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# FORT ORD NATURAL RESERVE

## 2022-2023 ANNUAL REPORT

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DIRECTOR, FORT ORD NATURAL RESERVE

UC SANTA CRUZ



Natural Reserve System  
UNIVERSITY OF CALIFORNIA



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UCSC BIOE 20F – FIELD BIOLOGY IN PRACTICE CLASS DISCUSSES FIELD OBSERVATIONS IN RARE MONTEREY MARITIME CHAPARRAL HABITAT AT UCSC FORT ORD NATURAL RESERVE

## EXECUTIVE SUMMARY

This report provides an overview of activity at UC Santa Cruz Fort Ord Natural Reserve (FONR), in Marina, California for the fiscal year 2022-2023. FONR is a 610-acre reserve that protects maritime chaparral,



ENDANGERED *GILIA TENUIFLORA* SSP. *ARENARIA*, MONTEREY  
GILIA

coastal scrub, grassland, and oak woodland on part of the former Fort Ord army base. Reserve staff and interns monitor and maintain habitat for multiple protected species throughout the reserve. As part of the University of California Natural Reserve System, FONR provides a living laboratory and outdoor classroom for researchers, K-12 students, university students and faculty, and the greater Monterey Bay community.

The Fort Ord Natural Reserve consists of maritime chaparral habitat that is home to many rare and endemic species, as well as grasslands, coastal scrub, and oak woodland habitat. For much of the 20th century the land was occupied by the Fort Ord US Army Base. FONR staff now uses the reserve to serve the community; helping to achieve regional conservation and education goals by supporting research, education, and outreach. The site was chosen as a UC Reserve due to the unique vegetation communities and the numerous sensitive and listed plant and animal species that occur throughout the reserve (including the federally endangered, state-

threatened sand gilia, state-endangered seaside bird's beak, and the federally threatened Monterey spineflower).



UCSC STUDENTS HANNAH DOWNING, ALEGRIA JEREMIAS-LIN, RUBY MONTGOMERY, AND STEVAN SERVIN USING PLANT KEYS AT THE UCMBEST CENTER

In 2022-2023 Reserve Director Joe Miller was assisted by student employees Jenna Cheng, Ruby Montgomery, and Nicole Gramlich. Multiple UC and CSU interns and volunteers contributed to work on the reserve as well. Instructors from UCSC, CSU Monterey Bay, and Cabrillo College continued use reserve resources. New partner institutions visited in 2022/23, including Cuesta College and local K-12 groups. Represented disciplines included environmental science, ecological assessment, biology, ecology, and environmental studies, scientific illustration, and others. This year we offered internship opportunities,

continued flora and fauna monitoring, and added new experiential learning opportunities in the form of multiple staff-led 3–4-day workshops.

Graduate students from UC Santa Cruz and CSU Monterey Bay continued research work related to plant disease, remote sensing, and community ecology. Research projects were started from institutions across the state: including California Academy of Sciences, University of Southern California, San José State University. We were able to host a months-long installation of a large ionospheric radio sounding device, a Transportable Dynasonde, which was run by researchers from University of Colorado, Boulder. This project helped us learn a lot about the extended possibilities of large research installations through much collaboration with UCSC Real Estate and Contract Services, US Army Corps of Engineers, Pacific Gas and Electric, and the City of Marina. More about ongoing research on UCSC FONR is included in the research section of this report.

FONR staff improved facilities, including small updates and maintenance of our fencing, workshop, and outdoor classroom area. We were fortunate to receive a grant from Central Coast Community Energy towards the purchase of an electric utility vehicle, a 2022 Polaris Ranger EV, which replaced our gasoline powered unit. We also received a grant to completely electrify our trail stewardship tools (weed trimmers, chainsaws, hedger tools, etc.) from the UCSC Sustainability Office. These electrifications go far to reduce our carbon footprint and set a good example for future land stewards and conservationists who are gaining experience on our reserve.



PACIFIC GOPHER SNAKE, *PITOUPHIS CATENIFIR CATENIFIR*



ANABELLE CARTER AND OLIVIA EQUINOA PARTICIPATE IN DRONE SURVEYS AT SALINAS RIVER NATIONAL WILDLIFE REFUGE

Staff also continued to assist Army contractors with continued environmental cleanup onsite. Three new groundwater monitoring wells were drilled on the Fort Ord Natural Reserve North parcel related to the Environmental Protection Agency's National Priorities List (NPL) site on former Fort Ord Army Base lands (also known as the "Superfund list"). FONR staff engages with federal contractors during this work to ensure protection of habitats and natural resources on the reserve. New partnerships were formed with local nonprofit organizations, university internship agencies, and educational institutions. UCSC FONR stayed actively engaged in efforts to facilitate research on adjacent protected lands, as well as on reserve property.

In service to greater University of California goals in the Southern Monterey Bay area, FONR staff, student employees, and interns assisted University of California Monterey Bay Education, Science and Technology Center (UCMBEST Center) with stewardship on an additional 400 acres of open space adjacent to the



A YOUNG ASSISTANT HELPS WEIGH A KANGAROO RAT IN A CLASS DEMONSTRATION FOR UCSC BIOE 82 - INTRODUCTION TO FIELD RESEARCH

natural reserve in Marina, CA. This work included trespass abatement and invasive plant monitoring. FONR staff led restoration efforts of state and federally protected rare plant species, as part of a mitigation related to MBEST lands that have potential for future university led development. As with most reserve activities, FONR staff included many UCSC, CSU Monterey Bay, and community College students in these activities to create hands on learning opportunities for those entering the natural science and land management fields.

Reserve individual user visitation numbers were similar to the previous year, with user days slightly lower. We believe this reflects a few cancellations due to an extremely rainy year. Road closures between Santa Cruz and Marina, CA affected travel to the reserve. In total the reserve hosted 1522 Individual users, on 2814 user days. The reserve itself was resilient. The weather toppled more than the average number of trees, and damaged shade structures, but infrastructure and roads were largely undamaged by 2022/2023 storms.

## EDUCATION

### CLASS VISITS

In fiscal year 2022/2023 staff supported a variety of class visits that spanned multiple disciplines. Existing classes that visit the reserve each year were maintained, and several new courses added reserve visits. We were pleased to host Questa Community College (San Luis Obispo) for the first time. We were also thrilled by the new UCSC Course BIOE 20f, Field Biology in Practice, which is the result of many years of hard work by UCSC Reserves staff to codify experiential learning in the UCSC undergraduate catalogue. In 2022 we were also able to add an ongoing class program with a local charter high school, Learning for Life, where students visit FONR multiple times each semester to learn about local natural history and career pathways in natural science and conservation. Reserve staff met regularly with classes to help support and develop teaching activities, interpret and identify flora and fauna, and help with student research projects. FONR is roughly 45 minutes from the UCSC campus, minutes away from CSU Monterey Bay, and within about an hour of several other higher education institutions in the greater Bay Area. The site is a favorite location for classes due to ease of access to a field student site, as well as no cost overnight accommodations for classes at the outdoor classroom and campsite. Represented classes included a wide variety of disciplines including biology, ecology, environmental studies, earth sciences, and art from multiple institutions and including several UC's, CSUs, and Community Colleges (Table 1).



UCSC NATURAL HISTORY OF FUNGI CLASS SPECIES LIST



CUESTA COLLEGE COASTAL FIELD STUDIES CLASS EXPLORES THE CHAPARRAL AT UCSC FONR

TABLE 1. FORT ORD NATURAL RESERVE CLASS USE

Course Number and Name	Institution	Instructor
California Community College		
BIO 209C – Coastal Field Studies	Cuesta College	Laurie McConnico
BIO 11C - Ecology	Cabrillo College	Allison Gong

California State University System		
AGPS 372 – Agricultural Entomology	CSU Monterey Bay	Kelly Barr
BIO 196 – Biology Introductory Research Practicum	CSU Monterey Bay	Gerick Bergsma
SICP 509 – Botanical Illustration	CSU Monterey Bay	Andrea Dingeldein
ENVS 240 – Environmental Biology	CSU Monterey Bay	Kelly Barr
ENV 350 + 42892 + 42502 – Quantitative Field Methods	CSU Monterey Bay	Robert Burton
ENV 44203 – Environmental Impact Analysis	CSU Monterey Bay	Robert Burton
BIO 364 - Mammalogy	CSU Monterey Bay	Jennifer Duggan
BIO 360 – Natural History of California Wildlife	CSU Monterey Bay	Jennifer Duggan
ENVS 464 – Wildlife Management and Conservation	CSU Monterey Bay	Jennifer Duggan
BIOE 379S – CSUMB Service Learning	CSU Monterey Bay	Joe Miller (supervisor)
ENVS 189: Coastal Field Studies	San Jose State University	Rachel Lazzeri-Aerts
University of California		
BIOE 20f – Field Biology in Practice	UC Santa Cruz	Ingrid Parker
BIOE 114I – Herpetological Research	UC Santa Cruz	Sean Riley
BIOE 82 – Introduction to Field Research	UC Santa Cruz	Kristen Heady, Allison Gong, Sean Riley, Gage Dayton
ENVS 19 – Natural History of Fungi	UC Santa Cruz	Christian Schwarz
UC California Naturalist Program	UC Santa Cruz	Linda Anderson
ENVS 83/183 – Environmental Studies Internship	UC Santa Cruz	Joe Miller (supervisor)
California Ecology and Conservation	UC Systemwide	Tim Miller
ENVS 18 – Scientific Illustration	UC Santa Cruz	Brett Bell
BIOE 117 - Systematic Botany	UC Santa Cruz	Kathleen Kay
K-12 Schools		
Natural History (Life Science)	Learning For Life Charter School	Barbara Lawrence-Emanuel



## UNDERGRADUATE RESEARCH

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Multiple undergraduate research and monitoring projects were supported by UCSC FONR staff in 2022-2023. Students from UCSC and CSUMB worked on research including but not limited to herpetology, mammalogy, plant disease ecology, unmanned aerial systems (UAS) mapping, community ecology research, and entomology. These projects involve many hours of individual mentorship by FONR staff and create great collaboration opportunities between reserve staff and faculty of supporting institutions. See “Current Research” below for listing of individual projects.

UCSC STUDENT DEAN MEIMAN WEIGHS A LIZARD DURING A MONITORING SESSION



UCSC SENIOR DANIELA MARTINEZ RESLEAS A HEERMAN'S KANGAROO RAT DURING MONITORING AT UCSC FONR

## INTERNSHIPS AND VOLUNTEERING

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In 2022-2032 FONR staff hosted multiple volunteer and internship positions that served over 40 participants from UCSC, CSU Monterey Bay. Interns were involved in a wide variety of stewardship, ecology, public service, research installations, rare plant restoration, and outdoor education. Agencies that provide class credit for these internships include the UC Santa Cruz Environmental Studies Internship Program, CSUMB Science Internship Program, CSUMB Habitats Stewardship Project, and the CSUMB Service-Learning Institute. FONR interns gain valuable experience while they assist staff in facilitating research, education, and public outreach. Interns are involved in a wide variety of activities including field data collection, repair and maintenance of reserve facilities, land stewardship, rare plant surveys, invasive species control, assisting with classes, reptile and amphibian monitoring, small mammal trapping, avian point counts, working with k-12 and public outreach efforts, and faculty research projects. Interns were also able to make connections and learn from the larger conservation community through a variety of projects: including professionals from the Bureau of Land Management, California Department of Fish and Wildlife, US Fish and Wildlife Service, Elkhorn Slough Foundation, California State Parks, California Native Plant Society, and local universities. Undergraduates who participate in internships at FONR gain research and practical skills, connect with faculty and other students, and get real world experience that cannot be acquired in a traditional classroom.



RAINBOWS GRACED OUR SPRING MAMMAL MONITORING WORKSHOP



FORT ORD NATURAL RESERVE WORKSHOPS REACHED MORE THAN 40 STUDENTS FOR IMMERSIVE FIELD EXPERIENCES IN FY 2022/2023

## RESEARCH AND MONITORING

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Fort Ord Natural Reserve was established to preserve educational and research access to unique and rare flora and fauna that occur throughout the reserve. Faculty and graduate students from multiple institutions use the reserve for research. Below we provide a short overview of some of the ongoing research projects on the reserve during the past year.

### 2022/2023 RESEARCH AND MONITORING PROJECTS

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#### IMPACTS OF MATERNAL STRESS ON OFFSPRING LIZARDS - DAVID ENSMINGER

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PRINCIPAL INVESTIGATOR: DAVID ENSMINGER

PROJECT MEMBERS: AMBER SINGH, SYDNEY CORTEZ, TONY VO, DANIEL HOOPS

SAN JOSE STATE UNIVERSITY | MACQUARIE UNIVERSITY

SPONSOR: NATIONAL SCIENCE FOUNDATION (NSF)

As the environment changes due to things such as human activities and climate change, animals experience more challenges and stressors. However, we know very little about how these challenges can affect future generations and thus our ability to inform conservation or wildlife decisions and understand the underlying physiology of these changes is severely limited.

The purpose of the proposed study is to understand the impact of maternal stress on offspring in wild lizards and the physiological mechanisms of these effects. These objectives will allow us to better understand the mechanisms that allow lizards to respond to stressors such as invasive species, habitat change, and anthropogenic activities and extrapolate to future stressors they and similar species will face. All three objectives are designed to improve our understanding of how lizards respond to stressors, with a focus on understanding the physiological impacts that could drive population dynamics in a time of increased anthropogenic interactions and environmental change. For objective 1, we will assess the impact of maternal stress on offspring oxidative damage, immune function, DNA methylation, gut



COAST FENCE LIZARD, *SCELOPEROUS OCCIDENTALIS* SSP. *BOCOURTII*

microbiota, and behavior. Objective 1 broadens our understanding of oxidative balance and immune function beyond typical mammal studies and is vital as recent research has shown that species can have drastically different responses to stress depending on their life history stages and activities. As these oxidative balance and immune function can drive individual fitness, it is important to understand for conservation management and ecological modeling. Additionally, we do not know how maternal stress effects temperature preference,

which could have profound effects on antipredator behavior, basking behavior, and food acquisition. We do know that overall activity can shift, but we do not know the thermal consequences of this shift. This research would help identify this impact and highlight future routes of exploration for the impacts of maternal stress on offspring fitness.

The second objective is to understand offspring stress hormone dynamics. Objective 2 seeks to highlight and broaden the complexity of the vertebrate stress response and the importance of examine the whole stress response axis as changes in hormones could have their impact strengthened or weakened depending on the status of hormone receptors. As the offspring will experience the mothers elevated stress hormones during development, the likelihood of changes in receptor density is high, but unknown due to lack of prior research on this subject in reptiles. Finally, objective 3 will allow the development of a cellular model for research on lizards, which will ultimately allow us to examine further cellular impacts of stress without having to interact with wild lizards. As the oxidative response to glucocorticoids is often tissue specific, examination of muscle cells will allow us to examine the cellular response of tissue to stress separate from the rest of the organism. Additionally, as lizards can regrow their tails, insight on how they heal damage to muscle cells would allow insight into health avenues for other species as well as humans.

Overall, this project will provide valuable information on how a native species is affected by environmental stressors as these results can be applied across different stressors and help us understand how stress alters reptile's interactions with their environment. While environmental stressors such as increased anthropogenic interactions, invasive species, and habitat alterations are occurring at increasing rates, we are unsure how this will impact many species. As maternal stress can alter the physiology and behavior of organisms, it is vital to understand maternal stress as it impacts species interactions as well as health. The techniques developed here will allow future research to identify the stress status of populations before populations collapse, providing biomarkers for identifying if a species is stressed. The results of these studies will help inform management plans for species that are at risk where similar studies would not be possible.

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### SHORT TERM DEPLOYMENT OF THE TRANSPORTABLE DYNASONDE SYSTEM AT THE UC SANTA CRUZ FORT ORD NATURAL RESERVE – NIKOLAY ZABOTIN

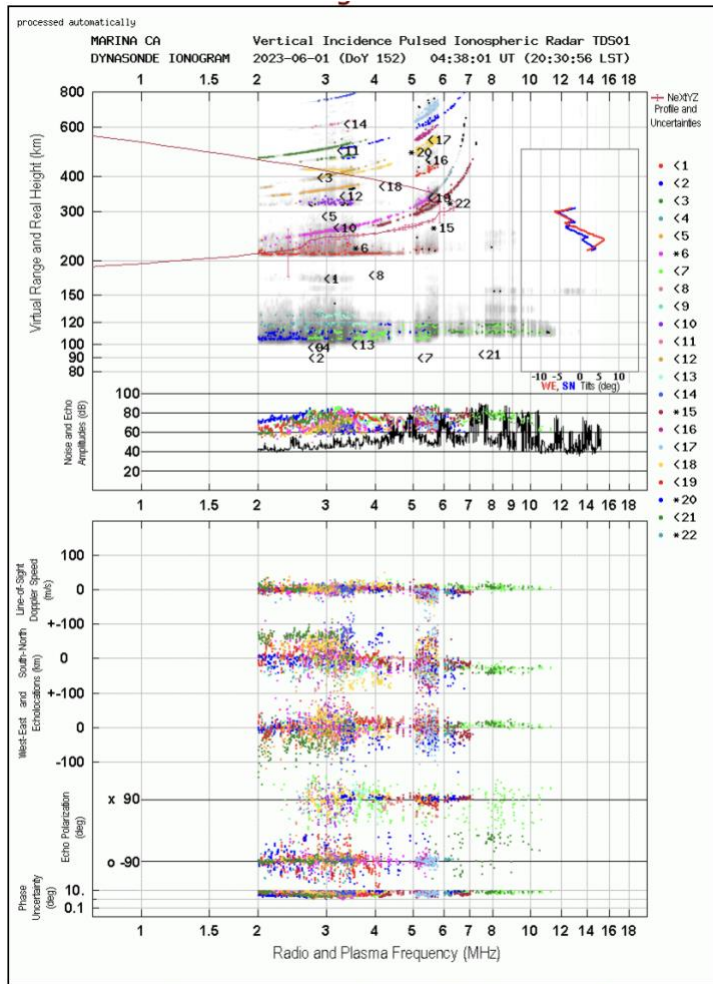
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PRINCIPAL INVESTIGATOR: NIKOLAY ZABOTIN

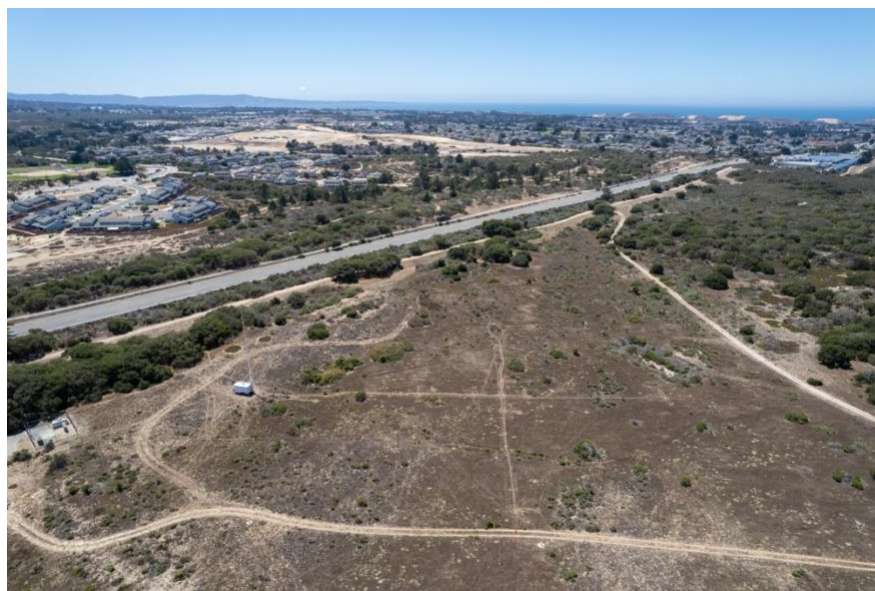
PROJECT MEMBERS: LUDMILLA ZABOTINA

UNIVERSITY OF COLORADO, BOULDER

Dynasonde approach to ionospheric radio sounding capitalizes on high precision of physical parameters and rich statistics of recognized echoes phase-based methods can provide. As has been recently demonstrated, the Dynasonde profiles of the electron density and of the horizontal gradients, complemented with profiles of the Doppler speed, carry comprehensive quantitative information about Atmospheric Gravity Waves, a ubiquitous feature of the space weather that has become an important objective of atmospheric modeling. Being combined into a time series, and without additional processing, the profiles allow visualization of the time fronts of the Traveling Ionospheric Disturbances (TIDs). They also provide high-resolution input data for calculating the complete set of parameters (both vertical and



horizontal) of TID activity in the upper atmosphere between the base of the E layer and the maximum of the F layer. Application of the Lomb-Scargle periodogram technique to the tilt data provides unique insight into the dynamics of spectral composition of the TIDs. A similar technique applied to longer time series allows determining characteristics of thermospheric tides. Single sounding sessions allow observations of ionospheric manifestations of acoustic waves produced by ground-based sources. All the mentioned products of the Dynasonde data analysis require a common, standard ionogram mode of radar operation. Therefore, information about standard parameters of the ionospheric E, F regions, possibility to obtain vector velocities characterizing movement of plasma contours, and quantitative parameters of the km-scale irregularity spectrum are not lost and contribute into comprehensive description of wave activity in the thermosphere-ionosphere system.



TRANSPORTABLE DYNASONDE INSTALLATION AT UCSC FORT ORD NATURAL RESERVE,  
 WITH MARINA, CA AND THE MONTEREY BAY IN THE BACKGROUND

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## COASTAL FOG MONITORING - DANIEL FERNANDEZ

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PRINCIPAL INVESTIGATOR: DANIEL FERNANDEZ

PROJECT MEMBERS: OLIVIA EQUINOA, CRYSTELLE VARGAS, JOE MILLER

CALIFORNIA STATE UNIVERSITY MONTEREY BAY

SPONSOR: UC SANTA CRUZ NATURAL RESERVES

As part of an ongoing project to measure fog water on the Pacific Coast of California. Goal will be to collect fog water samples to quantify the amount of fog deposition to a standard passive fog collector. The collection of water from fog offers a unique opportunity to engage with an environmental feature endemic to the Monterey area (fog). Worldwide, numerous countries capitalize upon the presence of fog to produce potable water in regions that receive little rainfall. In some cases, entire communities utilize fog water to meet their basic needs. Indeed, such deployments exist in Chile, Guatemala, Israel, Yemen, Eritrea, Morocco, Spain, and many other countries throughout the world. A simple mesh mounted properly on a square frame provides a surface for the fog water to coalesce. Once the droplets reach a suitable size, their weight causes them to fall off and collect in a trough below. From a single square meter of vertically mounted mesh up to several gallons of water have been produced in a single day under foggy conditions with sufficient wind. Actual amounts collected are very location dependent and under foggy conditions are more typically about a liter. Besides potentially providing a means of capture of usable water, which can serve multiple purposes, this technique provides a much more quantitative in situ means of assessing the presence of fog. The fog collected is a function both density of water in the air as well as the wind speed and direction. When the wind directs fog into the mesh, maximal fog water accrues. As wind speed increases, typically so does the amount of fog water collected.



CSUMB UNDERGRADUATE RESEARCHER OLIVIA EQUINOA PERFORMS MAINTENANCE ON A FOG COLLECTOR AT UCSC FONR

# Intermediate-Scale Variability in Fog Water Collection Across an Array in a California Coastal Environment, The Fort Ord Natural Reserve

Olivia Equinoa & Crystelle Vargas<sup>1</sup> (presenters), Daniel Fernandez<sup>1</sup>, Joe Miller<sup>2</sup>  
<sup>1</sup>California State University, Monterey Bay  
<sup>2</sup>UC Fort Ord Natural Reserve



## Background

- The UCSC Fort Ord Natural Reserve (FONR) is 606 acres of protected land, part of the University of California Natural Reserve System (UCNRS).
- The Marina, CA reserve's sandy maritime chaparral hosts rare flora and fauna, including coast horned lizard (*Phrynosoma blainvillii*), endangered sand gilia (*Gilia tenuiflora* ssp. *arenaria*), and threatened Monterey spineflower (*Chorizanthe pungens* var. *pungens*), which all require open sand habitat.
- In 2019, ten standard fog collectors (with accompanying rain gauges) were deployed to observe the spatial variability of fog deposition as it impacts maritime chaparral ecosystem.
- This project compares amount of collected water recorded along with the percentage of sand coverage within a 10 meter radius of each fog collector's location.



Image 1. Coast Horned Lizard



Images 2 & 3. Sand Gilia (left) and Monterey Spineflower (right)

## Methods

- Data were collected using fog catchers and tipping buckets, which count the amount of fog water collected in liters at all ten collection sites in FONR.
- Using R Studio, the collected data were overlapped and compared from all ten sites to observe similarities and differences between various collection sites. Data were displayed on two graphs to specify when collection sites 1,3, and 7 were relocated.
- Maps were generated using the precise longitude and latitudes of each site both before and after Sites 1,3, and 7 had been relocated.
- Using image files provided by the reserve's director, a radius was developed via ArcGIS and presented on a map to determine the sand to non-sand ratios around each collector.
- After gathering our data, we looked for any potential patterns between high percentages of open sand area and productive fog collector locations.



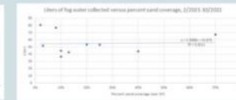
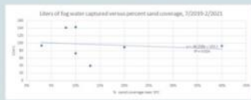
Image 4. One of 10 Fog Collectors at FONR



Figure 7. Map of 10 meter radius for FONR Station 4



Figure 8. Map of 10 meter radius for FONR Station 0



Figures 9 (left) and 10 (right) illustrate that neither before nor after the site relocation did there appear to be any relationship between the percent of sand coverage near a site and the amount of fog water collected by the SFC at that site. We posited that perhaps fog water could encourage more plant growth and, therefore, reduce the percentage of visible sand. That was not supported by this study, indicating that there are other factors associated with percent sand coverage near our measurement locations.

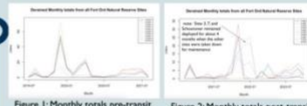


Figure 1: Monthly totals pre-transit Figure 2: Monthly totals post-transit



Figure 3: FONR Fog Collector locations Pre-relocation Figure 4: FONR Fog Collector locations Post-relocation



Figures 5 (left) and 6 (right) illustrate the amounts of pure fog (blue) and rain (green) collected by SFCs at each of the ten sites during each multi-year deployment (3 were relocated early in 2021)

## Results

- As expected, significant variability in fog water collection is seen throughout the reserve, with fog collectors located further from the coast typically observing lesser fog. In conjunction with the fog collectors, data from leaf moisture sensors located at various points along the transect are related to the presence or absence of fog along the reserve.
- FONR 5 appeared to be the most productive site over the time period, recording nearly 220 liters and dwarfing the least productive and most-inland site, SCHN 0 (at about 83 liters).
- FONR 0 and SCHN 0 had the least amount of pure fog collected. This is likely due to the inland location and lesser exposure. The times in which sites were down for maintenance affected some sites' productivities.

## Conclusions

- Overall, most productive fog collection in FONR occurred at locations with northern exposure closer to the coast.
- Fog patterns are supposed to occur primarily over the summer-fall, but we observed some events year-round in de-rained data.
- We did not observe any correlation between measured fog productivity and the percentage of sand present at the ten sites, indicating that there are likely other factors that affect sand coverage.
- FONR Station 0, one of the least productive sites, has less exposure due to nearby flora, which may be impeding its collection rates.
- We recommend that future studies explore how fog may be impacting flora and fauna propagation rates.

## References & Acknowledgments

We would like to thank and acknowledge Jon Deika, and the Fort Ord Natural Reserve reserve interns for the data that they have provided. We also wish to acknowledge the CSUMB Undergraduate Research Opportunity Center, the Naval Postgraduate School for their meteorological data, and Hangar One/Proximo Spirits for their support.



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## OAK RESPONSE TO STRESS: WATER-USE EFFICIENCY AND COMMUNITY INTERACTIONS ON A SCALE OF LICHEN OVERGROWTH – REMINGTON PLISCHKE

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PRINCIPAL INVESTIGATORS: REMINGTON PLISCHKE AND LAUREL FOX

PROJECT MEMBERS: JOSEPH BATOM, KIARA BREMNER, KEATON WOOD,

UNIVERSITY OF CALIFORNIA, SANTA CRUZ

The relationship between lichens, oaks, and stress can be more fully understood by comparing the community and physiological differences between these areas. I examine the soil composition as well as pathogen and herbivore interactions along a gradient of lichen growth to identify the initial cause of defoliation. I also measure the water use efficiency through stomatal conductance and water potential to



LACE LICHEN ON COAST LIVE OAK TREES AT FORT ORD NATURAL RESERVE

understand the response of the oak trees to stress. We hypothesize that oak trees with higher lichen presence will be associated with lower soil moisture and increased microbiota; these community differences will also correlate with higher stomatal conductance and less negative water potential. So far we have observed that herbivory and water stress are likely the initial defoliating stressors on the oak trees at Fort Ord Natural Reserve. Increased insect herbivory is seen in trees with higher amounts of lichen. We have also found that more defoliated trees have higher stomatal conductance, suggesting the oaks can respond to stress.

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## GENOMIC DIVERSITY OF THE MANZANITA GALL AHPID ACROSS CALIFORNIA – DONALD MILLER

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PRINCIPAL INVESTIGATOR: DONALD MILLER

CALIFORNIA STATE UNIVERSITY, CHICO

SPONSOR: CALIFORNIA GENOMICS PROJECT



The purpose of this project is to characterize genomic variation in the gall aphid, *Tamalia coweni*, across the eco-regions of California. This is part of the state-wide California Conservation Genomics Project.

*TAMALIA COWENI*,  
MANZANITA GALL APHID



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## FORT ORD NATURAL RESERVE ENTOMOLOGICAL SURVEY

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PRINCIPAL INVESTIGATORS: DUSTIN LOFLAND AND JERRY WILSON

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## MAPPING GENETIC DIVERSITY AND RESPONSES TO SELECTION IN TWO CALIFORNIA BUTTERFLY SPECIES – JAYME LEWTHWAITE

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PRINCIPAL INVESTIGATORS: JAYME LEWTHWAITE, VAUGHAN SHIREY, MELISSA GUZMAN  
UNIVERSITY OF SOUTHERN CALIFORNIA

Insects are important parts of our ecosystems and provide crucial services for human well-being including pollination and waste management. Insect populations are exposed to many kinds of anthropogenic threats throughout their range, from climate change to pesticide use, and land use change. The ability of these populations to withstand and adapt to these multiple threats depend on two factors. First, the combined exposure of these threats throughout their range. Second, the susceptibility of individuals and populations to those threats. Both can vary throughout a species range, and understanding how these two interact is crucial to mitigate potential declines and inform conservation efforts. In this project we aim to tackle both factors for two butterfly species in Western United States.



VANESSA ANNABELLA, WEST COAST LADY BUTTERFLY

In order to evaluate the combined exposure threat, we model species observations using existing publicly available data. However, to evaluate the population's susceptibility, we will need to collect live individuals from across each species' range to genotype and to estimate genetic diversity across the species' ranges.

These specimens will also allow us to identify any putative anthropogenically-induced adaptation across each species' range as we will be conducting genome wide selection scans. The selection scans will allow us to identify loci or single nucleotide polymorphisms (SNPs) that are

targets of adaptation in the population. We will be examining these patterns across a gradient of land use (the UC reserves represent the more "natural" end of the gradient and will be paired with specimens from less natural areas nearby) and degree of temperature change experienced over the past century (we are surveying across a large latitudinal gradient from Southern Oregon to Southern California) to identify candidate loci that are under strong selection from land use change and climate change.

As a final step, we will identify areas that are most important to protect to promote long term survival. Together, these sources of data will provide a comprehensive picture of risk and susceptibility of species across their range, needed to make decisions about their conservation

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## NORTH-COASTAL HANTAVIRUS SURVEILLANCE – CALIFORNIA DEPARTMENT OF PUBLIC HEALTH

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PRINCIPAL INVESTIGATOR: CHRISTOPHER KILONZO

PROJECT MEMBERS: MEGAN SAUNDERS, TINA FEISZLI, CHRISTIAN IRIAN

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH

As part of the Vector-Borne Disease Section of the California Department of Public Health, we conduct environmental surveillance for zoonotic diseases transmitted by arthropod and rodent vectors. Hantavirus Pulmonary Syndrome (HPS) is the most important rodent-borne disease in California with 87 human cases reported between 1980 and 2019. In California, exposure to hantavirus has mostly been reported following exposure to high elevation rural areas in the Sierra Nevada range. As follow up to a human hantavirus case in a Santa Cruz County resident, who lived and worked in coastal scrub habitat, we are interested in expanding our surveillance to better understand risk of hantavirus exposure in north-coastal California. Fort Ord Natural Reserve is the ideal habitat to conduct surveillance (trapping of deer mice with live Sherman traps, taking a blood sample, releasing animals at the site they were trapped, and testing the blood sample for both viral RNA and antibodies to hantaviruses).

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## DEMOGRAPHY OF CALIFORNIA POPPY – ELSA CLELAND

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PRINCIPAL INVESTIGATOR: ELSA CLELAND

PROJECT MEMBERS: JOSEPH KESSLER, ISABEL GUIHEAU, RACHEL BROWN, ROMAN GARZELLONI

UNIVERSITY OF CALIFORNIA, SAN DIEGO | UNIVERSITY OF CALIFORNIA, SANTA BARBARA



Project Abstract: Predicting species responses to climate change requires understanding population-level processes across a species range. Here, we propose to monitor demography of *Eschscholzia californica* (California poppy) at UCNRS reserves across California and incorporate population-level vital rates into a new kind of species distribution model, a “demographic distribution model.”

CALIFORNIA POPPY

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## LONG TERM RESEARCH ON PLANT AND ANIMAL INTERACTIONS AT FORT ORD - LAUREL FOX

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PRINCIPAL INVESTIGATOR: LAUREL FOX  
UNIVERSITY OF CALIFORNIA, SANTA CRUZ



UCSC PROFESSOR LAUREL FOX, WORKING AT THE OUTDOOR CLASSROOM AT UCSC FONR

Long term research at UCSC FONR emphasizes the effects of interactions on community structure and dynamics, especially plant-herbivore and three- trophic-level interactions. Research focuses on resource use, plant defenses and the role of nutrients. Enclosures (3m x 3m) that exclude deer and both deer and rabbits are measured each year, and seed production is monitored. Collections of live *Ceanothus*, dead *Ceanothus*, and live stems of *Arctostaphylos* sp. are used to determine shrub/stem age and important environmental factors affecting germination.



LAUREL FOX AND UCSC INTERNS MEASURING TRANSECTS IN MARITIME CHAPARRAL AT UCSC FONR

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CALEDNA WILDFIRE RISK: PRE-FIRE SEASON SOIL SAMPLING – RACHEL MEYER

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PRINCIPAL INVESTIGATOR: RACHEL MEYER

PROJECT MEMBERS: CALI GALLARDO, WENDY BUSSIÈRE

UNIVERSITY OF CALIFORNIA, SANTA CRUZ

We are taking soil samples from sites in California that have recently experienced severe drought and/or are at high fire risk in anticipation of the 2022 fire season. The same sites will be sampled after fire season has ended. Environmental DNA from the samples will be analyzed when funding allows, with an aim to better understand how ecosystems recover from fire at a microbial level.

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XERCES PROJECT: IDENTIFY THE CLOSEST ECOLOGICAL REPLACEMENT FOR THE EXTINCT XERCES BLUE BUTTERFLY – DURRELL KAPAN

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PRINCIPAL INVESTIGATORS: CHRISTOPHER GRINTER, CHRISTOPHER SCHWIND, STUART WEISS, DURRELL KAPAN

PROJECT MEMBERS: ALIZEE GAMBER

CALIFORNIA ACADEMY OF SCIENCES | UNIVERSITY OF CALIFORNIA, SANTA CRUZ | CREEKSIDE SCIENCE

SPONSOR: CALIFORNIA ACADEMY OF SCIENCES



SILVERY BLUE BUTTERFLY, *GLAUCOPSYCHE LIGADAMUS*

The extinct Xerces Blue, one of the first documented invertebrates to go extinct due to human-caused habitat destruction, now only exists in museum collections. To identify a suitable ecological replacement for Xerces we have extracted DNA & sequenced the genomes of 80-to-100-year-old museum specimens

of Xerces and its close relative, the Silvery Blue (*Glaucopsyche lygdamus*). Bringing back a 'stand-in' for the Xerces Blue is intended to not only help restore lost connections in San Francisco's newly restored Presidio dunes but spark our collective imagination & show how we can work together to regenerate the natural world.

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## CALIFORNIA LEPIDOPTERA SURVEY – CHRISTOPHER GRINTER

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PRINCIPAL INVESTIGATORS: CHRISTOPHER GRINTER, JULIA BETZ, DIANA PHAN, TRACI GRZYMALA

PROJECT MEMBERS: ELISE VASQUEZ, JOE MILLER

CALIFORNIA ACADEMY OF SCIENCES | UNIVERSITY OF CALIFORNIA, BERKELEY

SPONSOR: CALIFORNIA INSTITUTE OF BIODIVERSITY



As part of an ongoing collaborative project to survey and study the Lepidoptera of California, this project will serve to enhance our understanding of the moth fauna of the state.

CALIFORNIA ACADEMY OF SCIENCES

PINNED INSECT SAMPLES

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## ESTIMATING LEAF WETNESS PATTERNS IN A WILDLAND LANDSCAPE FOR PLANT DISEASE MANAGEMENT

### A DRONE-POWERED DEEP LEARNING METHODOLOGY FOR HIGH PRECISION REMOTE SENSING IN CALIFORNIA'S COASTAL SHRUBS – JON DETKA

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PRINCIPAL INVESTIGATORS: UCSC PHD CANDIDATE JON DETKA, GREGORY GILBERT

PROJECT MEMBERS: HAYLEY COYLE, MARCELLA GOMEZ

UNIVERSITY OF CALIFORNIA, SANTA CRUZ

#### Dissertation Abstract:



As a drone pilot, ecologist, and scientist comfortable with emerging remote sensing technologies I have designed my dissertation around using drones to understand landscape processes and the ethical challenges associated with using drones as they intersect with privacy concerns. This work is organized into two main parts, with the first part exploring the role of plant pathogens in wildlands and the use of drones to enhance plant disease research. The second part examines the legal and ethical implications of commercial use of drone technology. In the first half, I used drones to map the distribution of host plants in diverse wildland communities, contributing to a better understanding of plant diseases in two closely related wildland manzanita plant species. I employed advanced computer modeling techniques to accurately identify dominant plant species, crucial for conservation efforts in this challenging landscape. Additionally, I used analytical

approaches to examine the relationship between the amount of time that leaves have wet surfaces and the association with the spatial distribution of plants along a coastal to inland climate gradient, providing valuable insights into disease dynamics.

The second part of this work explores the ethical considerations of using drones and the importance of balancing the benefits of drone technology with minimizing harm to the environment, respecting privacy expectations, and ensuring transparency and equity. I analyzed the historical, legal, and policy aspects of drone use, focusing on federal safety regulations and state privacy laws. The tension between federal and state regulations underscores the need for drone pilots to be well-versed in both. Then, I examine the existing federal certification framework for drone pilots and identify the lack of training on privacy ethics

JON DETKA

and best practices for maintaining transparency. I propose expanding professional certification beyond the federal

program to include a focus on privacy concerns. This certification, administered through non-profit organizations collaborating with commercial and higher-education entities, can help establish industry standards and provide essential training for drone pilots.

Overall, this dissertation demonstrates the significant potential of drones in ecological research, particularly in studying plant diseases and wildland conservation. It highlights the importance of ethical considerations, privacy protection, and transparent practices in the use of drone technology for scientific purposes.

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## UCSC FONR BAT MONITORING – BETHANY SCHULZE

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PRINCIPAL INVESTIGATOR: BETHANY SCHULZE

UNIVERSITY OF CALIFORNIA, SANTA CRUZ | CALIFORNIA STATE UNIVERSTY, MONTEREY BAY

SPONSOR: UCSC NATURAL RESERVES



ACOUSTIC BAT  
MONITORING STATION

Bethany Schulze is a CSU Monterey Bay graduate student working on bats along the central coast. At Fort Ord, she is conducting year-round monitoring efforts using bat acoustic data loggers. This information provides data on bat use throughout the year and is providing insight into the temporal shift in bat activity and species composition at the reserve.

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## UCSC FONR FLORA AND FAUNA SURVEYS

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PROJECT MEMBERS: JOE MILLER, RUBY MONTGOMERY, SARAH LAYER, JENNA CHENG, ANNIE ALLENBAUGH, DORA RASCH, T WAGNER, VIVIAN GERSTEIN, ELIJAH TIPTON, ELISE VASQUEZ, ANABELLE CARTER, AYL A KNUTSON, DEAN MEIMAN, ELI SCHWEITZER, ELIZABETH HUMPERT, WENDY OLVERA, NICOLE GRAMLICH, E LLOYD, REMINGTON PLISCHKE, DANIELA MARTINEZ, KAITLYN BOTROS, GRETCHEN BERNDT, OLIVIA FRAGIACOMO, MAXIMO MARTINEZ

UNIVERSITY OF CALIFORNIA, SANTA CRUZ | CALIFORNIA STATE UNIVERSTY, MONTEREY BAY

SPONSOR: UCSC NATURAL RESERVES



RUBY MONTGOMERY (UCSC) AND OLIVIA EQUINOA (CSUMB) TAKING  
PRECISION FIELD MEASUREMENTS

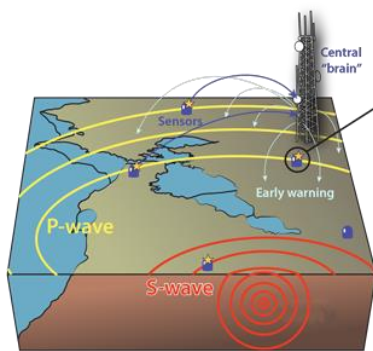
FONR staff and undergraduate interns from both UC Santa Cruz and CSU Monterey Bay monitor 600-acre UCSC Fort Ord Natural Reserve land. These efforts accomplish critical baseline monitoring of the reserve and, importantly, engage students in a wide range of research and stewardship techniques that teach them important skillsets. Activities include photo point surveys, rare plant surveys, herpetology cover board and pitfall array surveys, wildlife camera surveys, small mammal monitoring, UAV mapping, and the establishment of long-term chaparral vegetation monitoring plots.

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SEISMIC MONITORING AND SHAKE ALERT EARLY WARNING SYSTEM – UC BERKELEY  
SEISMOLOGY LAB

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UNIVERSITY OF CALIFORNIA, BERKELEY SEISMOLOGY LAB



## ShakeAlert:

- 1) When an earthquake begins, non-damaging P-waves are detected by sensors throughout the region.
- 2) Information about shaking is sent to a central processing center, where the size and location of the event are determined.
- 3) A forecast of the shaking intensity at locations away from the epicenter is sent out seconds to minutes before the damaging S-waves arrive.

Today, the technology exists to detect earthquakes so quickly that an alert can reach millions of people before strong shaking arrives. The UC Berkeley and its partners operating California's seismic network, CISN, are developing and implementing the ShakeAlert earthquake early warning system to identify and

characterize an earthquake within few seconds after it begins. We quickly calculate the expected intensity of ground shaking, and can send warnings to people and infrastructure in harms way. To reliably distribute warnings for all parts of the State with high earthquake hazard, it is important to have a robustly operating, dense network of seismic stations capable of providing data that can be used in ShakeAlert. The blue dots on the adjacent map are the stations contributing to ShakeAlert now. Particularly in Northern California, more sites are needed (green triangles, yellow squares). UC Berkeley and CISN partners are looking for locations where we can install new earthquake monitoring stations. UCSC Fort Ord Natural Reserve's station went online in Summer 2019. In addition to contributing to ShakeAlert, the new stations will also support the mission of the CISN, to operate a reliable, modern, statewide system for producing earthquake information for the benefit of public safety, emergency response, and loss mitigation.

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ARCTOSTAPHYLOS SEED BANKS AND ANIMAL FORAGING – TOM PARKER

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PRINCIPAL INVESTIGATOR: TOM PARKER

SAN FRANCISCO STATE UNIVERSITY

Dr. Tom Parker is studying a variety of abiotic and biotic factors that influence the distribution of Manzanita throughout the state. His work at Fort Ord is focused on quantifying seed banks of *Arctostaphylos pumila* and *A. tomentosa* and how density of seeds in the soil influence foraging effort of small mammals.



## PUBLIC SERVICE HIGHLIGHTS



FIRST YEAR UCSC UNDERGRADUATE, ANABELLE CARTER, HELPING TO INTRODUCE "BANDIT THE CALIFORNIA KINGSNAKE" TO LOCAL KINDERGARTENERS AT UCSC FORT ORD NATURAL RESERVE



FONR DIRECTOR JOE MILLER, ALONG WITH NANCY VIELMAS, EDUCATION PROGRAMS COORDINATOR FOR CSUMB HABITAT STEWARDSHIP PROJECT, PREPARING MARINA 1<sup>ST</sup> GRADE STUDENTS FOR A FIELD TRIP TO UCSC FONR

Each year Fort Ord Natural Reserve staff works to engage the public, both locally and regionally, to share the amazing resources that are contained within the boundaries of the reserve. We continue to maintain annual programs, such as our "Nature Detectives" Pre-K-1<sup>st</sup> grade hikes that include every class from all three Marina CA elementary schools. We have also been fortunate to add new public hikes and outreach programs each year. Below are a few highlights:

## LEARNING FOR LIFE CHARTER SCHOOL – INTRODUCTION TO FIELD RESEARCH AND NATURAL HISTORY

In Fall of 2022, UCSC FONR Director Joe Miller and Learning for Life independent study charter school Associate Director Barbara Lawrence-Emanuel created a program for High School students to visit the



LEARNING FOR LIFE CHARTER SCHOOL STUDENTS WORKING ON FIELD JOURNALS AT THE FONR OUTDOOR CLASSROOM

reserve for a series of four field visits each semester. This program is designed to teach students about local natural history, introduce them to career pathways in natural science and conservation, and boost retention for participants at the charter school. By creating meaningful connections to a natural resource professional, introducing them to university students, and creating experiential learning that many of the students have not encountered; the program has created measurable success in science credit completion rates the students.



MEASURING VEGETATION TRANSECTS IN OAK WOODLAND HABITAT



CALCULATING TRANSECT RESULTS BACK AT THE OUTDOOR CLASSROOM



LEARNING FOR LIFE STUDENTS MEET A WESTERN FENCE LIZARD

Each semester students have four visits. Trips are led by the reserve Director, and often accompanied by CSU Monterey Bay and UC Santa Cruz undergraduate students who are there to relate their university experience and answer questions from the group. First, a broad view is taken on a general tour of Fort Ord Natural Reserve, where students learn about different habitat types, soil, and climate that has shaped the unique maritime chaparral there. Subsequent visits narrow focus on topics such as herpetology, mammalogy, and field data collection methods. On every visit, students learn nature journaling techniques

and have time to quietly consider their observations for the day. The final visit to the reserve involves a plant survey that acts as an introduction to quantitative field methods, and basic indices are introduced.

Students then return to their school and tie everything together with their instructors, referencing their field journals from the semester to create a final project. The success of this program has led us to continue offering through 2023/24, and we hope to expand on the concept for other local schools.



THE SPRING 2023 LEARNING FOR LIFE CREW POSE FOR A GROUP PHOTO IN THE CHAPARRAL

## VANDENBERG GIRL SCOUTS – SPACE AND SEA SERVICE UNIT



VANDERNBERG GIRL SCOUTS MEET A POCKET MOUSE  
AT UCSC FONR

In May of 2023, UCSC Fort Ord Natural Reserve was fortunate to host the Vandenberg Space Force Base troop of the Girl Scouts of America. This troop is known as the Space and Sea Service Unit.



SCOUTS EXPLORE THE RESERVE

On this trip, troop leader and wildlife biologist Tiffany Whitsitt had the goal of showing the scouts examples of research in action. Over three days FONR staff introduced career possibilities, tools of the trade, and concepts related to land management and natural science field research. As most of the scouts are in military families, one additional goal was to experience unique ecosystems of California before they move to their parents next post assignment. FONR staff taught the scouts about small mammal monitoring, basic plant identification, habitats on the reserve, and we were able to fly the reserves research drones (which was very well received!).

This visit is an example of the opportunities that FONR offers to many different youth groups that visit the reserve. From scouts, home-school groups, independent study high schools, to public hikes: we aim to provide a public service in addition to and beyond the programs that we offer to university students and researchers.



DRONES-EYE VIEW OF THE GIRL SCOUTS SPACE AND SEA SERVICE UNIT

## RESERVE USE

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TABLE 2. NGO, GOVERNMENTAL, K-12, AND AFFILIATED USER GROUPS

The Monterey Bay Drone, Automation, and Robotics Technology (DART)	UC Monterey Bay Education, Science and Technology Center (UCMBEST)	University of California Agriculture and Natural Resources	CSUMB Monterey Bay Habitat Stewardship Project
CSUMB Undergraduate Research Opportunities Center (UROC)	UCSC Environmental Studies Internship Office	UCSC Kenneth Norris Center for Natural History	Department of Defense Base Realignment and Closure (BRAC)
Clovis Unified School District	The Western Section of The Wildlife Society	Monterey Peninsula Unified School District	Learning For Life Charter School
UC Santa Cruz Arboretum	California Native Plant Society	California Academy of Sciences	Vandenberg Space Force Base Girl Scouts
CSUMB Sciences Internship Program	CSUMB Service-Learning Institute	Elkhorn Slough Foundation	United States Naval Postgraduate School
Cabrillo College	Santa Cruz Museum of Natural History	Bureau of Land Management	Marina Police Department
UC Genomics Consortium	California Department of Fish and Wildlife	Monterey Bay Tracking Club	CSUMB Scientific Illustration Program
US Department of Fish and Wildlife	Marina Fire Department	US Army Reserve	City of Marina
Scouts BSA			

## APPENDICES

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### APPENDIX 1. USE DATA FOR FISCAL YEAR 2022-2023

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RESERVE USE DATA Fiscal year: 2022-2023

Campus: University of California, Santa Cruz  
Reserve: Fort Ord Natural Reserve

	UC Home		UC Other		CSU System		CA Comm College		Other CA College		Out of State College		International University		Government		NGO/Non-Profit		Business Entity		K-12 School		Other		Total			
	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs		
<b>UNIVERSITY- LEVEL RESEARCH</b>																												
Faculty	2	10	0	0	5	31	0	0	0	0	1	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	82
Research Scientist/Post Doc	0	0	1	9	0	0	0	0	2	6	1	41	0	0	0	0	3	10	0	0	0	0	0	0	0	0	7	66
Research Assistant (non-student/faculty/postdoc)	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Graduate Student	3	7	0	0	2	16	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	6	25	
Undergraduate Student	40	198	2	4	21	120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	63	322	
Professional	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	0	0	0	0	0	0	0	2	12	4	16
Volunteer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	1	4	
Reserve Staff	5	34	0	0	0	0	0	0	0	0	0	0	0	0	0	6	12	0	0	0	0	0	0	0	0	11	46	
<b>SUBTOTAL</b>	<b>51</b>	<b>250</b>	<b>3</b>	<b>13</b>	<b>28</b>	<b>167</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>6</b>	<b>2</b>	<b>82</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>4</b>	<b>10</b>	<b>24</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>16</b>	<b>101</b>	<b>562</b>		
<b>UNIVERSITY - LEVEL INSTRUCTION (CLASS)</b>																												
Faculty	6	17	0	0	7	19	4	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	50	
Research Assistant (non-student/faculty/postdoc)	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	
Graduate Student	6	16	0	0	49	49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	55	65	
Undergraduate Student	235	677	25	75	317	438	37	57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	614	1247	
Other	3	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	30	33	35	
Reserve Staff	1	10	3	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	19	
<b>SUBTOTAL</b>	<b>252</b>	<b>728</b>	<b>28</b>	<b>84</b>	<b>373</b>	<b>506</b>	<b>41</b>	<b>71</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>30</b>	<b>30</b>	<b>724</b>	<b>1419</b>		
<b>OTHER</b>																												
Faculty	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	
Research Scientist/Post Doc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	
Undergraduate Student	6	6	0	0	10	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	16	
K-12 Instructor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	22	0	0	0	0	55	22	
K-12 Student	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	522	554	0	0	0	0	522	554		
Professional	1	3	1	1	0	0	0	0	0	0	0	0	0	0	3	6	2	9	1	1	1	4	1	3	10	27		
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	28	14	47	0	0	4	12	42	54	67	141		
Docent	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	
Volunteer	2	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60	60	62	66		
Reserve Staff	1	3	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2	4		
<b>SUBTOTAL</b>	<b>11</b>	<b>19</b>	<b>1</b>	<b>1</b>	<b>10</b>	<b>10</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>10</b>	<b>34</b>	<b>19</b>	<b>59</b>	<b>1</b>	<b>1</b>	<b>542</b>	<b>592</b>	<b>103</b>	<b>117</b>	<b>697</b>	<b>833</b>		
<b>HOUSING</b>																												
<b>TOTALS</b>	<b>314</b>	<b>997</b>	<b>32</b>	<b>98</b>	<b>411</b>	<b>683</b>	<b>41</b>	<b>71</b>	<b>2</b>	<b>6</b>	<b>2</b>	<b>82</b>	<b>0</b>	<b>0</b>	<b>12</b>	<b>38</b>	<b>29</b>	<b>83</b>	<b>1</b>	<b>1</b>	<b>542</b>	<b>592</b>	<b>136</b>	<b>163</b>	<b>1522</b>	<b>2814</b>		

APPENDIX 2. UCSC NATURAL RESERVES COMMITTEE AND CHARGE

University of California Santa Cruz

2023-2024 Natural Reserves Advisory Committee

Charge

The committee provides oversight of on- and off-campus natural reserves of instructional and research interest. It is responsible for developing program vision and policy for the management and use of the UCSC Campus Reserve, Santa Cruz Mountains Reserve, and of the four UC Natural Reserves System holdings: Año Nuevo Island Reserve, Landels-Hill Big Creek Reserve, Younger Lagoon Reserve and Fort Ord Reserve. The committee coordinates with the system wide NRS Advisory Committee that advises on policy for all NRS reserves.

In addition to the chair (Faculty Director), membership of the committee is comprised of faculty advisors to each reserve, one faculty representative at large, one non-senate academic appointment, one staff representative, one graduate student, two undergraduate students, and ad hoc faculty members as needs arise. The Faculty Director, in consultation with the Dean and the Administrative Director of the UCSC Natural Reserves, appoints the committee. Membership terms begin September 1 unless otherwise specified.

Curation of Appointments

Faculty Director: 5 years

Faculty Advisors: 3 years

Non-Senate Academic, Staff, and Students: 1 year

Members may be reappointed at the discretion of the Faculty Director in consultation with the Administrative Director.

Hours/Quarter: Chair/NRS Representative-20, Members-10

Reports to: Division of Physical & Biological Sciences Dean

2023-2024 NATURAL RESERVES ADVISORY COMMITTEE MEMBERSHIPS				
Faculty Director of the Natural Reserve System	Don Croll	Professor of Ecology and Evolutionary Biology	Long Marine Lab, Center for Ocean Health	(831)459-3610 dcroll@ucsc.edu
Faculty Advisor Younger Lagoon Reserve	Karen Holl	Professor of Environmental Studies	Environmental Studies Department	(831) 459-3668 kholl@ucsc.edu
Faculty Advisor Año Nuevo Reserve	Daniel Costa	Professor of Ecology and Evolutionary Biology	Long Marine Lab, Center for Ocean Health	831) 459-2786 costa@ucsc.edu
Faculty Advisor UCSC Campus Natural Reserve	Gregory Gilbert	Professor of Environmental Studies	Environmental Studies Department	(831) 459-5002 ggilbert@ucsc.edu
Faculty Advisor Fort Ord Natural Reserve	Laurel Fox	Professor of Ecology and Evolutionary Biology	Ecology and Evolutionary Biology Department	(831) 459-2533 fox@ucsc.edu
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