.

Results



Figure 3. Lights with values higher than 4000K are problematic due to impact on circadian rhythm. Lights with lux (brightness) values that overlap with a neighbor light are problematic as that indicates excessive light intensity.



Figure 4. ArcGIS Map depicts the dark sky quality readings for 6 zones around campus. Darker colors indicate a darker sky, while light colors indicate higher rate of light pollution.

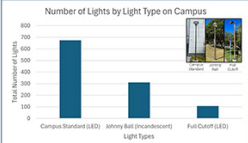


Figure 5. Bar graph shows the number of 3 main light fixtures on campus, categorized into LED or incandescent bulbs. There are more than double the amount of Campus Standards as Johnny Balls.

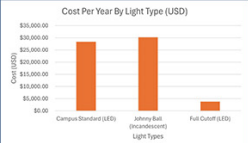


Figure 6. Bar graph shows the total cost per year in USD for each light type. Total cost is proportional to overall energy use by wattage for LED or incandescent and the rate of \$0.15 per kilowatt-hour.



Figure 7. Pie chart showing the proportion of which residential halls the students are reporting on the survey. (n = 9 responses)

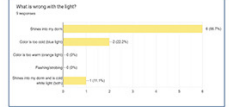


Figure 8. Bar graph showing proportion of survey answers for what is wrong with the light. (n = 9 responses)

There were 35 problematic lights measured by the team around the residential areas of campus with upwards of 35 identified as being problematic for factors not limited to kelvin and lux values. Our findings reveal 14 of the 35 measured lights were greater than 4000K and 18 of the 35 measured lights had lux values that resulted in excessive light overlap (Fig. 3).

For the Dark Sky Quality results, zone 1 was classified as a highly suburban sky, zone 2, 3, 4 were classified as suburban/urban transition, zone 5 & 6 were classified as suburban sky (Fig. 4). At zones 5 and 6, only hints of zodiacal light are seen on the best nights in autumn and spring⁷. Brighter zones 3 and 4 result in light pollution making the entire sky light gray.

The cost per year (USD) for individual fixtures was calculated at Campus Standard (65W): \$42.09; Full Cutoff LED (55W): \$35.62; Johnny Balls (150W): \$97.13. The total cost for all 674 Campus Standards was \$28,369.17 and for all 127 Full Cutoff LEDs was \$3,810.83, while the 311 Johnny Balls cost \$30,208.21 per year (Fig. 5 & 6).

From the 6 versions of info flyers distributed across campus from January and continuing today, there were 9 student responses recorded within the first two months. There was a majority of reports from San Nicolas at 44.4% (Fig. 7) and the most frequently reported issue was the light shining into the students' dorm from 7 of 9 responses (Fig. 8).

Discussion

- Our field measurements and direct responses from student surveys show there is a sufficient amount of problematic lights that need to be addressed by the campus lighting staff to improve the health and safety of students in the residential halls.
- The Bortle Scale,⁸ used to characterize dark skies, ranges from 22.0 (Excellent Dark Sky) to <18.0 (City Sky). Readings for heavily populated cities like Buenos Aires, Argentina were 16.09 (Inner City sky), while the NamibiRand Nature Reserve in Namibia was 22.05 (excellent dark sky). UCSB's dark sky readings ranged higher, towards a intermediate-darker sky. Zones with excessive light pollution and minimal visibility of the night sky must be addressed with replacing or adding shields to fixtures that have vertical light trespass.
- LEDs cost less and last longer than incandescents and thus should be the preferred bulb. Switching incandescents to LEDs would save \$17,117.98 per year.
- Aforementioned studies reveal increased lighting does not necessarily decrease crime as light glare can impede a victim's view of objects in the shadows (Fig. 10).¹⁴
- There were limited student responses to the survey, next steps would include more active, in-person engagement such as night tours or tabling outside the library to speak face-to-face and directly hear their concerns.
- Off-campus residential zones had full beam spread overlap, so single fixture measurements were not feasible. Future readings would focus overall light trespass into rooms rather than specific problematic fixtures.
- Our findings will be reported to the lighting staff to take our suggestions into consideration to reduce light pollution, increase campus safety, and improve student health and academic performance.
- We will recommend shields to campus lighting staff to be purchased and installed on all problematic lighting fixtures. We will identify unnecessary lights that could be removed to save energy costs and reduce light overlap.



Figure 9. Aerial view of campus light shining into the night sky. Top photo San Nicolas Slope. Bottom photo Marquessa Village. Photo credits: Jeremy Bender



Figure 10. Visual representation of light glare impeding vision. A person in the shadows of both photos; top photo unable to see with glare; bottom photo visible by blocking the glare. Photo credit: Ken Weisauer

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Acknowledgements


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Students Kaitlyn Briggs, Hibah Ganie, Owen Crosby, Arianna Huang and Director of Ecosystem Management Lisa Stratton researched the effects of campus lighting on humans, specifically how excessive light negatively impacts humans through reduced safety due to glare, disturbances in circadian rhythms, and diminished opportunities for stargazing. The team identified problematic lights near 12 campus residential areas and conducted field measurements of light intensity and color temperature. They then visualized the data using ArcGIS Online maps, illustrating color temperature gradients and light overlap. Sky light pollution was quantified using the Unihedron Sky Quality Meter at 6 zones, and attention-grabbing info flyers with QR codes for a student engagement survey were created and distributed.


The students found that there were 35 problematic lights around the residential areas of campus. Of these 35, 14 measured lights had color temperature values greater than 4000K, which can impact circadian rhythms. Additionally, 18 of the 35 measured lights had lux values that resulted in excessive light overlap, indicating excessive light intensity. They will recommend shields to campus lighting staff for purchase and installation on all problematic lighting fixtures, and will identify unnecessary lights that could be removed to save energy costs and reduce light overlap. When discussing the project, Kaitlyn Briggs stated "Collaborating with my team at the Cheadle Center and the campus lighting staff, our efforts towards mitigating light pollution on campus highlighted the importance of a community effort on a topic that impacts us all on a daily, or nightly, level. As this project will continue to evolve, it illuminates the significance of sustainable lighting practices, benefiting both students and the surrounding natural habitats, ensuring harmony with our

cherished native wildlife."



Assessing seed predation to inform the conservation and recovery of the critically endangered Nipomo Mesa Lupine, *Lupinus nipomensis*.

Calen Campos, Lisa Stratton, Wayne Chapman, An Bui, Mary Cadogan
 Cheadle Center for Biodiversity and Ecological Restoration
 Department of Ecology and Evolution, University of California Santa Barbara



Background

Focal Species

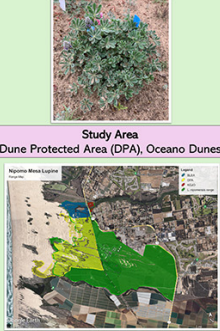
- Nipomo Mesa Lupine (*Lupinus nipomensis*)
- State of California and federally endangered plant
- Limited to a 2 sq. mile back dune area on the central California coast
- Threatened by the invasive grass *Ehrharta calycina*

Veldt Grass (*Ehrharta calycina*)

- Invasive, perennial African grass
- Introduced for grazing and agricultural purposes, leading to severe effects on native ecosystems
- Rapidly accumulates thatch layers and a large seed bank in introduced areas, adapting well to the mild Mediterranean climate of coastal California while smothering native plants.

Heermann's kangaroo rat (*Dipodomys heermanni*) and Deer mouse (*Peromyscus maniculatus*)

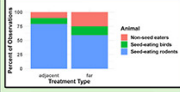
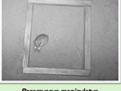
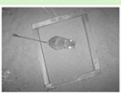
- Adapted to the prevalence of veldt grass in dune ecosystems
- Extensive veldt grass cover has altered diets of rodents over recent decades
- Scatter-hoarding species, potentially facilitating seedling dispersal of predated plant species




Study Area
Dune Protected Area (DPA), Oceano Dunes

Results

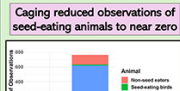
Seed-eating rodents were the most abundant seed predators regardless of veldt proximity

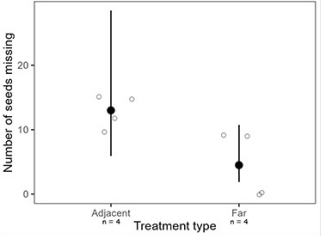
Avian seed predators were also present but not in abundance



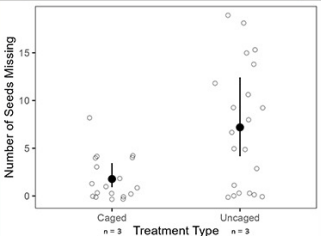
Caging reduced observations of seed-eating animals to near zero



Most seeds were missing from stations deployed for >13 days adjacent to veldt grass



Caging significantly reduced seed predation regardless of deployment length



Main Research Goals

- Document seed predation rates of Nipomo lupine
- Evaluate the influence of veldt grass cover and hardware wire caging on seed predation rates

Effect of Vegetation Cover on Predation Hypothesis:

Lupine seed would be consumed at a higher rate within areas adjacent to veldt grass due to increased rodent activity and foraging behavior.

Impact of Hardware-Wire Fences Hypothesis:

The presence of hardware-wire fences, or "cages," would reduce the activity of native rodents and subsequently decrease predation of *L. nipomensis* seeds.

Methods

Veldt-Lupine-Granivore Relationship

- Placed trail cameras and bait stations containing *L. nipomensis* seeds to monitor seed removal.
- Replicates were deployed at two distance treatments, adjacent (within veldt stand) to veldt and far from veldt grass (>2m from veldt).

Caging Lupine

- 3 x 3m, 0.6m-tall hardware cloth fenced plots were compared to unfenced seed box deployment locations.
- Same seed boxes and camera traps were deployed, in caged areas and uncaged areas

Statistical Modeling

- Generalized Linear Mixed Models (GLMMs) were performed in R using the "lme4" package
- Models followed a negative binomial distribution

Significance of Findings:

Establishing seed predation rate data now will enable us to assess whether, over time, a reduction in cover and food resources of veldt grass resulting from conservation actions will lead to a more stable equilibrium between granivorous rodents and the available native resources. Vulnerable species, like *Lupinus nipomensis*, are at a heightened risk of extinction spiral, meaning factors reducing plant recruitment can compound until a population is unable to sustain itself. Current seed predation rates of *L. nipomensis* by high densities of rodents in nearby veldt monocultures may be exceeding the tolerable range of predation, potentially contributing to the lupine population's downward trajectory. We hope that our results may help guide veldt management near extant lupine populations, and that our results that caging leads to significant reductions in seed predation will be considered by USFW and California State Parks for future conservation efforts to mitigate impacts on this critically endangered species.

Acknowledgements

Thank you to Lisa Stratton, Wayne Chapman, Claire Wilhelm-Safian, and all at the Cheadle Center for providing me with the opportunity to take on this research project and for the guidance as I navigated through my entry into research. Thank you to An Bui for your guidance in statistics and modeling. Other thanks to Ben Wagner with the California State Parks service for providing access to the DPA study site and assisting with all site planning within the research area. Finally, thank you to John Orrock for your informative suggestions and expert perspectives.

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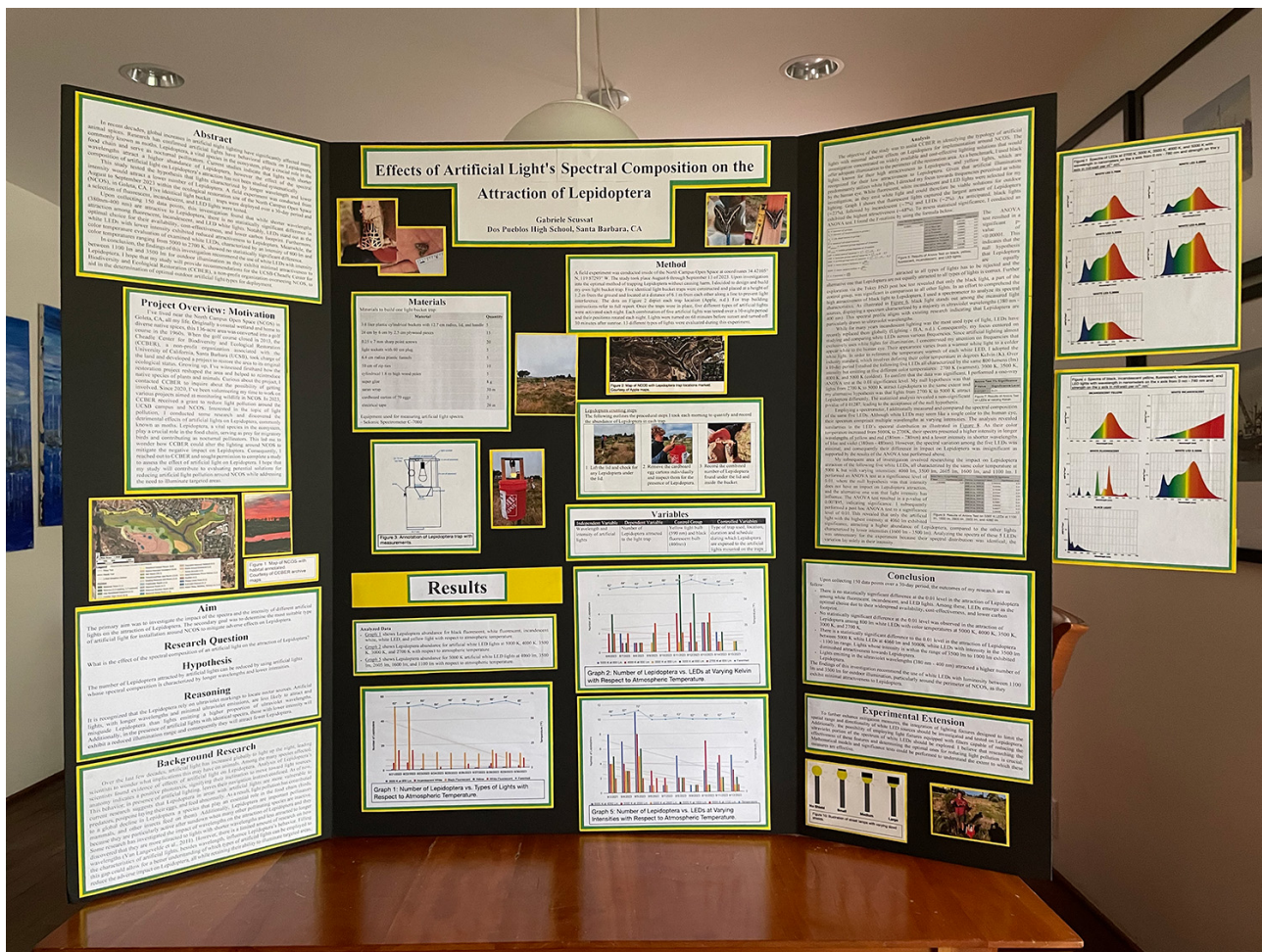
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Students Calen Campos, An Bui, and Mary Cadogan, along with staff members Lisa Stratton and Wayne Chapman, focused their research on Nipomo Lupine (*Lupinus nipomensis*) seed predation. They placed trail cameras and bait stations containing *L. nipomensis* seeds to monitor seed removal. To assess the impact of invasive Veldt Grass (*Ehrharta calycina*) on seed predation, replicates were deployed adjacent to veldt stands and also far from veldt grass. Additionally, they deployed hardware cages to assess the impact of fencing on predation of *L. nipomensis* seeds by native rodents. Their findings indicate that seed-eating rodents were the most abundant predators regardless of proximity to Veldt grass, and that caging significantly reduced seed predation.

[https://mailchi.mp/0b2deae0bc/newsletter-for-the-north-campus-open-space-restoration-project-20341510?e=\[UNIQID\]](https://mailchi.mp/0b2deae0bc/newsletter-for-the-north-campus-open-space-restoration-project-20341510?e=[UNIQID])

30/45



Gabriele Scussat's science fair poster.

In addition to the abundance of collegiate research, Dos Pueblos High School student Gabriele Scussat conducted his own independent research on the effect of artificial light on Lepidoptera at NCOS. The primary aim of his study was to investigate the impact of both the spectra and the intensity of different artificial lights on the attraction of Lepidoptera, with a secondary goal of determining the most suitable type of artificial light for installation around NCOS to mitigate their adverse effects on Lepidoptera. He utilized five identical light bucket traps with five different types of artificial lights that were activated each night. Each combination of five artificial lights was tested over a 10-night period, and their positions were rotated each night, with a total of 13 different types of lights evaluated during this experiment. Each morning, he would remove the traps and record the combined number of Lepidoptera found under the lid and inside the bucket.

Gabriele found that white LEDs with intensities between 1100 lm and 3500 lm exhibited minimal attractiveness to Lepidoptera and recommends their use in areas surrounding NCOS. After completing the research, he competed in the Ventura County Science Fair and won 1st place in the Environmental Science category. He then advanced to the California State Science Fair, where he was awarded 3rd place in the Environmental Science category. Congratulations, Gabriele!

Volunteer Opportunities



"Second Saturdays" at NCOS

May 11th, 9:00 - 12:00

Please RSVP to ncos@ccber.ucsb.edu

Help us restore and create NCOS with plants and more! Meet at 6969 Whittier Drive at 9am. Bring water, sunscreen, and wear a hat, clothes and shoes that are suitable for outdoor work



Thursdays - Greenhouse Associates

Thursdays 9:00 - 12:00

Come help transplant seedlings of native plants with the CCBER team. To join, please send an email to ncos@ccber.ucsb.edu.



Nature Guide Tour

May 18th, 9:30 - 11:00

Come take a walk around NCOS and learn about native plants and animals with a trained Nature Guide.

Community Photos

We are interested in any observations of wildlife activity on NCOS, as well as plants and landscapes. Please send your observations, with or without photos, to ncos@ccber.ucsb.edu. Thank you!



Hooded Mergansers in Phelps Creek. Photo by Daniel Forseth.



Western Pond Turtles in Phelps Creek. Photo by Frank DiMarco.



Raccoon at the Campus Lagoon. Photo by Sally Colman.



Lesser Scaup at the Campus Lagoon. Photo by Sally Colman.



Red-breasted Merganser at the Campus Lagoon. Photo by Sally Colman.



Mallard with ducklings at NCOS. Photo by Jeremiah Bender.



Red-winged Blackbird at NCOS. Photo by Jeremiah Bender.



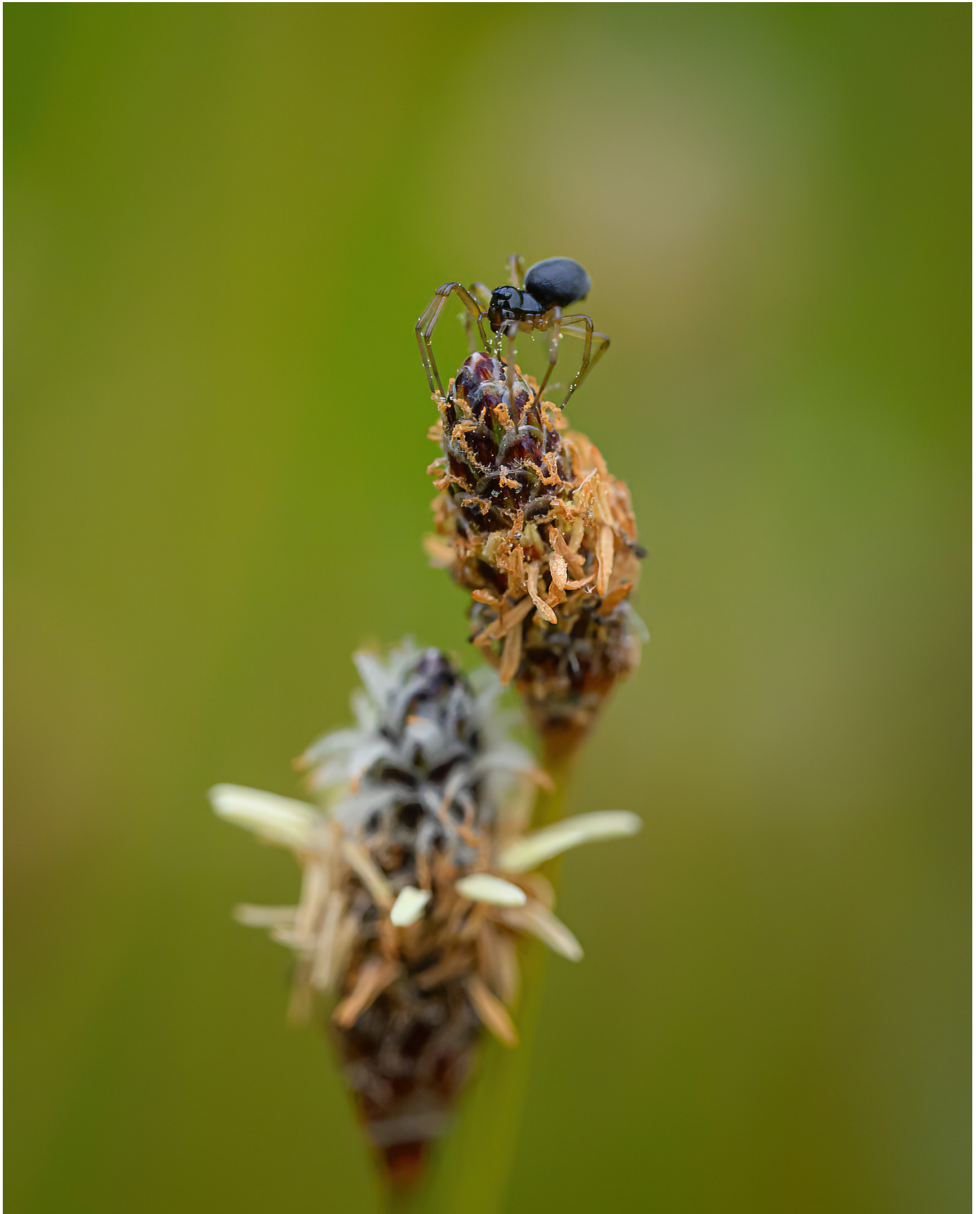
A Caspian Tern flies low over the slough at NCOS. Photo by Jeremiah Bender.



Ruddy Ducks at NCOS. Photo by Jeremiah Bender.



A Belted Kingfisher trails a thin piece of algae after a dive into the Devereux Slough at NCOS. Photo by Jeremiah Bender.



A tiny spider balances on top of Sand Spikerush (*Eleocharis montevidensis*) at the NCOS Visitor Plaza. Photo by Jeremiah Bender.

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Cheadle Center for Biodiversity and Ecological Restoration
Bldg 578 Harder South
UCSB, MC 9615
Santa Barbara, CA 93106



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