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CSU COAST-WRPI

Student Research Poster Reception

Book of Abstracts

March 8, 2016 • Long Beach, CA

WRPI

Welcome!

On behalf of the CSU Council on Ocean Affairs, Science & Technology (COAST) and the Water Resources and Policy Initiatives (WRPI), we are pleased to welcome you to the 2016 Student Research Poster Reception at the Chancellor's Office. Student researchers from each of the 23 CSU campuses are on hand to highlight the excellent and timely research conducted throughout the system. COAST and WRPI are proud to present a suite of projects representing efforts to develop solutions to the complex water and coastal zone challenges we currently face. Each project also demonstrates the commitment of CSU faculty members and students to education and learning while advancing our knowledge of California's natural resources, reinforcing the value of the basic scientific process, and achieving excellence.

Thank you for joining us today, and enjoy!

Krista Kamer, Ph.D.
Director
COAST
CSU Monterey Bay
100 Campus Center
Seaside, CA 93955
415-518-2161
www.calstate.edu/coast/

Boykin Witherspoon III
Executive Director
WRPI
CSU San Bernardino
5500 University Pkwy
San Bernardino, CA 92407
909-537-7681
www.calstate.edu/water/

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Note: * denotes student authors throughout

CSU Bakersfield

Title: **Coccidioidomycosis in rescued marine mammals along California's coast**

Authors: Yazmine Mejia Muñoz[1]*, Shawn Hannah[2]*, Heather Liwanag[2], Birgitte McDonald[3], and Antje Lauer[1]

Affiliation: [1]Department of Biology, CSU Bakersfield
[2]Department of Biological Sciences, California Polytechnic State University, San Luis Obispo
[3]Moss Landing Marine Laboratories, San Jose State University

Abstract: Coccidioidomycosis is the number one fungal infection among stranded marine mammals in California. However, nothing is known about differences in incidence of the disease in California sea lions and other pinnipeds along California's coast. Arthroconidia from the soil-dwelling fungal pathogen *Coccidioides spp*. can become airborne when soil is disturbed in endemic areas and thus, can be transported by the wind to non-endemic areas, including California's coast. We hypothesize that California sea lions and other pinnipeds rescued by Marine Mammal Care Centers (MMCs) closest to the Southern San Joaquin Valley, known as a hot spot for coccidioidomycosis, will have a higher incidence of the disease compared to animals rescued further north. In our ongoing project, we include animals of all age groups rescued at 5 MMC's along California's coast. By performing immunodiffusion assays to detect IgG and IgM, we have detected IgM antibodies against the pathogen in about 10% of blood sera from predominantly adult and subadult California sea lions rescued at the facility in San Pedro in 2014 and 2015 (*n*=70), indicating acute coccidioidomycosis. Only one animal was positive for IgG which could indicate a chronic infection with the pathogen. More samples are currently being investigated from other rescue facilities.

CSU Channel Islands

Title: **Sandy beach rapid assessment synoptic survey: student-and citizen science-based sentinel monitoring proves an invaluable tool for measuring coastal health**

Authors: Sean Anderson[1], Clare Wormald Steele[1], Don Rodriguez[1], Linda O'Hirok[1], Paul Spaur[1], Tevin Schmitt[1]*, Dorothy Horn[1]*, Chase Tillman[2]*, Reily Pratt[1]*, and Aimee Newell[1]*

Affiliation: [1]Environmental Science and Resource Management Program, CSU Channel Islands
[2]Biology Department, Moorpark Community College

Abstract: Four years ago, CSU Channel Islands began development of a Rapid Assessment Tool for Sandy Beach ecosystems. Despite the fact sandy beaches cover 60-90% of our Southern California county shorelines and are fundamental to our economy (generating > $61 billion per year) and culture, they have generally been ignored academically. Our now-robust and well-vetted rapid assessment tool (equivalent to an EPA Tier II protocol) measures ecological, geomorphological, landscape, and anthropogenic variables. Human density, shorebird abundance, sand crab abundance, *Acanthocephala* (crab-bird parasites) prevalence, slope, and fecal indicator bacteria show the strongest correlations to date suggesting that short field sampling events (1-2 hours) may be sufficient to characterize the condition of a given strip of sandy beach. Our monitoring protocol has also proven useful in detecting and quantifying unanticipated impacts such as highly variable tarring in the wake of the May 2015 Refugio Oil Spill and the ubiquity of microplastic (particles and fibers <5mm) contamination, both of which show that sandy beaches are bearing the brunt of these pollution assaults. In the case of the Refugio Oil Spill, infaunal diversity dropped and heretofore unobserved conspicuous dead *Emerita analoga* (sand crabs) became common in the swash zone across several beaches.

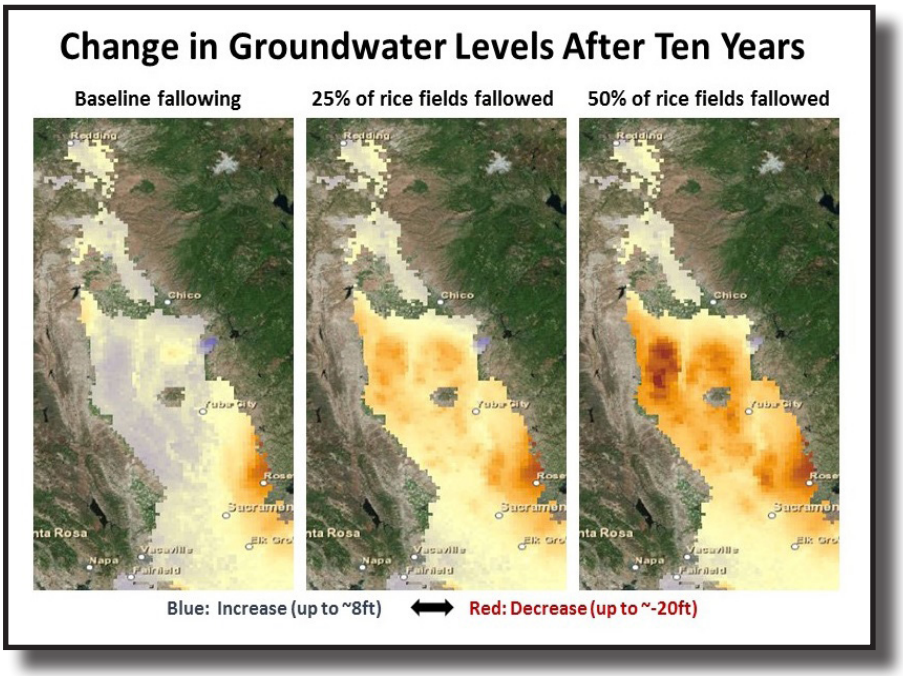
CSU Chico

Title: **Modeled effects of rice field fallowing on groundwater systems in the Sacramento Valley**

Authors: Kevin Anderson[1]*, Eric Houk[2], and Steffen Mehl[3]

Affiliation: [1]Department of Geological and Environmental Sciences, CSU Chico
[2]College of Agriculture, CSU Chico
[3]Department of Civil Engineering, CSU Chico

Abstract: Following previous research on the hydrologic effects of agricultural water transfers with groundwater substitution, this study examines the similar practice of agricultural water transfers with field fallowing. The necessity of this study is driven by the prevalence of rice farming in the Sacramento Valley. In times when water is scarce, there is an economic incentive for rice farmers to fallow fields and sell their allocated surface water to farmers elsewhere where the cost of water is higher. Given the predominance of flood irrigation in rice farming, there is the possibility that rice field fallowing would reduce a significant source of recharge to the groundwater system. The Central Valley Hydrologic Model (CVHM) was used to investigate the effects of rice fallowing on the groundwater system. CVHM is a regional-scale hydrologic model developed by the USGS for the Central Valley. CVHM is based on MODFLOW and uses the Farm Processes Package (FMP) to account for the effects of land use on the surface water and groundwater systems. Partial funding for this project has been provided by the CSU Agricultural Research Institute.



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CSU Dominguez Hills

Title: **Physiological responses of larvae of the Mediterranean mussel during El Niño conditions**

Authors: Lindsay Almaleh*, Courtney Fiamengo*, and Jacqueline Padilla-Gamiño

Affiliation: Environmental Sciences Department, CSU Dominguez Hills

Abstract: In California, El Niño events are characterized by ocean conditions with unusually high temperatures and a drastic decline in primary productivity. These conditions can impact the survival and physiology of marine organisms with important implications to the aquaculture industry. Our work will combine remote sensing data and laboratory experiments to evaluate the effects of the 2015-2016 El Niño conditions on the development and ecophysiology of early life stages of the Mediterranean mussel *Mytilus galloprovincialis*. Real-time sea surface temperatures (SST) and phytoplankton densities (estimated through chlorophyll-a [chl-a] levels) will be obtained using remote sensing data from NASA satellites Lansat-8, TIR and Aqua, MODIS. This data will be used to inform our experiments and manipulate temperature and food concentrations within an ecological context. Parent mussels for this experiment will be obtained from California (Catalina Sea Ranch) and Oregon (Taylor Shellfish Farm) in order to determine if parental effects influence larvae resilience and acclimation capabilities during El Niño conditions. Lipids and proteins will also be measured to assess sub-lethal stress. This research will be performed in collaboration with Catalina Sea Ranch Farm, the first offshore shellfish farm within United States federal waters and a shellfish farm designed to support the National Shellfish Initiative.

CSU East Bay

Title: **Exploring the relationship between habitat temperature and enzymatic hydrogen bonds in marine ectotherms**

Authors: Devin Schaefferkoetter* and Tyler Evans

Affiliation: Department of Biological Sciences, CSU East Bay

Abstract: Temperature has a pervasive effect on the structure and function of enzymes. High temperatures cause enzymatic proteins to unfold and lose their catalytic activity. Cold temperatures cause enzymes to become rigid, preventing the shape change necessary to complete catalysis. Hydrogen bonds act as stabilizing agents for metabolic enzymes. Consequently, we hypothesize that the number of hydrogen bonds in enzymes will be correlated with prevailing environmental temperature regimes for ectothermic animals. Specifically, a greater number of hydrogen bonds should be found in the enzymes of ectotherms inhabiting warm environments in order to protect against heat-induced unfolding. Conversely, fewer hydrogen bonds should be present in ectotherms inhabiting cooler environments so that these enzymes are capable of conformational change during catalysis. Our research explores these hypotheses by using protein modelling software to compare the number of hydrogen bonds between cold- (*Mytillus trossulus*) and warm-adapted (*Mytillus galloprovincialis*) mussels that inhabit the California coast. To date, we have developed a pipeline to model, visualize and count hydrogen bond using GenBank DNA sequences available for each species. Our work will provide much-needed insight into the biochemical basis of heat tolerance and may also help to predict vulnerability or resilience toward ongoing ocean warming.

CSU Fresno

Title: **Performance evaluation of biological wastewater treatment for dairy farm**

Authors: Jorge Hernandez*, Bijay Kc*, Fayzul Pasha

Affiliation: Department of Civil and Geomatics Engineering, CSU Fresno

Abstract: Earthworms have about 600 million years of experience and can tolerate toxicity and devour the microorganisms helping the wastewater to be cleaned. Unlike the conventional treatment plants that use chemicals to treat wastewater, earthworm based biological treatment plants use biological process for the treatment. It is eco-friendly and the byproducts along with the treated water can be reused. The main objective of this study is to test the performance of an earthworm based wastewater treatment plant in reducing constituents in dairy wastewater and to measure the energy use to achieve these reductions. Earthworm based biological wastewater treatment system known as Dynamic Aerobic Biofilter (BIDA®) is applied to treat the wastewater from California State University Fresno's dairy farm in this study. Performance of the treatment plant is observed based on the removal efficiency of sixteen water quality parameters (B, BOD5, Ca, COD, EC, K, Mg, Na, NH4, NO3-N, P, pH, Salt-Sol, TDS, TKN, and TSS). The results showed that the removal efficiencies of nitrogen based constituents such as NH4, NO3-N and TKN are significantly high (i.e. above 90%). BOD5 and COD showed promising result. However, the plant performed poorly on other constituents. For the energy requirement to treat 1000 gallons of wastewater, about 25% of the data show extraordinary performance than the baseline study. However, about 50% of the data did not outperform the baseline study. The poor performance of the plant for water quality and energy requirements may be due to the poor data sample handling and mechanical failure of the pump during this study.

WRPI

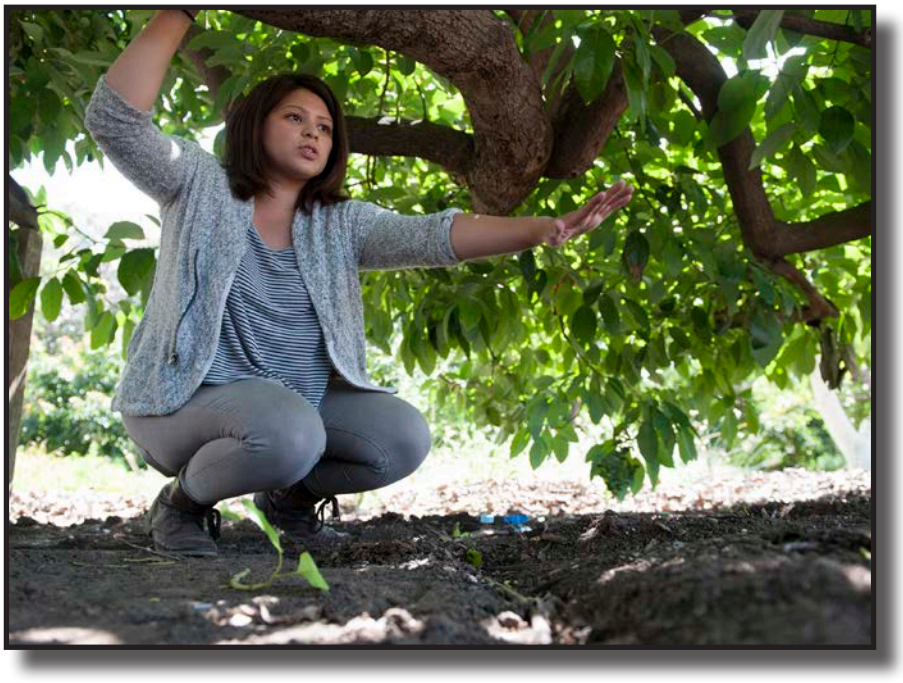
CSU Fullerton

Title: **Investigating continuous measures of plant stress for avocado trees to guide irrigation**

Authors: Miriam Morua* and Jochen Schenk

Affiliation: Department of Biological Science, CSU Fullerton

Abstract: California regularly experiences water shortages due to periodic droughts. Decreased availability of irrigation water has spurred interests in new irrigation strategies to minimize agriculture water use. Such strategies largely rely on soil-water measurements, but plant-based measures are hypothesized to be a better guide for assessing water needs of orchard trees. The purpose of my study is to identify a plant-based measure of water stress in avocado, *Persea americana*, that can be continuously monitored to guide irrigation decisions. Three Fuerte avocado trees were subjected to temporary drought conditions at the Fullerton Arboretum in July and August, 2015. Irrigation was kept at a level that meets the trees' demands and was interrupted for two-week intervals, during which several water stress parameters were monitored. The state of water stress during these periods was determined directly using destructive measurements of leaf water potentials. In addition, I monitored plant-based responses to water stress continuously by measuring stem diameter, trunk water potential, and wood water content. Soil water contents and soil water potentials were also monitored continuously. To determine the most suitable plant- and/or soil-based measure for irrigation scheduling, correlations will be assessed between the different continuous measures and leaf water potential.



WRPI

Humboldt State University

Title: **Collaborative research methods for surveying fish communities associated with nearshore rocky reefs in the northern California marine protected area study region**

Authors: Jay Staton[1]*, Ian Kelmartin[1]*, Drew Barrett[1], Timothy Mulligan[1], and Joe Tyburezy[1,2]

Affiliation: [1]Department of Fisheries Biology, Humboldt State University
[2]California Sea Grant

Abstract: Rocky reefs are iconic features of the California coast. They support important recreational and commercial fisheries while providing habitat for a rich diversity of fishes. Using methods developed by the California Collaborative Fisheries Research program, we conducted hook-and-line surveys, partnering with commercial passenger fishing vessel (CPFV) captains and volunteer anglers to characterize the baseline status of fish assemblages in four MPAs, along with four reference sites, off the north coast. Over two sampling years, 4248 individuals were captured, representing 22 species, including 14 species of rockfishes (*Sebastes spp.*). Catch composition was dominated by black rockfish (*Sebastes melanops*, 39%), blue rockfish (*Sebastes mystinus*, 19%) and lingcod (*Ophidion elongatus*, 15%) across all sites. Linear models were used to compare relative fish abundance, diversity, and size structure to distance from the nearest fishing port, a proxy for historical fishing pressure. We found higher relative fish abundances (p-value = 0.001) and diversity (p-value = 0.022) as distance from port increased. We also saw significant increases in fork length of the two most commonly captured fishes, black rockfish (*Sebastes melanops*) and blue rockfish (*Sebastes mystinus*) as the distance from nearest fishing port increased (p-value < 0.0001).

CSU Long Beach

Title: **Energetic utilization in a derived echinopluteus form: *Centrostephanus coronatus***

Authors: Annie Jean Rendlemen*, Janine Ashley Rodriguez*, Aura Eunice Deleon*, Alec Ohanian*, Priscilla Figueroa*, and Douglas Pace

Affiliation: Department of Biology, CSU Long Beach

Abstract: Typical sea urchin larval forms, or echinoplutei, exhibit eight arms circumscribed with cilia, which allow for feeding and swimming. *Centrostephanus coronatus* (crowned urchin) larvae, however, possess only two very long arms. Growth is influenced by nutritional intake, meaning morphology of larval forms may have a significant effect on development. This research seeks to understand the physiological consequences of morphological variation in larval forms through a detailed analysis of metabolic growth efficiency. It was hypothesized that the dramatic difference in morphology of *C. coronatus* would result in significantly different growth efficiency relative to typical echinoplutei forms. Rates of larval feeding, growth, and metabolism were measured in order to model growth efficiency. Larvae ingested 81,263 algal cells ind^{-1} by day 37, resulting in the acquisition of 186 mJ of energy. Analysis of developmental metabolism determined that larvae used a total of 34 mJ of energy by day 37. Protein growth resulted in the deposition of 1,458 ng protein, requiring 92 mJ of energy. This resulted in a gross energetic efficiency of 68% and a protein growth efficiency of 37%. This research is important for addressing the role of morphological variation in determining the physiological and biochemical efficiency of larval growth and development.

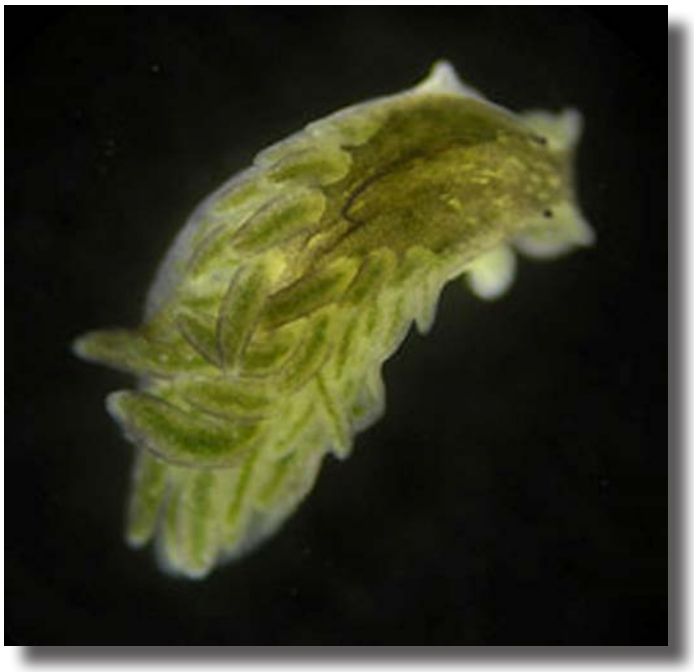
CSU Los Angeles

Title: **Multivariate selection and the range limit of *Alderia willowi*: the effects of salinity and trait covariance**

Authors: Jackson A. Powell* and Patrick J. Krug

Affiliation: Department of Biological Sciences, CSU Los Angeles

Abstract: For estuarine animals, range limits may be set by complex interactions between abiotic factors, such as geographical gradients in salinity and temperature, and interspecific competition. Further, multivariate selection can inhibit adaptation to any one stressor. Thus, range limits may occur in different places than would be predicted by considering one environmental factor or trait in isolation. The northern range limit of the sea slug *Alderia willowi* may be set by low salinity following winter rains, and/or competition with its sister species *A. modesta*. We studied multivariate selection on *A. willowi* based on short-term fitness in laboratory experiments. Slugs will be stressed by combinations of low salinity and presence of *A. modesta*, and egg production measured for 1-2 weeks. Analyses of multivariate selection considered the relationship of number of cerata (appendages that circulate body fluid), rate of ceratal beating, and body size on fitness. Preliminary results indicate that lower salinities significantly suppressed initial egg production, but slugs recovered to control levels after a one-week period of acclimation. There was no interaction between body size and fitness in preliminary experiments. Results of ongoing research will provide insight into the basis for northern range limits of estuarine animals along the U.S. west coast.



CSU Maritime Academy

Title: **Estuarine water quality and ballast water management: undergraduate research at the California State University Maritime Academy**

Authors: Austin Gearty[1]*, Hannah Foster[1]*, Meredith McPherson[2], Richard Muller[2], and Alexander Parker[3]

Affiliation: [1]Department of Marine Transportation, CSU Maritime Academy
[2]Golden Bear Facility, CSU Maritime Academy
[3]Department of Science and Mathematics, CSU Maritime Academy

Abstract: The California State University Maritime Academy (Cal Maritime) is a specialized campus of the California State University (CSU) system with a mandate to train students for maritime professions. With financial support from the CSU COAST Undergraduate Research Support Program students developed and carried out marine science research in 2015 aimed at assessing the role of nutrients on phytoplankton growth and primary production in the San Francisco Estuary (SFE). Working with Cal Maritime's ballast water treatment testing facility, one project investigated estuarine phytoplankton growth rates in treatment tanks testing the hypothesis that the time required for the algae to fully utilize available nitrogen and phosphorus nutrients was predictable and based upon the initial nutrient concentration supplied. A second project investigated whether phytoplankton growth response would vary with additions of different forms of nitrogen or phosphorus, with the hypothesis that nitrogen and not phosphorus would promote algal growth in the SFE. The results will be applied to optimize protocols in the creation of "challenge water" used for the testing of ballast water treatment technologies and may be broadly applied to the management of nutrient pollution in California estuaries.

CSU Monterey Bay

Title: **Danger zone: role of a military restricted area in protection of demersal fish and invertebrate communities at San Clemente Island, California**

Authors: Michael Esgro[1]*, James Lindholm[1], Kerry Nickols[1], Jessica Bredvik[2]

Affiliation: [1]Division of Science and Environmental Policy, CSU Monterey Bay
[2]Naval Facilities Engineering Command Southwest

Abstract: "De facto" marine protected areas (DFMPAs) are regions of the ocean that are not formal marine protected areas (MPAs), but experience limited human impact nonetheless. Although DFMPAs are widespread globally, their potential contributions to marine conservation have not been well studied. In 2012 and 2013, we conducted remotely operated vehicle (ROV) surveys of mid-depth (20—500 m) marine communities inside a military DFMPA and a fished control site at San Clemente Island, the southernmost of the Channel Islands in the Southern California Bight. We used data extracted from ROV imagery to compare relevant ecological metrics (abundance and biomass of ecologically and economically important target species, as well as community-level differences in richness, diversity, and species composition) between sites. Abundance and biomass of California sheephead (S*emicossyphus pulcher*), biomass of olive/yellowtail rockfishes (*Sebastes serranoides*/*S. flavidus*), and biomass of vermilion/canary rockfishes (*Sebastes miniatus*/*S. pinniger*) were significantly higher inside the DFMPA. While neither species richness nor species diversity were significantly different between sites, an analysis of similarity based on Bray-Curtis dissimilarity indices indicated that fish communities at the two sites had significantly different species compositions. These results indicate that DFMPAs may play an important role in the conservation of critical marine species.

CSU Northridge

Title: **Improvement of the national hydrography dataset for parts of the lower Colorado region and additional areas of importance to the DLCC**

Authors: Carlos Reyes-Andrade*, Joel Osuna, and Danielle Bram

Affiliation: Department of Geological Sciences, CSU Northridge

Abstract: The National Hydrography Dataset (NHD) is a nation-wide GIS-based hydrography dataset that is housed and maintained by the US Geological Survey (USGS). This dataset contains surface water features and valuable attribution data that offers diverse utility for the end user beyond map-making. The USGS has implemented a stewardship-based framework to bring improvement to this dataset in which qualified entities act as stewards and update the NHD. This project represents a partnership between USGS National Geospatial Program, the US Fish and Wildlife Service (on behalf of the Desert Landscape Conservation Cooperative, DLCC), and the Center for Geographical Studies (CGS) at California State University, Northridge, in which CGS will actively update the NHD data. This project implemented improvements to the NHD data in select arid regions of the Southwestern US. This work is designed to support the science objectives for the DLCC and its partners, specifically, providing an important framework basis for the development of hydrologic models required to address effects of climate change and other pertinent conservation research topics. In addition to data improvements, best practices and update rules for decision making within arid regions were documented to aid in building standards for future update work.

WRPI

California State Polytechnic University, Pomona

Title: **Assessing local implementation of hexavalent chromium treatment technologies**

Authors: Andrew Kennedy*, Erik Cheung*, and Ali Sharbat

Affiliation: Department of Civil Engineering, California State Polytechnic University, Pomona

Abstract: California water agencies are facing difficulty making diminishing water supply meet rising demand. In addition to population growth and extended drought, stricter quality standards also limit available water sources. America's first regulation directly concerning hexavalent chromium came into effect in 2014 as a state-level maximum contaminant limit (MCL) in California. Also known as chromium(VI), hexavalent chromium is a demonstrated carcinogen via oral and inhalation routes. The 10 part-per-billion MCL was enacted to reduce the cancer risk associated with lifelong exposure. However, meeting this limit is a challenge for suppliers. Between 2000 and 2012, chromium(VI) was detected at concentrations above the current MCL at 339 groundwater sources throughout California. Due to both natural and anthropogenic contamination, some municipal water systems have been found non-compliant. The goal of this study is to assess technologies that reduce chromium(VI) levels in drinking water with an emphasis on implementation potential by state water agencies. Emerging technologies, to include forward osmosis and biological removal, are examined in addition to relatively proven methods of ion exchange and reaction-coagulation-filtration. Technologies that can expediently ensure the required quality, deliver at municipal scale, and integrate with extant treatment could potentially mitigate regulation-induced strain on water supply.

CSU Sacramento

Title: **Use of naturally occurring aluminosilicate materials as amendments for the remediation of agricultural soils**

Authors: Emily Gorrie* and Susan Crawford

Affiliation: Department of Chemistry, CSU Sacramento

Abstract: Heavy metal contamination in agricultural soils is a topic of increasing concern on both the state and global scale. Heavy metal soil contaminants have been shown to be absorbed and accumulated in certain crops, such as spinach varieties; these metal ions are then transferred into the food chain by consumption of these contaminated crops. Cadmium, specifically, is often accumulated in crops that have been grown in cadmium contaminated soil, or that have been fertilized with fertilizers containing the metal. Due to the toxicity of heavy metals, contaminant remediation is vital. Evidence for long range metal ion exchange between dissimilar zeolites (aluminosilicate materials) indicates zeolites may make good soil amendments for the remediation of metal ion contamination. Herein, the long range cadmium exchange for ionic nutrient, potassium, was monitored in the spinach variety *Spinacia oleracea*. Spinach was grown in soil dosed with combinations of cadmium contaminant and zeolitic amendment. The naturally abundant zeolite clinoptilolite utilized herein was exchanged with a potassium ion prior to soil dosing. Plant growth rate was recorded and the uptake of cadmium by the plants was monitored through acid digest of leaf material and graphite furnace atomic absorption spectroscopy.

CSU San Bernardino

Title: **Archiving and digitizing the Salton Sea**

Authors: Lauren Adams*, Casey Lee*, and Thomas Long

Affiliation: Department of History, CSU San Bernardino

Abstract: Since summer 2015, Casey and Lauren have been working with the Water Resources Institute (WRI) at California State University San Bernardino, Palm Desert Campus, to archive and digitize material surrounding the Salton Sea. Hundreds of documents have been categorized and filed. Currently, all documents are in the process of being scanned and made into a PDF to provide online access to people interested in its resources. The Salton Sea Archives, located at WRI Palm Desert, have been created with documents and data gathered from the Salton Sea Authority, local water agencies, and the Joseph Andrew Rowe Water Resources Archives, including a large selection from the William Claypool Collection. The focus of the Archives is the Salton Sea, but also includes materials of interest to the history and development of the Coachella and Imperial Valleys, including the Lower Colorado Watershed. It is supported by donations from the Agua Caliente Band of Cahuilla Indians and the Salton Sea Authority. Revitalizing the environment and economy of the Sea requires an integrated approach to recognizing old problems as potential new solutions, and to delivering multiple benefits with thoughtful strategies that integrate economic opportunity and environmental stability.

San Diego State University

Title: **Ladybeetle predators enchance salt marsh growth via non-consumptive and total effects**

Authors: Shelby Rinehart[1,2]* and Jeremy Long[1]

Affiliation: [1]Biology Department, San Diego State University
[2]Joint Doctoral Program, San Diego State University and UC Davis

Abstract: Trophic cascades have historically been attributed to the consumptive effects (CEs) of predators on prey. However, predators can also induce trophic cascades via non-consumptive effects (NCEs) by inducing behavioral, morphological, or physiological changes in prey which, in turn, impact the abundance of basal resources. Here, we examined the total predator effect (TEs) and NCEs of a salt marsh ladybeetle on populations of scale insects and a foundational marsh plant (*Spartina foliosa*). In mesocosm studies, ladybeetles induced a trophic cascade on plants via their TEs and NCEs on scale insects. Specifically, ladybeetles increased the belowground biomass of *Spartina*, which is important given that *Spartina* primarily reproduces via rhizome expansion. This study provides evidence that top-down regulation exists in west coast salt marshes and suggests that ladybeetles are more important for maintaining functional marsh habitat than previously assumed. Therefore, further understanding the interactions between predators and foundational species is crucial if we are to successfully restore and manage salt marsh habitats.

San Francisco State University

Title: **Characterizing adaptive genetic variation in the salt marsh harvest mouse, *Reithrodontomys raviventris***

Authors: Anastasia G. Ennis* and C. Sarah Cohen

Affiliation: Romberg Tiburon Center for Environmental Studies and Department of Biology, San Francisco State University

Abstract: Montane meadows are common geomorphological features of the Sierra Nevada. They store, filter and regulate water, and support wetland and riparian plant communities, which in turn provide unique wildlife habitat. Many of these meadows have been degraded by enhanced runoff and gullying, primarily due to historical agricultural and extractive industries. Restoration techniques are being utilized in select meadows to redress the gullying and return the water table to pre-disturbance levels. The objective of this study is to examine the role of restoration practices on the ecohydrology of meadow ecosystems, particularly atmospheric exchanges of water, carbon and energy. The rate and sign of these exchanges were measured using eddy covariance in a restored Sierra Nevada montane meadow during the growing season. Biometric sampling was also conducted both within the measurement footprint and in a degraded meadow for comparison. The restored meadow ecosystem provides a strong sink for atmospheric carbon and source of atmospheric water, and has a high ratio of latent to sensible heat flux. There was also significantly higher soil moisture and organic content, vegetation diversity and density, and above- and below-ground biomass in the restored montane meadow as compared to the degraded meadow.

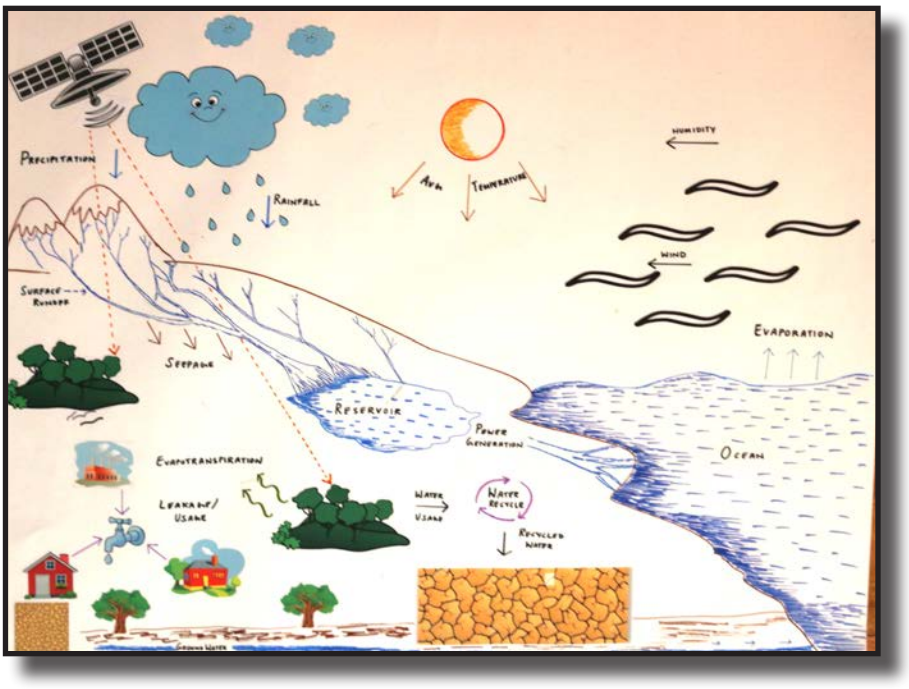
San Jose State University

Title: **Big data analytics - California drought prediction system**

Authors: Pradeep Ivan Bosco[1]*, Alice George Thomas[1]*, Kayalvizhi Porselvi Alagupackiam[1]*, Kiranmaiye Mannava[1]*, Jerry Gao[1], and Sen Chiao[2]

Affiliation: [1]Department of Computer Engineering, San Jose State University
[2]Department of Meteorology and Climate Science, San Jose State University

Abstract: Water scarcity and drought are serious problems in California today. Counties implement policies and restrictions for water conservation to reduce water scarcity. The existing drought prediction has limitations like usage domain specific approach based on limited data, only considering estimation and computation depending on PDSI indexing with limited impact factors. It computes drought for entire state rather than considering region factors. The prediction doesn't consider urban development and natural factors, and lacks real-time systematic monitoring, computation, and prediction capability. The paper proposed has a prediction model with a systematic approach to model multi-dimensional drought indicators. A "Drought-Watch" system is developed to support real-time big data collection, monitoring, computation, and prediction of drought using hierarchical modeling and bottom-up approach of regional computing and estimation. A major advantage is the system is a real-time big data based system with user-friendly interface supporting and monitoring environmental Water Eco-system. The model is based on historic data, comprehensive impact factors with data integration, and model integration. The system supports computing and prediction based on comprehensive and integrated big data sets for reservoir, climate change, water usage, and PDSI information. Our prediction model can be used as an educational source, and government can implement various policies to eradicate water scarcity.



WRPI

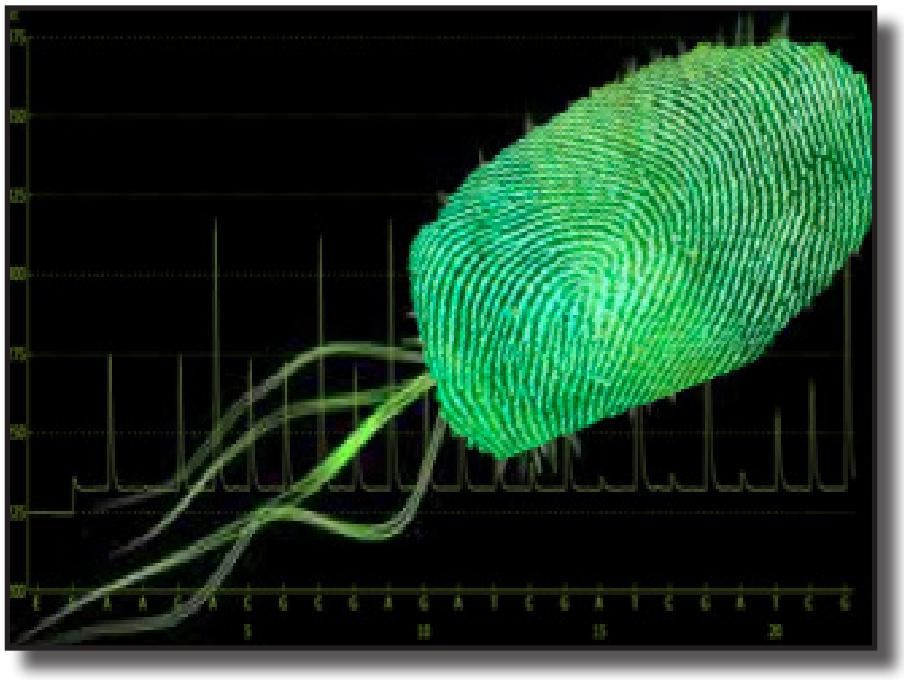
California Polytechnic State University, San Luis Obispo

Title: **Application of pyroprinting for source tracking of *Escherichia coli* in Pennington Creek**

Authors: Charles Moritz*, Christopher Pann*, Dillon Shapiro*, Jennifer VanderKelen, Michael Black, Christopher Kitts

Affiliation: Biological Sciences Department, California Polytechnic State University, San Luis Obispo

Abstract: This project's goal was identifying sources of fecal contamination in Pennington Creek; part of the Morro Bay watershed running past an outdoor school, making the reported high *Escherichia coli* counts a public health concern. This study was funded by Cal Poly's Center for Applications in Biotechnology and the Morro Bay National Estuary Program with the purpose of informing management strategies for the creek. Water samples were collected at three locations over a 14-month period and isolated *E. coli* were strain-typed using a novel DNA-based fingerprinting method called pyroprinting. Pyroprints from the creek *E. coli* were matched to a pyroprint database of >7000 *E. coli* collected from various hosts: local wildlife, humans, and domesticated animals. Out of 398 *E. coli* isolated from Pennington Creek, 87 (22%) were successfully assigned to unique host species. Overall, the dominant source of *E. coli* was cows (44%), followed by turkeys (15%), humans (11%), deer (9%), and a variety of lesser contributors. Spatial and temporal analysis indicated that cows were contributing year round and at all three sites, and that turkey and deer were contributing mainly at the site farthest upstream. The large number of *E. coli* that did not match database entries indicates a need to increase the database size.



CSU San Marcos

Title: **Differences in ecosystem carbon and nitrogen storage between an artificial wetland and reference natural wetlands in southern California**

Authors: Jacob Maziarz* and George Vourlitis

Affiliation: Department of Biological Sciences, CSU San Marcos

Abstract: Freshwater wetlands are among the most productive habitats in the world and provide numerous benefits (ecosystem services) to human communities, such as food, tourism, wastewater treatment, nutrient uptake, and flood/erosion control. To alleviate the loss of natural wetland habitats, the construction of artificial wetlands, as well as restoration projects on degraded wetlands, have become commonplace. These artificial wetlands are intended to provide the same benefits of natural wetlands, but several studies have found that artificial wetlands often fail to meet the levels of carbon (C) and nitrogen (N) storage of natural wetlands, which raises questions as to whether artificial wetlands can serve the same functions as natural wetlands. This research focuses on an artificial wetland established at California State University San Marcos (CSUSM) in 2004, which was created to mitigate for the loss of a natural wetland that was filled for development. Soil and plant tissue samples were collected from this wetland every two years, and preliminary results indicate rapid rates of plant and soil C and N sequestration. Similar samples will be obtained from natural and artificial wetlands in southern California to evaluate how C and N storage of the CSUSM wetland compares to other local wetlands.

WRPI

Sonoma State University

Title: **Pilot testing of a microbial fuel cell-based system for treating winery wastewater**

Authors: Gabriel Sacher[1]*, Frank Monforte[2]*, Elianna Sternfeld[1]*, John Kozlowski[1]*, David J.W. Simpson[3], Igor Goryanin[3], Farid Farahmand[2], and Michael Cohen[1]

Affiliation: [1]Department of Biology, Sonoma State University
[2]Department of Engineering Science, Sonoma State University
[3]Okinawa Institute of Science and Technology Graduate University

Abstract: Wastewater treatment can be a major cost for wineries. The most energy-intensive portion of the treatment process is aerating the wastewater to facilitate microbial oxidation of organic compounds. However, some bacteria, instead of consuming oxygen, are able to oxidize organics by delivering electrons to conductive surfaces. Microbial fuel cells (MFCs) harness this flow of electrons to an external cathode, generating an electric current. We are investigating applications of MFC technology as an energy-saving substitute for wastewater aeration. After a period of laboratory tests with small-scale MFCs, in October 2015 we initiated operation of a pilot-scale MFC-based system to treat winery wastewater at Vintners Square, Santa Rosa. The entire system consists of a 150-L anaerobic digestion/pH stabilization tank, a novel 50-L tubular MFC, and a 200-L vertical-upflow wetland for removing residual nitrogen and phosphate from the MFC effluent. Outflow from the system is used to drip-irrigate on-site landscaping. Use of a unique controller/datalogger permits adjustment of MFC electrical circuit path and remote-monitoring of electricity production. Results gathered from the testing and optimization of this pilot system will inform the development of full-scale MFC-based systems to treat winery wastewater to a level suitable for irrigation while producing electricity.

WRPI

CSU Stanislaus

Title: **Assessment of the structural integrity of flood-control levees in the estuary of the Sacramento and San Joaquin rivers**

Authors: Maira Campos[1]* and Horacio Ferriz[2]

Affiliation: [1]Department of Physics, CSU Stanislaus
[2]Department of Geology, CSU Stanislaus

Abstract: The estuary of the Sacramento and San Joaquin rivers comprises 700 miles of waterways and intervening islands bound by over 1,100 miles of levees critical for the region's agriculture. Since 1900 there have been 160 levee failures for various reasons related to three fundamental problems: heterogeneity of the levee materials, subsidence, and oxidation of peat incorporated into the levees. We are conducting geophysical resistivity and seismic surveys on Sherman Island, to document the condition of a 4,000-foot stretch of the levee that was repaired in 1969 after a catastrophic break, and which is currently deforming landward. Field methods applied included dipole-dipole capacitively-coupled resistivity, and multi-spectral analysis of surface shear waves (Love wave). The resulting tomograms indicate higher resistivity (100 to 200 ohm-m) in the repair area than in the older portions of the levee (30 ohm-m). This reflects the difference between a levee built over the years, layer after layer of local soils rich in clay and peat, and the single-event repair made with boulders and river sand. In the seismic velocity tomography the levee repair and actively deforming portions have a low shear wave velocity of 120 to 160 m/s, indicating poor shear strength.

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