10-4-2019

INRSEP/CNRS Research Symposium Program

INRSEP/CNRS
Humboldt State University

INRSEP CNRS Scientific Research Symposium

OCTOBER 4, 2019

HUMBOLDT STATE UNIVERSITY

Indian Natural Resources
INRSEP Science & Engineering Program
+Diversity in STEM

Poster Session

1. Samantha Dunn, Geology
Petrography of the Holocene Inconstance Lava Flow, Mt. Shasta, California
Mentor: Dr. Brandon Browne

2. Eric Malekos, Applied Mathematics & Computer Science
Application of the Abel Transform in Galaxy Visualization
Mentor: Dr. Ellery Ames

3. Adam Turk, Physics
Novel Tests of Gravity Below Fifty Microns
Mentor: Dr. C D Hoyle

4. Cristina Tusei, Chemistry
Photodegradation of Chlorinated Organic Compounds in Surface Waters
Mentor: Dr. Cristoph Aeppli

5. Wiyaka Previte, Forestry
Culturally Significant Plants to the Karuk Tribe and the Effects of Wildland Fire
Mentor: Dr. Frank Lake

6. Jaycee Owsley, Fisheries Biology
Rapid Assessments on Fish Passage and Tribal Trust Species
Mentors: Vina Frye, Dr. Jennifer Norris

7. Katiana Galdon Ramos, Fisheries Biology
The Use of Ultrasound to Determining the Sex in Juvenile Steelhead Trout Oncorhynchus mykiss and Cutthroat Trout Oncorhynchus clarkia
Mentor: Dr. Rafael Cuevas Uribe

8. Mario Kaluhiokalani, Environmental Sci & Management
Genetic barcoding of native and invasive mullet species in the fishponds of Hawaii
Mentors: Dr. Clifford Kapono & Dr. John Burns

9. Luisa Segovia, Microbiology
Investigating the genetic diversity of immune genes in non-native populations of American Bullfrogs (Lithobates catesbeianus)
Mentor: Dr. Karen Kiemnec-Tyburczy

10. James Gomez, Cellular/ Molecular Biology
Star-Related Lipid Transfer Protein D4/5 Effects on Cultured Human Cell Viability
Mentor: Dr. John Steele

11. Amanda Pope, Cellular/ Molecular Biology
Using Sleeping Beauty Transposon-mediated mutagenesis to drive the evolution of fluid shear stress resistance in a pancreatic cancer cell population
Mentor: Dr. John Steele

12 Nicole Giske, Brandon Light, Cellular/ Molecular Biology
Loss of LGL 1 affects AKT and Girdin in Murine Neural Progenitor Cells
Mentor: Dr. Amy Sprowles

13. M. Gohazrua Butler, Biochemistry
Regional Variance in Cholinergic Innervation to Cochlear Nucleus in the Mammalian Auditory Brainstem
Mentor: Dr. Jenny Cappuccio

14. Erik Ramos, Environmental Science & Management
Gains and Losses of Nitrogen in Southern Appalachian Forests
Mentor: Dr. Nina Wurzburger

15. Megan Mitchell, Microbiology Range Resource Science
Spectroscopic Detection of Resazurin and Resorufin to Indicate Dehydrogenase Activity in Soil
Mentor: Dr. Susan Marshall

16. Maribel Perez Espinal, Biology
Phytophthora, Hide and Seek
Mentor: Dr. David Baston

17. Fernando Zaragoza, Rangeland Resource Science
Observing the Effects of Wildfire on Annual Site Erosion with GIS: An Earth Observation Study
Mentor: Laura J. Rodgers

18. Andrew Chambers, Asinn Kim, Camron Colgan, Jeremy Dustin, Preston Heen, Joshua Neubrand, Trevor McBroom, Walter Saldana, Alana Nichol, Noah Schwerdtfeger, Leo DiPierro, Louise Martin, Jennifer McLean, Cameron Whitney-Giordano, Quinn Hinojosa, Grace Hall, Riley Harte, Lawrence Camacho, James Laming, Lucila Corro, Shayne Magstadt
Surveying Coastal Dune Ecosystems using Multi-Spectral Drone Imagery in the North Spit of Humboldt Bay
Mentor: Dr. Buddihika Madurapperuma

Oral Presentations

2:00-2:15
Octavio Acosta, Botany
The Use of Co-digesting Substrates from Dairy Feed Bi Products; Napier Grass & Pineapple Peel, to Optimize the Production of Methane in Anaerobic Digesters
Mentor: Dr. Chinnapong Wangnai

2:20-2:35
Erik Ramos, Environmental Science and Management
Gains and losses of Nitrogen in Southern Appalachian Forests
Mentor: Dr. Nina Wurzburger

2:40-2:55
Rosebelle Ines, Environmental Science and Management
Effects of Beehive Ginger (Zingiber Spectabile) on Leaf Litter Arthropods Across Forest Types at Las Cruces Biological Station, Costa Rica
Mentor: Dr. Kerry Byrne

3:05-3:20
Amanda Pope, Cellular Molecular Biology
Using Sleeping Beauty Transposon-Mediated Mutagenesis to Drive the Evolution of Fluid Shear Stress Resistance in a Pancreatic Cancer Cell Population
Mentor: Dr. John Steele

3:25-3:40
Fernando Zaragoza, Rangeland Resource Science
Observing the Effects of Wildfire on Annual Site Erosion with GIS: An Earth Observation Study
Mentor: Laura J Rodgers

3:45-4:00
Sirena Torres, Environmental Science and Management
A Third Tricostate Moss from the Lower Cretaceous of Vancouver Island (British Columbia, Canada)
Mentor: Dr. Alexandru Mihai Tomescu

Poster Abstracts

1. Samantha Dunn, Geology

Petrography of the Holocene Inconstance Lava Flow, Mt. Shasta, California

Mentor: Dr. Brandon Browne

Samples were collected close to and along Inconstance Creek, Mt. Shasta from along levees and middle of the lava flow. The Hotlum lava flows (<8.5 ka) are the youngest deposits on Shasta and therefore represents the most likely composition of magma to erupt in the future. Results from this project will describe the mineralogy of the lava, as well as the textures seen in the crystals and future research will focus on the pre-eruptive conditions of the Hotlum Cone. Specifically we will be looking at disequilibria textures such as oscillatory zoning with unconformities and dusty-sieved textures in plagioclase and reverse zoning in pyroxenes. The presence of these textures are evidence to suggest that magma mixing occurred in the host magma reservoir and was a trigger for eruption.

2. Eric Malekos, Applied Mathematics & Computer Science

Application of the Abel Transform in Galaxy Visualization

Mentor: Dr. Ellery Ames

Until recently solutions to the self-gravitating Vlasov-Poison (V-P) model in astrophysics were almost entirely limited to the spherical case. Lately more mathematically complicated models have been constructed which enlarge the space of axisymmetric solutions to include toroidal, spindle-like, and disk-like cases and compositions thereof. Given the observed abundance of non-spherical galaxy-configurations, the addition of these solutions has greatly diminished the distance between model representations and the galaxies we encounter. In this work we build on these new models in order to continue to close the distance between computer models and observed galaxies. Specifically we apply the Abel Transform, which integrates the models'3-dimensional representations into 2-dimensional views that would be comparable to the observations of a telescope-using observer.

3. Adam Turk, Physics

Novel Tests of Gravity Below Fifty Microns

Mentor: Dr. C D Hoyle

Attempts to unify the Standard Model and General Relativity often include features that violate the Weak Equivalence Principle (WEP) and/or the gravitational Inverse-Square Law (ISL). A violation of these would question our fundamental understanding of gravity. To further understand nature, undergraduate researchers and faculty at Humboldt State University are using an experiment to measure gravitational interactions below 50 microns. The experiment uses a torsion pendulum with equal masses of two different materials arranged as a composition dipole. The twist of the torsion pendulum is measured as an attractor mass in a parallel-plate configuration is oscillated nearby. This creates a time dependent torque on the pendulum. The magnitude and size of this torque may lead to deviations in the WEP or ISL at this untested scale.

4. Cristina Tusei, Chemistry

Photodegradation of Chlorinated Organic Compounds in Surface Waters

Mentor: Dr. Cristoph Aeppli

Chlorinated organic compounds are produced in large quantities and used in industrial products as pesticides and solvents. They leach into aquatic environments and pose a health risk to aquatic organisms and humans due to lengthy residence times and slow biodegradation. However, sunlight has the potential to photodegrade these compounds and abstract chlorine atoms through the reaction with hydrated electrons (e_(aq^-)) and hydroxyl radicals (·OH). Dissolved organic matter (DOM) present in natural waters forms eaq^- and ·OH when exposed to sunlight and may facilitate photodegradation. While much research has been conducted on ·OH, not much is known about the importance of e_(aq^-) in the degradation of chlorinated compounds in surface waters. The research presented here explores the effects eaq^- and ·OH have on the photodegradation of a mixture of six chlorinated compounds in deionized and seawater matrices irradiated by simulated sunlight. The results from these experiments suggest that hydrated electrons play a greater role in facilitating photodegradation of highly chlorinated compounds than do hydroxyl radicals. A clear depletion in four out of six chlorinated compounds was observed in irradiated samples in deionized water and with a source of e_(aq^-) . Although it cannot be said the results are statistically significant, a clear pattern is established. Initial experiments performed with natural seawater were not yet able to clearly identify the effects of e_(aq^-) and further experiments must be conducted to understand the role DOM plays in photodegradation. These results may be used for future reference in studying the fate of chlorinated organic compounds. By understanding the characteristics of free radicals produced by DOM, it is possible to predict the degradation rate of harmful chlorinated compounds in natural waters.

5. Wiyaka Previte, Forestry

Culturally Significant Plants to the Karuk Tribe and the Effects of Wildland Fire

Mentor: Dr. Frank Lake

How are traditional plants used by Karuk people responding to, or are effected by wildland fire? This research sampled Karuk culturally significant plants from two burned (5 and 10 years old) wildland fire areas compared to adjacent un-burned forested areas in the USFS Six Rivers National Forest-Orleans Ranger District.
Objective was to evaluate the abundance and condition of cultural use plants in recent burns by comparing similarities and differences among forest site conditions and post-fire effects. The hypothesis for this project; H1: The abundance (density) and percent cover of plants [target species] will be less in burned areas compared to non-burned [control] areas. H2: Plant species' abundance and height are affected by fire intensity and severity at site. The methods consisted of measuring multiple parameters within a 1m by 1m plot frame, as well the 10m surrounding the frame. As a result, recovery was less in higher severity burn areas comparing 5 year vs. 10 years post-fire. The recovery, as plant abundance (stem density) was greater 10 years post-fire, height of plant was not different between 5 and 10 years post-fire in the study areas and there was less flowering of the plants five years post-fire [data not presented]. Additional research is needed to conclude this study.

6. Jaycee Owsley, Fisheries Biology

Rapid Assessments on Fish Passage and Tribal Trust Species

Mentors: Vina Frye, Dr. Jennifer Norris

Conducting rapid assessments on restoration projects allows for a qualitative measurement of individual projects that meet high priority restoration needs. When addressing culvert design, fish passage is one of the critical factors contributing to the success of a restoration project. Conducting pre- and post-assessments on priority culverts along tributaries feeding into the Trinity River allows for the success rates of restoration to be assessed in terms of fish passage. In this project, two pre-assessments (Weaverville, CA) and two post-assessments (Junction City, CA) were conducted using the ICE Protocol (ONEMA) and SNIFFER Protocol to identify the passability of barriers on a qualitative scale (Barry et al. 2018). Water quality, depth, culvert dimensions, and vegetative cover/ invertebrate production measurements were taken at each of the culverts. High-priority pre-assessment culverts were identified as complete barriers to all life stages of fish. Post-assessment high-priority culverts were deemed passable after restoration. Restoration along the Trinity River (through the Trinity River Restoration Program) is significantly funded, and the purpose of this project is to assess the results and implications of restoration on high-priority fish barriers, in this case culverts. Funding is determined by the success of these restoration projects, so it is fundamental to qualify positive results.

Barry, J., Coghlan, B., Cullagh, A., Kerr, J., King, J. 2018. Comparison of coarse-resolution rapid methods for assessing fish passage at riverine barriers: ICE and SNIFFER protocols. River Research and Applications. Vol 34. Issue 9. https://doi.org/10.1002/rra.

7. Katiana Galdon Ramos, Fisheries Biology

The Use of Ultrasound to Determining the Sex in Juvenile Steelhead Trout Oncorhynchus mykiss and Cutthroat Trout Oncorhynchus clarkia

Mentor: Dr. Rafael Cuevas Uribe

The ability to asses sex and determine maturation for salmonids is essential for fisheries management and other aquaculture applications. Ultrasound technology is a noninvasive method that can be used to examine the internal anatomy, gonadal maturation, and the reproductive status of various freshwater and marine species. The goal of our study is to determine the sex in juvenile Steelhead (Oncorhynchus mykiss) and Cutthroat Trout (Oncorhynchus clarkii) at the Humboldt State University Fish Hatchery. Being able to determine the sex of the juveniles can help hatchery managers allocate the appropriate resources into raising the sex of their choice in their hatchery. Forty 10 month juveniles of Steelhead were scanned using an ultrasound (Echo Sphere ver 2.1) with a 7.5 MHz linear probe starting in the month of October. From October to May of 2019, each fish was scanned using the ultrasound. Ultrasound images were used to determine the sex of each fish. Although sex determination was difficult in the earlier months, we started to see immature gonadal development of the fish. This versatile and noninvasive method has shown to be an effective and accurate tool in the field of aquaculture for providing the ability to identify sex, reproductive readiness, gonad volume, fecundity, and egg collection.

8. Mario Kaluhiokalani, Environmental Sci & Management

Genetic barcoding of native and invasive mullet species in the fishponds of Hawaii

Mentor: Dr. Clifford Kapono & Dr. John Burns

‘Ama‘ama (Mugil cephalus) is a renowned food fish for the Hawaiian islands and a culturally significant fish that has been traditionally cultivated in fishponds. An invasive species of mullet, known as kanda (Osteomugil engeli), was introduced to Hawaii in the 1950's. Kanda pose a threat to native 'ama'ama through resource competition. Similar juvenile morphology eliminates the ability to visually differentiate between the two species. DNA replication of the CO1 gene through various PCR processes will reveal the difference in base pairs between the two species. Sanger Sequencing and comparison of genetic code shows a significant difference in the genetic code between the two species. Genetic barcoding of both Mugil cephalus and Osteomugil engeli will enable fishpond stewards to control recruitment, and thus stock more 'ama'ama into the fishponds. An increase of 'ama'ama into fishponds would aid in the survival of a native species as well as provide a sustainable food source for surrounding communities.

9. Luisa Segovia, Microbiology

Investigating the genetic diversity of immune genes in non-native populations of American Bullfrogs (Lithobates catesbeianus)

Mentor: Dr. Karen Kiemnec-Tyburczy

The American Bullfrog (Lithobates catesbeianus) is a highly invasive species that has successfully colonized different habitats around the world. Our project's objective was to isolate and characterize the genetic diversity of a rapidly evolving immune gene in an invasive bullfrog population in California's Sutter National Wildlife Refuge. The level of immune gene genetic variability in a population may help determine how resistant a population is to pathogens and how persistent an invasive population may be over time. Our hypothesis is that our focal population harbors high genetic diversity, consistent with its presence in Northern California for decades. To test our hypothesis, we amplified a Major Histocompatibility Complex (MHC) gene using polymerase chain reaction (PCR) and cloned the alleles from each frog. We then assessed individual heterozygosity, number of alleles in population and genetic diversity of those alleles using standard population genetic metrics. Finally, we compared the genetic diversity within this bullfrog population to that found in other frog populations, including both native and non-native populations. We found that the levels of diversity in our focal population were similar to the levels found in native populations of other species and higher than in native species that have undergone population declines.

10. James Gomez, Cellular/ Molecular Biology

Star-Related Lipid Transfer Protein D4/5 Effects on Cultured Human Cell Viability

Mentor: Dr. John Steele

Disruption in cholesterol homeostasis within cells is a hallmark characteristic of Niemann Pick Disease type C which ultimately leads to neurodegeneration through cholesterol mismanagement within the cell. Our current understanding regarding cholesterol homeostasis shows that pathologies which arise from their malfunction affect autophagic responses and overall cell viability. It is therefore believed that inhibition of sterol transporters involved with cholesterol homeostasis would further mitigate cellular viability under conditions that induce autophagy. To further elucidate the relationship that cholesterol homeostasis has with autophagy and cell viability we seek to disrupt sterol transporters STARD4 and STARD5 which have been shown to play important roles in cholesterol homeostasis. To do this we are attempting to knockdown sterol transport proteins STARD4 and STARD5 utilizing doxycycline activated CRISPR/dcas9KRAB integrated into pLizzard plasmids targeting these genes individually as well as together in HEK293T cells. Each transfected cell line was placed in both nutrient rich conditions (DMEM+10%FBS) and nutrient deprived conditions (HBSS) to induce autophagy. Cell were analyzed using resazurin and calcein AM then normalized to non-targeting control. Results from this experiment will help us to further elucidate the relationships these sterol transporters have with overall cell function and their maintenance of cholesterol homeostasis. This may also reveal more about how cellular metabolism and viability is related to cholesterol redistribution under conditions that induce autophagy

11. Amanda Pope, Cellular/Molecular Biology

Using Sleeping Beauty Transposon-mediated mutagenesis to drive the evolution of fluid shear stress resistance in a pancreatic cancer cell population

Mentor: Dr. John Steele

The majority of cancer-related deaths occur as a result of metastasis of tumor cells from the site of the primary tumor to distant locations. During metastasis, tumor cells penetrate from connective tissue into the circulatory system, where they are subjected to mechanical stress due to high velocity blood flow (fluid shear stress, FSS). For metastatic tumors to form, tumor cells must survive FSS, exit circulation, and successfully colonize new locations. It had been assumed that the majority of tumor cells are eliminated by mechanical damage due to FSS, but some recent studies have revealed that many tumor cell types are able to activate signaling pathways that enable them to rapidly adapt to FSS1. Understanding the mechanisms of tumor cell resistance to FSS might enable new therapeutic strategies to disrupt the metastatic process by blocking the ability of metastatic tumor cells to survive FSS-induced mechanical damage. Because most but not all tumor cell lines examined display resistance to FSS2, we hypothesize that resistance to FSS is due to genetically selectable differences in signaling pathways that are activated in cells with intrinsic FSS resistance compared to FSS-sensitive cells. Here we will begin to test our hypothesis using MiaPaca pancreatic cancer cells, one of the rare tumor cell types we have encountered which lacks FSS resistance. We hypothesize that FSS-resistance can be reactivated in MiaPaca cells by mutagenesis followed by selection for FSS-resistant cells. To mutagenize MiaPaca cells and test our hypothesis, we have used the Sleeping Beauty transposon system. The system has two parts: the Sleeping Beauty transposase (SB) and a mutagenic transposon called pT2-Onc3. SB mediates the insertion of pT2-Onc3 at any TA-dinucleotide site in the genome (Fig.1). The pT2-Onc3 transposon can switch genes on or off, depending on where is inserted in the genome. It contains a strong promoter to drive gene expression, as well as spice donor and acceptor sequences that can disrupt gene expression or promote expression of truncated proteins (2).

12. Nicole Giske, Brandon Light Cellular/ Molecular Biology

Loss of LGL 1 affects AKT and Girdin in Murine Neural Progenitor Cells

Mentor: Dr. Amy Sprowles

Gliomas are tumors of the central nervous system showing very poor prognosis as individuals affected by glioma have a 90% death rate three years after prognosis. Glioma has been shown to be caused by a cancer stem cell. Our laboratory studies the role of Lethal Giant Larvae 1 (LGL1) in suppressing cancer properties in murine neural progenitor cells. Previous unpublished results suggest that loss of LGL 1 is associated with increased migration of neural progenitor cells and that the mTOR signaling pathway may be involved. We hypothesized that the increased migration can be caused by protein girdin, which is associated to AKT, which is associated to mTOR. We evaluated phosphorylation of murine and/or localization of mTOR, AKT and girdin in murine neural progenitor cells obtained from the subventricular zone (SVZ) of the brain. We used Immunocytochemistry to visualize these proteins of interest in LGL1-/- murine neural progenitor cells obtained from the SVZ of neonatal mice and cultured in the presence of the mTOR inhibitor Torin. We also analyzed the actin morphology of the cells in order to better understand how these proteins could potentially interact with the actin cytoskeleton. Our analysis suggests that loss of LGL 1 causes changes in phosphorylation and localization of AKT and Girdin. The ways in which LGL 1 interacts with these proteins is so far undetermined, however future research could evaluate the change in cell migration associated with the mutation further clarifying their effect. Next steps in glioma research would be pivotal as understanding the exact interactions of AKT and Girdin with LGL 1 could aid in the development of targeted glioma therapeutics.

13. M. Gohazrua Butler, Biochemistry

Regional Variance in Cholinergic Innervation to Cochlear Nucleus in the Mammalian Auditory Brainstem

Mentor: Dr. Jenny Cappuccio

Auditory disorders such as tinnitus and hearing loss are related to disruption of normal auditory processing. In the mammalian nervous system, auditory information is processed first in a region of the brainstem known as Cochlear Nucleus (CN), then relayed in an ascending manner towards higher brain regions. These regions send descending projections back towards CN, forming a circuit. Acetylcholine is a principal neurotransmitter involved in these descending pathways, and acts to modulate the function of neurons in CN - however the nature of cholinergic modulation, target sites of innervation, and effects on auditory processing in CN are poorly understood. The present study examined innervation patterns of cholinergic axons into CN using a vesicular acetylcholine transporter (VAChT) antibody label in transgenic choline-acetyl transferase (ChAT) dependent Cre/LoxP complex mouse line. High-resolution confocal microscopy and 3D image reconstruction software clarified differential innervation patterns and cholinergic synapse density in three subsections of CN. Whereas the ventral CN and granule cell layer showed high density labeling, the dorsal CN showed scattered and diffuse labeling. "En passant" fibers present in the CN also suggests cholinergic innervation to the inner ear as an additional mechanism of auditory regulation. The data suggest cholinergic pathways regulate primary auditory processing in the CN by specifically innervating certain cell types in two regions, but innervating multiple cell types in the third. Further analysis of which cell types receive innervation, electrophysiological effects of acetylcholine on these cells, and the relationship between cholinergic modulation of CN and upstream processing could be used to better understand the underlying causes of tinnitus and hearing loss.

14. Erik Ramos, Environmental Science & Management

Gains and Losses of Nitrogen in Southern Appalachian Forests

Mentor: Dr. Nina Wurzburger

During the summer I was an intern at the University of Georgia conducting research in the Appalachian Mountains as part of a 75 year study alongside side the USFS. This study focused on long-term patterns in forest recovery from disturbance. Specifically, we were interested in the fate of nitrogen fixed by Robinina pseudoacacia (black locust) after the disturbances of the early 20th century (logging and the demise of chestnut). My primary goal was to quantify the fate of historically-fixed nitrogen and how it has changed nitrogen cycling over decades of forest recovery. I worked on three different parts of the study. First, was a root nodule analysis of how nitrogenase activity compared to root nodule mass. Then, I looked at how slope position affected the rate of nitrogen fixation in the watershed. Finally, I compared how slope position affected denitrcification rates, and this is where our findings become interesting. There was also a fair amount of GIS work that I was involved with in order to find plots that met certain requirements.

15. Megan Mitchell, Microbiology Range Resource Science

Spectroscopic Detection of Resazurin and Resorufin to Indicate Dehydrogenase Activity in Soil

Mentor: Dr. Susan Marshall

Promoting the health of the soil microbiome via organic carbon (OC) amendments and anaerobic soil disinfestation (ASD) are promising approaches to enhance soil fertility, however, techniques to assess soil health and microbial activity continue to be improved. Enzymes regulate microbial metabolism and nutrient cycling in soil, thus enzymatic activity can be measured to indicate soil health. Resazurin/resorufin redox dyes can be used to indicate soil dehydrogenase activity (DHA) by spectroscopically measuring microbial reduction of resazurin to its fluorescent product, resorufin. Fluorescent detection of resorufin is more sensitive than absorbance measurements of resazurin; However, incorporation of a resazurin calibration curve and measuring absorbance is more economic than fluorescence methods and may yield comparable qualitative results.The objective of this study was to evaluate spectrophotometric determination of soil DHA by detecting both resazurin and resorufin in soils (hydric and agricultural) and sand amended with OC or ASD treatments. Resazurin and resorufin was also detected in non-amended samples and sterilized samples to serve as a control and blank, respectively. Resazurin was measured initially and after 9 hours, then substrate depletion was determined by constructing a resazurin calibration curve with R2 values between 0.9617-0.9985. The relative changes in resorufin fluorescence emission with time was measured over 9 hours. Both spectroscopic measurements showed similar trends and suggest OC amendments and ASD treatments resulted in significantly higher soil DHA

16. Maribel Perez Espinal, Biology

Phytophthora, Hide and Seek

Mentor: Dr. David Baston

Phytophthora, a member of the oomycete group, is a soil borne pathogen detrimental to trees and agricultural crops alike (Willsey, Chatterton, & Cárcamo, 2017). We are focused on the Phytophthoraspp. which target oak trees in California, specifically northern California coastal environments. Historical literature indicates that the first known transmission of Phytophthoraspp., strains of Phytophthora infestans, into the US and Europe, culminating in the famous Irish potato famine of 1845, was from the South American Andes (Gómez-Alpizar, Carbone, & Ristaino, 2007). Circa the mid-1990s many versions of the pathogen were inadvertently introduced in California by natural dispersal (Claire Sansford, Inman, Baker, Susan Frankel, De Gruyter, et al. 2009). As an invasive species Phytophthoraramorum, tentaculata, lateralis, cambivora, and cinnamomicause significant damage and threaten the survival of oak trees. Sudden Oak Death (SOD) has become a problem found in coastal areas and one of increasing concern toward action on habitat management (Claire Sansford, Inman, Baker, Susan Frankel, De Gruyter, et al. 2009). In an effort to monitor the spread of SOD a study was designed to develop an assay to identify 5 particular Phytophthoraspecies: tentaculata,ramorum, lateralis, cambivora, andcinnamomi. Our aim is to identify these Phytophthora using Polymerase Chain Reaction (PCR) to categorize and build on distinguishing these closely related species through Single Nucleotide Polymorphism (SNP) genotyping. To start developing a complete assay several soil and/or tree samples were obtained in Humboldt County where our target species might be found. From these soil and tree samples we were able to bait, isolate, and extract DNA for PCR and sequencing identification. The result of primer sets targeting our template DNA indicated, through gel electrophoresis, bands potentially representative of our species of interest. Our PCR tests revealed bands that were used to compare amplicon lengths of the five species to confirm the presence of that Phytophthora. We have developed primers and tested them among unknown isolates. We looked at 48 primer sets and of those primers 75% were effective. In addition, we have tested our known isolates with our developed primers to determine optimum annealing temperatures for Phytophthora species identification. We plan to continue by developing probes, and using nanofluidics for the final assay which should reduce identification time from weeks to days.

17. Fernando Zaragoza, Rangeland Resource Science

Observing the Effects of Wildfire on Annual Site Erosion with GIS: An Earth Observation Study

Mentor: Laura J. Rodgers

Wildfires are a socio-ecological challenge faced on a yearly basis. According to the National Interagency Fire Center (NIFC), it is estimated there are over 100,000 annually reported wildfires throughout the country. Many cases of these fires cost hundreds of billions of dollars due to damages, as well as billions to contain. The National Institute of Standards and Technology projects these costs to be up to $63 billion a year in fire suppression. In addition, wildfires can cause up to $350 billion worth of annual property damage to homes, businesses and infrastructure. The immediate impact of these fires are often widely studied and well documented. Understanding the immediate effects of wildfire on affected sites allow us to make predictions on the long term impacts of these burns and can give us greater insight on potential changes to groundcover, soil and hydrology. Agencies throughout the country, such as the Bureau of Land Management (BLM), the United States Forest Service, as well as the dedicated Burned Areas Emergency Response team (BAER) employ thousands of workers and volunteers to visualize the immediate and near-term effects of wildfire via land surveying & field studies. The long-term impacts, however, are less well known and difficult to visualize at scale. The Revised Universal Soil Loss Equation (RUSLE) allows the user to observe predicted annual erosion based on known set parameters of any observed site. RUSLE is a commonly used method of estimating annual site erosion by land managers and conservationists at small scales. Utilizing the Revised Universal Soil Loss Equation (RUSLE) and ArcGIS, I demonstrate how earth observations can be utilized to map site erosivity at scale. I created erosion models depicting estimated annual erosion rates of the 2007 Zaca Fire burn scar in Santa Barbara, California. I hypothesized that the removal of woody vegetation results in an increase in annual erosion rates post-fire. I created an erosion model of pre-fire conditions, along with immediate post-burn, and a seven year time series out to 2014. The results of my models depict low to medium site erosivity in my pre-burn model with higher erosivity in high elevation, high slope steepness areas. The immediate post-burn model expressed the highest potential for erosion. The models created of the years following the fire depicted medium to high erosion potential till around 2014 when woody species begin recover. Pre 2014 conditions reported high potential for erosion even well after the fire likely due to the establishment of invasive annual grasses throughout the burn scar. Ultimately what can be learned is that not only can the removal of vegetation be an important factor in site erosivity, but a change dominant cover type post-fire can have significant potential to impact reported annual erosion rates in comparison to pre-fire conditions. I believe that the methods employed in my project have the potential to be utilized by land managers, conservationists, and wildland firefighters as a demonstration of how earth observation can be utilized for improving post fire recovery best practices in regards to erosion observation and mitigation.

18. Andrew Chambers, Asinn Kim, Camron Colgan, Jeremy Dustin, Preston Heen, Joshua Neubrand, Trevor McBroom, Walter Saldana, Alana Nichol, Noah Schwerdtfeger, Leo DiPierro, Louise Martin, Jennifer McLean, Cameron Whitney-Giordano, Quinn Hinojosa, Grace Hall, Riley Harte, Lawrence Camacho, James Laming, Lucila Corro, Shayne Magstadt

Surveying Coastal Dune Ecosystems using Multi-Spectral Drone Imagery in the North Spit of Humboldt Bay

Mentor: Dr. Buddihika Madurapperuma

High-resolution multi-spectral imagery is vital in assessing vegetation dynamics, geomorphology and topographic variation of coastal dune ecosystems for designing better conservation strategies. This paper presents an integrated methodology for mapping native/invasive species, elevation change, and social/established trails of the North Spit of Humboldt Bay using a multispectral camera mounted onto DJI Matrice 100 drone. A team of four/five students from the intermediate remote sensing class carried out a detailed survey on the dune ecosystem using a high-resolution imagery. We flew over a 20 acre plot of the dunes and acquired 2855 images. The images were mosaiced using Structure from Motion (SfM) in Agisoft PhotoScan and obtained an orthomosaic image with a spatial resolution of 5.4 cm. SfM algorithms delivered high point cloud density (95.2 points/m^2). Ten ground control points were set up within the region of interest using real-time kinematic (RTK) GPS with an accuracy of 7 cm. Group 1 showcased the selected native species distribution that expands the accuracy of previous projects. Through the use of NDVI and PCA, a texture analysis unsupervised classification generated 6 total class types on vegetation and groundcover. Ground truthing of these 6 mapped classes is to be conducted later this semester. With the combined data, standard deviation can be assessed for dominant species present in each mapped class. Group 2 mapped the invasive species hotspots using maximum likelihood classification and heat maps. Training data for European beachgrass (*Ammophila arenaria*) and Yellow Bush Lupine (*Lupinus arboreus*) were used to classify the image. Group 3 quantified the change in elevation and subsequent dune migration along a main trail from the top of the dunes towards the beach. The mean elevation derived along the main trail was 9.4 m ± 3.6 for DEM and 8.6 m ± 3.0 for the Google Earth. Group 4 digitized social and established trails in the dunes and compared development and movement of trails from 2018 to 2019 data. Within the study area, 2019 social trails expanded by 101 m in length over the existing 1176 m found in 2018. Main trails remained at 1050 m in length. In conclusion, these findings can aid as baseline information to implement best coastal management plans to mitigate climatic and anthropogenic vulnerabilities.

Oral Presentation Abstracts

2:00-2:15
Octavio Acosta, Botany

The Use of Co-digesting Substrates from Dairy Feed Bi Products; Napier Grass & Pineapple Peel, to Optimize the Production of Methane in Anaerobic Digesters

Mentor: Dr. Chinnapong Wangnai

The effect that the co digest substrates; Pineapple peel juice and Napier Grass juice, have on the anaerobic digestion of cow manure was investigated using standard Biomethane potential (BMP) methods in which benchtop digesters were used to evaluate the rate and production of methane and biogas. Parameters of carbon oxygen demands, total solids, volatile solids, alkalinity, pH, and volatile fatty acid concentration where used to analyze conditions prior and after digestion. Biogas volume and methane concentrations where measured daily during experimentation. The analysis on the parameters indicated an undesirable community composition of microbes in the inoculum (fresh cow manure) used due to the inhibition of methanogens through eutrophication

2:20-2:35
Erik Ramos, Environmental Science and Management

Gains and losses of Nitrogen in Southern Appalachian Forests

Mentor: Dr. Nina Wurzburger

During the summer I was an intern at the University of Georgia conducting research in the Appalachian Mountains as part of a 75 year study alongside side the USFS. This study focused on long-term patterns in forest recovery from disturbance. Specifically, we were interested in the fate of nitrogen fixed by Robinina pseudoacacia (black locust) after the disturbances of the early 20th century (logging and the demise of chestnut). My primary goal was to quantify the fate of historically-fixed nitrogen and how it has changed nitrogen cycling over decades of forest recovery. I worked on three different parts of the study. First, was a root nodule analysis of how nitrogenase activity compared to root nodule mass. Then, I looked at how slope position affected the rate of nitrogen fixation in the watershed. Finally, I compared how slope position affected denitrcification rates, and this is where our findings become interesting. There was also a fair amount of GIS work that I was involved with in order to find plots that met certain requirements.

2:40-2:55
Rosebelle Ines, Environmental Science and Management, Ecological Restoration

Effects of Beehive Ginger (Zingiber Spectabile) on Lear Litter Arthropods Across Forest Types at Las Cruces Biological Station, Costa Rica

Mentor: Dr. Kerry Byrne

Though tropical landscapes are the biodiversity hotspots of the world, some studies estimate that up to 36% of tropical forests are going to disappear by the year 2050. This disappearance can be accelerated by introduced exotic species because of their ability to modify invaded sites and alter nutrient cycling, which in turn threatens biodiversity and the overall ecosystem stability. In this study, we assessed whether the invasion of Zingiber spectabile alters the mean abundance of leaf litter arthropods across forest types at Las Cruces Biological Station in Costa Rica, since arthropods are ecological indicators used to detect anthropogenic impacts. We also determined if the degree of herbivory on Z. spectabile predicted the mean abundance of leaf litter arthropods across forest types. We hypothesized that the invasion of Z. spectabile would decrease the mean abundance of leaf litter arthropods in all forest types because leaf litter arthropods have not adapted to the environment created by the plant. We further predicted that the degree of herbivory on Z. spectabile would predict the mean abundance of leaf litter arthropods found across forest types since we expected a large proportion of herbivory to be produced by non-flying leaf litter arthropods such as ants. We sampled leaf litter arthropods by setting up 18 paired point comparison pitfall traps in invaded and non-invaded sites across three forest types. Our results showed that the invasion of Z. spectabile had no significant effect on the mean abundance of leaf litter arthropods across all forest types. Rather, the mean abundance of these arthropods was significantly reduced due to habitat type, in this case, in the secondary forest. Contrary to our hypothesis on herbivory, the degree of herbivory predicted the mean abundance of beetles and crickets across forest types. We recommend conducting further studies regarding the effect of Z. spectabile on arthropods in comparison to native species in LCBS and incorporating environmental variables. Additional data will help make better decisions for the restoration and conservation of tropical landscapes.

3:05-3:20
Amanda Pope, Cellular Molecular Biology

Using Sleeping Beauty Transposon-Mediated Mutagenesis to Drive the Evolution of Fluid Shear Stress Resistance in a Pancreatic Cancer Cell Population

Mentor: Dr. John Steele

The majority of cancer-related deaths occur as a result of metastasis of tumor cells from the site of the primary tumor to distant locations. During metastasis, tumor cells penetrate from connective tissue into the circulatory system, where they are subjected to mechanical stress due to high velocity blood flow (fluid shear stress, FSS). For metastatic tumors to form, tumor cells must survive FSS, exit circulation, and successfully colonize new locations. It had been assumed that the majority of tumor cells are eliminated by mechanical damage due to FSS, but some recent studies have revealed that many tumor cell types are able to activate signaling pathways that enable them to rapidly adapt to FSS1. Understanding the mechanisms of tumor cell resistance to FSS might enable new therapeutic strategies to disrupt the metastatic process by blocking the ability of metastatic tumor cells to survive FSS-induced mechanical damage. Because most but not all tumor cell lines examined display resistance to FSS2, we hypothesize that resistance to FSS is due to genetically selectable differences in signaling pathways that are activated in cells with intrinsic FSS resistance compared to FSS-sensitive cells. Here we will begin to test our hypothesis using MiaPaca pancreatic cancer cells, one of the rare tumor cell types we have encountered which lacks FSS resistance. We hypothesize that FSS-resistance can be reactivated in MiaPaca cells by mutagenesis followed by selection for FSS-resistant cells. To mutagenize MiaPaca cells and test our hypothesis, we have used the Sleeping Beauty transposon system. The system has two parts: the Sleeping Beauty transposase (SB) and a mutagenic transposon called pT2-Onc3. SB mediates the insertion of pT2-Onc3 at any TA-dinucleotide site in the genome (Fig.1). The pT2-Onc3 transposon can switch genes on or off, depending on where is inserted in the genome. It contains a strong promoter to drive gene expression, as well as spice donor and acceptor sequences that can disrupt gene expression or promote expression of truncated proteins (2).

3:25-3:40

Fernando Zaragoza, Rangeland Resource Science

Observing the Effects of Wildfire on Annual Site Erosion with GIS: An Earth Observation Study

Mentor: Laura J. Rodgers

Wildfires are a socio-ecological challenge faced on a yearly basis. According to the National Interagency Fire Center (NIFC), it is estimated there are over 100,000 annually reported wildfires throughout the country. Many cases of these fires cost hundreds of billions of dollars due to damages, as well as billions to contain. The National Institute of Standards and Technology projects these costs to be up to $63 billion a year in fire suppression. In addition, wildfires can cause up to $350 billion worth of annual property damage to homes, businesses and infrastructure. The immediate impact of these fires are often widely studied and well documented. Understanding the immediate effects of wildfire on affected sites allow us to make predictions on the long term impacts of these burns and can give us greater insight on potential changes to groundcover, soil and hydrology. Agencies throughout the country, such as the Bureau of Land Management (BLM), the United States Forest Service, as well as the dedicated Burned Areas Emergency Response team (BAER) employ thousands of workers and volunteers to visualize the immediate and near-term effects of wildfire via land surveying & field studies. The long-term impacts, however, are less well known and difficult to visualize at scale. The Revised Universal Soil Loss Equation (RUSLE) allows the user to observe predicted annual erosion based on known set parameters of any observed site. RUSLE is a commonly used method of estimating annual site erosion by land managers and conservationists at small scales. Utilizing the Revised Universal Soil Loss Equation (RUSLE) and ArcGIS, I demonstrate how earth observations can be utilized to map site erosivity at scale. I created erosion models depicting estimated annual erosion rates of the 2007 Zaca Fire burn scar in Santa Barbara, California. I hypothesized that the removal of woody vegetation results in an increase in annual erosion rates post-fire. I created an erosion model of pre-fire conditions, along with immediate post-burn, and a seven year time series out to 2014. The results of my models depict low to medium site erosivity in my pre-burn model with higher erosivity in high elevation, high slope steepness areas. The immediate post-burn model expressed the highest potential for erosion. The models created of the years following the fire depicted medium to high erosion potential till around 2014 when woody species begin recover. Pre 2014 conditions reported high potential for erosion even well after the fire likely due to the establishment of invasive annual grasses throughout the burn scar. Ultimately what can be learned is that not only can the removal of vegetation be an important factor in site erosivity, but a change dominant cover type post-fire can have significant potential to impact reported annual erosion rates in comparison to pre-fire conditions. I believe that the methods employed in my project have the potential to be utilized by land managers, conservationists, and wildland firefighters as a demonstration of how earth observation can be utilized for improving post fire recovery best practices in regards to erosion observation and mitigation.

3:45-4:00

Sirena Torres, Environmental Science and Management

A Third Tricostate Moss from the Lower Cretaceous of Vancouver Island (British Columbia, Canada)

Mentor: Dr. Alexandru Mihai Tomescu

The Early Cretaceous fossil assemblages at Apple Bay on Vancouver Island host abundant fossil bryophytes preserved by permineralization in near-shore marine concretions. Notable within this assemblage are mosses characterized by tricostate leaves. A third tricostate moss is characterized by relatively large gametophytes with stems 600 µm in diameter possessing 15 µm, thick-walled epidermal cells. Branch primordia occur at close intervals (every 1.5-2 mm) in three positions around the stem. Leaves are arranged in a 1/3 helical phyllotaxis. They are lanceolate, at least 3.5 mm long and c. 1.8-2.4 mm wide. Leaves bear three strong costae which diverge separately and fuse at leaf apex. Between the two differentiated epidermal layers, costae have long, narrow (up to 10 µm) cells. The lamina is unistratose with bistratose portions. The abaxial epidermis of the costae and the lamina cells are isodiametric, polygonal-rectangular (18 µm). Three-dimensional branching, indicating upright growth habit, and isodiametric laminal cells are consistent with acrocarpy. The two other tricostate mosses described from Apple Bay (Tricosta and Krassiloviella) are pleurocarps. Aside from Apple Bay, tricostate mosses are known only as compressions assigned to genus Tricostium in Mesozoic rocks of Russia and Mongolia. Species of Tricostium differ in costae anatomy and mode of preservation from the Apple Bay moss. Characterization of this new moss continues ongoing efforts to document patterns of diversity in the rich Apple Bay bryoflora. The unique combination of characters of this moss reiterates the importance of the fossil record relevant to bryophyte evolution. In conclusion, this is the fifth sixth moss type described from the Early Cretaceous Apple Bay flora of Vancouver Island, which also includes leucobryaceous and polytrichaceous mosses, and two tricostate mosses. The Grimmiaceae may be present in Eocene Baltic amber and are present for sure at Apple Bay, as indicated by Tricarinella, which was described recently from this locality and represents the oldest fossil occurrence of the family. So, this new moss adds a second grimmiaceous type to the Apple Bay flora. This new moss is also tricostate, but its unique combination of characters places it outside of the Tricostacea. Instead, the defining characters of this moss indicate that it represents a new genus and support strong affinities with the family Grimmiaceae. If so, then this new moss is,, the second member of the Grimmiaceae known from the Apple Bay flora, and, along with Tricarinella, marks the oldest occurrence of this family in the fossil record (Valanginian, 136 million years). Inclusion of this new moss among the Grimmiaceae expands the morphospace occupied by members of this family beyond the region defined by its living genera.