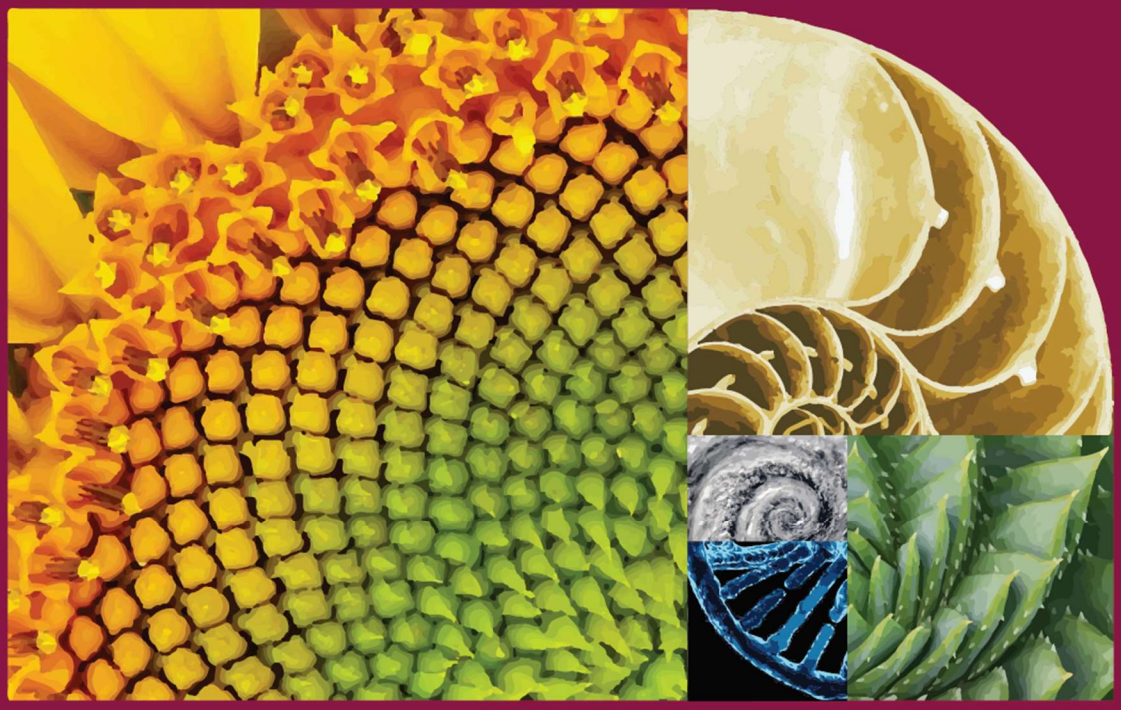
Department of Biology
New Mexico State University
Biosymposium



BE BOLD. Shape the Future.
College of Arts and Sciences

Saturday, March 6, 2021

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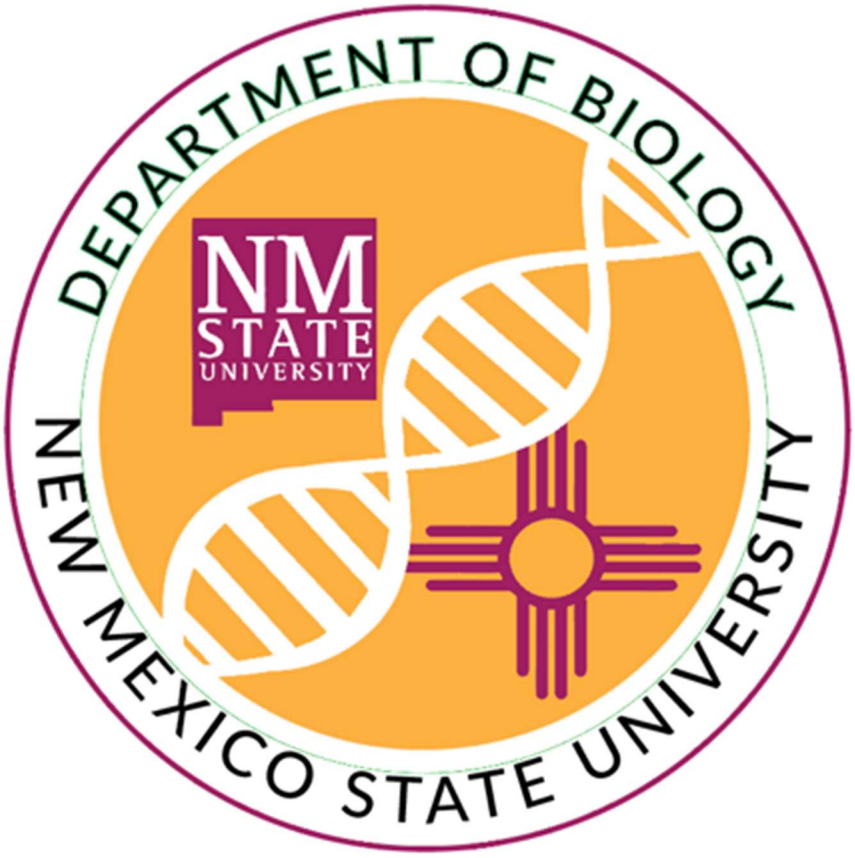

ORAL PRESENTATIONS

Presenter name*	Talk†	Title
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Arthur, Corinne	T9	Impacts of Extreme Weather on Migratory Songbird Mortality
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Pandey, Ashmita	T4	Metformin Reduces Survival Rate, Fecundity and Immunity During Bacterial Challenge through AMPK Activation in Mosquitoes
Tamrakar, Rubin M.	T3	An Assessment of Genetic Variation Associated with Differential Response to Fire Among Populations of Cheatgrass (Poaceae, *Bromus tectorum*)
White, Leah	T7	Influence of Wildfire and Forest Management on Large Mammal Distribution, Habitat Use, and Co-Occurrence in the Jemez Mountains of New Mexico

***Listed alphabetically by presenter surname; †Talk order assigned at random**

POSTER PRESENTATIONS

Presenter name*	Poster†	Title
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Helms, Kyle	P2	Elucidating the Function of the Gene CG46385 During Drosophila Melanogaster Eye Development
Hoellrich, Mikaela	P3	Biocrust Carbon Flux under Timed Light Incubation
Ibanez IV, Daniel	P4	Bat Species Composition of Bridges Spanning the Rio Grande and Urban Density
Ike-Newton, Ida-Victoria	P5	Development of a Live Cell Probe to Examine Polarity Reversal During the Epithelial-Mesenchymal Transitions in Sea Urchin Embryos
Kristupaitis, Milda	P6	Competitively Inferior Ponderosa Pines Succumbed to Bark Beetle Attack at Low Latitudes due to Compromised Growth and Defense
Nuñez, Clarissa	P7	Applying High-Throughput Analysis to Understand Cell Proliferation under Different Adhesion Conditions
Perez, Valeria	P8	Effects of Sexual Dimorphism on the Capture Rate of Introduced Rosy-Faced Lovebirds, *Agapornis roseicollis*
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Sedillos, Allison	P10	Testing the Importance of Soil Fertility for Nurse-Plant Effects in Desert Ecosystems
Tryc, Matthew	P11	Cruel to Be Kind: The Ethics of Destructive Collecting of Pollinators
Villalba, Alondra	P12	Effects of Chronic Stress on Vocal Learning

***Listed alphabetically by presenter surname; †Poster numbers assigned alphabetically by surname**

LINKS FOR JOINING BIOSYMPOSIUM

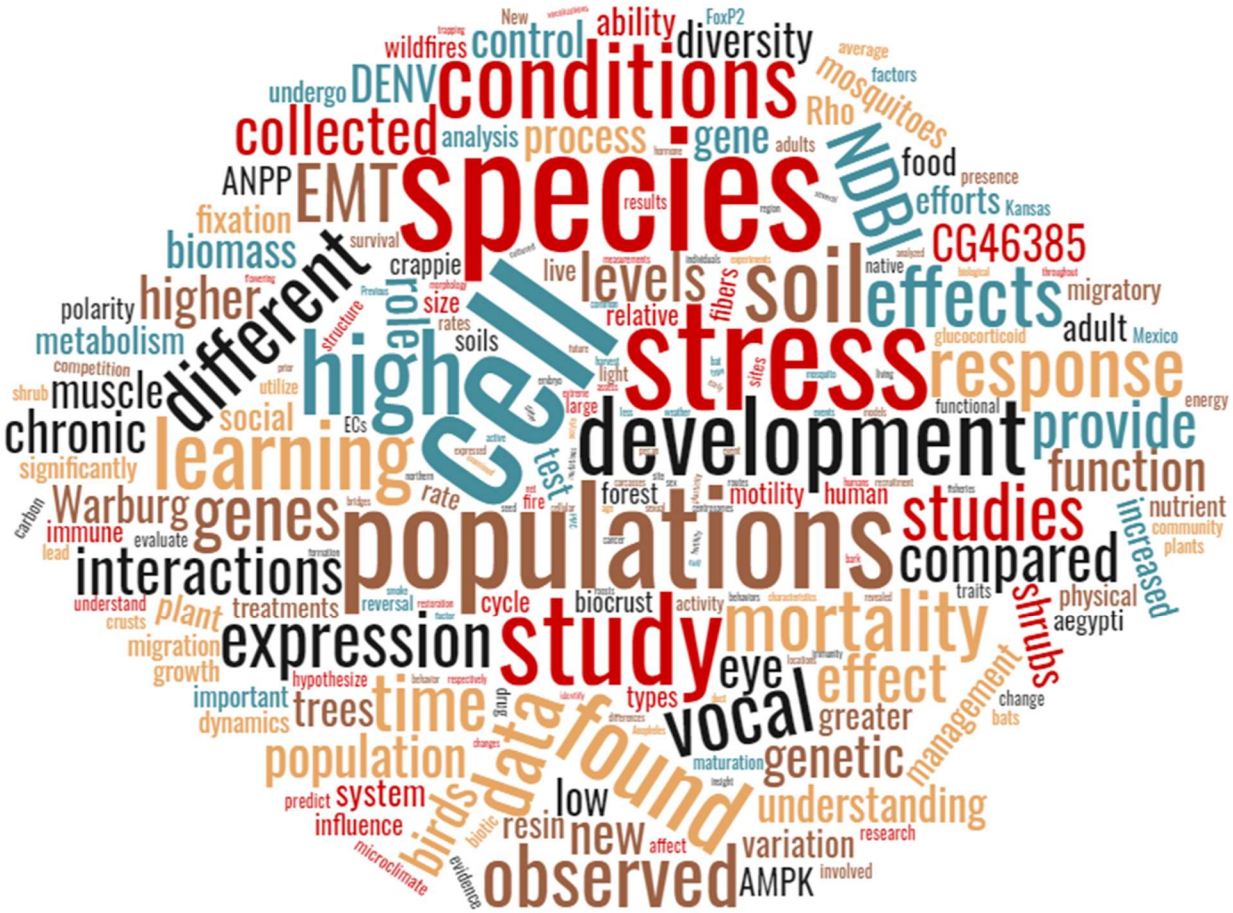
All times are MST

Oral Presentations (same link for all talks)

Begins: 6 Mar 2021, available at 07:45 AM for presenters
Meeting ID: 972 4346 1687
https://nmsu.zoom.us/j/97243461687
Passcode: biosym21

Poster Presentations (same link for all posters with unique breakout rooms)

Begins: 6 Mar 2021, available staring at 10:30 AM for presenters
Meeting ID: 941 7268 3749
https://nmsu.zoom.us/j/94172683749
Passcode: biosym21



EVENT SCHEDULE

All times are MST

8:00 AM Welcome and Overview

8:05 AM Oral Presentations Session 1—T1 to T5

8:05 T1. Lee, Steven (10-minute talk)
8:15 T2. Moehn, Brett (10-minute talk)
8:25 T3. Tamrakar, Rubin (10-minute talk)
8:35 T4. Pandey, Ashmita (10-minute talk)
8:45 T5. Bowden, Samantha (7-minute talk)

8:55 AM Short Break (return by 9:00 AM)

9:00 AM Oral Presentations Session 2—T6 to T11

9:00 T6. Debadrita, Pal (10-minute talk)
9:10 T7. White, Leah (10-minute talk)
9:20 T8. Moon, Alex (10-minute talk)
9:30 T9. Arthur, Corine (10-minute talk)
9:40 T10. Hernandez-Acosta, Eduardo (10-minute talk)
9:50 T11. Meadors, Savannah (7-minute talk)

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10:10 AM Oral Presentations Session 3—T12 to T15

10:10 T12. Abraha, Zebib (10-minute talk)
10:20 T13. Ennis, Joanna (10-minute talk)
10:30 T14. Miazga, James (10-minute talk)

11:00 AM Poster Session—P1 to P13 in unique breakout rooms

12:30 PM Conclusion and Acknowledgements

T12. Spatiotemporal Markers of Polarity Reversal in Epithelial-Mesenchymal Transition during Sea Urchin Gastrulation

Zebib Sielu Abraha[1], Silvia Sepulveda[1], Leslie Toledo-Jacobo[1], Charles B. Shuster[1]

[1]Department of Biology, New Mexico State University

Abstract: Cell motility is a central feature of animal development and a critical factor contributing to many pathologies. In the sea urchin embryo, Primary Mesenchyme Cells (PMCs) undergo an Epithelial Mesenchymal Transition (EMT), cross a basement membrane and enter the blastocoel, where they undergo a final division prior to terminal differentiation. And while the gene regulatory network for PMC specification and EMT has been characterized in detail, the actual conditions and subcellular alterations that result in polarity reversal and the initiation of motility remain poorly understood. In an effort to determine the morphological transitions that occur during polarity reversal and EMT, we examined the apical polarity marker, Par-6. Par-6 is recruited to the membrane following fertilization and is polarized as early as the 2 cell embryo. Preliminary data shows prior to PMC ingression, Par-6 is internalized into intracellular compartments that bear a strong resemblance to liquid-liquid phase separation aggregates (LLPs). And while depletion of transcription factors known to drive EMT (Snail, Tbr & Foxn2/3) significantly depressed PMC ingression, there was only a mild effect on Par6 internalization. Together, these results suggest the existence of novel cellular conditions that must be met before cells can undergo EMT, and current efforts are focused on understanding interrelationship between the cell cycle, polarity reversal, and the gene regulatory networks that ultimately drive PMC ingression.

Presenter: Zebib S. Abraha
Status: Graduate Student
Presentation type: 10-minute talk

T9. Impacts of Extreme Weather on Migratory Songbird Mortality

Corinne Arthur[1] Trish Culter[2], Mara Weisenberger[3], Tim Wright[1], Martha Desmond[4]

[1]Department oof Biology, New Mexico [2] US Army Garison, White Sands Missile Range, Monument Manager, [3]Bureau of Land Management, Las Cruces, NM, [4]Department of Fish, Wildlife and Conservation Ecology, New Mexico State University

Abstract: An extreme weather event in the Fall of 2020 coincided with mass mortality of thousands of songbirds that were migrating through New Mexico. Mass mortality events are difficult to study and are often attributed to multiple factors including extreme weather. Extreme wildfires and weather events are becoming more common and severe as climate change continues to alter the environment. I plan to investigate the role of weather-related starvation and wildfires in this mass mortality event. To provide a baseline for this study, I have compared records of species from birds salvaged in several locations including locations across White Sands Missile Range and Doña Ana County. Wilson's warbler (*Cardellina pusilla*), western-wood pewee (*Contopus sordidulus*), and chipping sparrow (*Spizella passerina*) were some of the most commonly observed mortalities. I hypothesize that the additive effect of the extreme cold weather to birds already in poor condition from the draught and wildfire resulted in mass mortality. I predict that carcasses collected from this event will show stronger indications of poor conditions and starvation compared to other migratory years. During this time, wildfires were burning throughout the western United States, potentially impacting migrant physiology. I hypothesize that smoke from active wildfires during September 2020, indirectly contributed to the Fall 2020 mortality. I predict that the carcasses from Wilson's warbler and chipping sparrows from 2020 will have greater evidence of smoke exposure than carcasses from years with fewer wildfires. I hypothesize that higher respiratory infection rates will differ between specimens collected in 2020 compared to birds sampled in the Fall of 2021. I predict that birds exposed to smoke will have higher rates if infection than birds not exposed to smoke. Future research will include collecting data from carcasses and live birds near active fires. I will test feathers and the upper respiratory system for carbon debris and secondary bacterial infections.

Presenter: Corinne Arthur
Status: Graduate Student
Presentation type: 10-minute talk

T5. Robust regeneration in adult electric pulse fish and the formation of its electric organ form fast muscle fibers

Samantha Bowden[1], Oscar Velasquez[1], Graciela Unguez[1]

[1]Department of Biology, New Mexico State University

Abstract: In most weakly electric fish species, cells called electrocytes (EC) make up the electric organ (EO), and derive from a subpopulation of muscle fibers that undergo phenotypic conversion to replace their contractile function for an electrogenic one. Our previous findings using the knifefish *Sternopygus macrurus* revealed that ECs form via fusion of fast muscle fibers during adult tail regeneration. Whether this EC formation is conserved in other highly regenerative electric fish species is the focus of this study. Specifically, we used immunolabeling to characterize the morphology and muscle-protein expression of mature electrocytes, and the muscle fiber type composition in the distal-most tail prior to amputation in the species *Brachyhypopomus pinnicaudatus*. Regeneration of skeletal muscle and EO was studied at different time points post tail cut – 1, 2, 3, 4, and 6 weeks. Our immunolabeling studies detected that some, but not all, ECs contained desmin, alpha-actinin, tropomyosin, titin, and sarcomeric myosin heavy chain (MHC) IIb. In *B. pinnicaudatus*, cell differentiation progressed from proximal to distal and peripheral to central, with muscle fibers being detected prior to ECs at each stage of regeneration. Myogenesis and regenerating ECs were evident by Day 7, with presence of fibers positively labeled with mouse antibody (MF20) against all MHC isoforms (n= 2) and clustering of myofibers stained by cresyl violet respectively. These early ECs exhibited immunolabeling with MF20, cell shape transformation, and medial location relative to the muscle fibers. These data strongly suggest that type-II fast muscle fibers contribute to the formation of new electrogenic electrocytes.

Presenter: Samantha Bowden
Status: Undergraduate Student
Presentation type: 7-minute talk

P1. Effects of Chronic Stress on Physiological Measures, Circulating Corticosterone, and Neural FoxP2

C. Draney[1], J.M. Jawor[1], J. Apodaca[1], A. Schmidt[2], T. Wright[1]

[1]Department of Biology New Mexico State University; [2]Department of Natural Resources Management, Texas Tech University

Abstract: Stress plays an important role in the lives of all animals, and a successful stress response in the face of acute stress can be critical to survival. Chronic stress, however, can lead to major fitness consequences. Glucocorticoids play an important role in healthy stress physiology at baseline, or unstressed, levels but can be detrimental when sustained at elevated levels. This study focuses on the ability of elevated glucocorticoid levels to affect downstream gene expression, specifically our target protein: FoxP2. FoxP2 is involved in vocal learning in humans and avian taxa, and is expressed differentially in vocal learning species, with overexpression leading to decreased vocal learning ability. In this study, we examined the effects of chronic stress on glucocorticoid and FoxP2 expression in adult male budgerigars (*Melopsittacus undulatus*), a parrot species with adult vocal learning. We randomly assigned birds to groups that were subjected to different levels of induced chronic stress, with glucocorticoid samples taken every week and brains collected at the end of the experimental period to test FoxP2 expression. Through hormone immunoassays and immunohistochemistry, we found that baseline stress levels were significantly increased by chronic stress, and that chronic stress leads to overexpression of FoxP2 in learning centers and a decrease in neural plasticity. These results together suggest that chronic stress in adults impairs vocal learning ability and affects stress response, which can have especially relevant effects for human adults trying to learn a new language or those suffering chronic stress due to PTSD, traumatic brain injury, or stroke.

Presenter: C. Draney
Status: Undergraduate Student
Presentation type: Poster

T13. Elk, Mule Deer, and Pronghorn Migration in Northcentral New Mexico: Are All Routes Created Equal in a High-Elevation Monsoonal Landscape?

Joanna R. Ennis[1], James W. Cain III[1], Nicole Tatman[2], Orrin Duvuvuei[2], Anthony Opatz[2]

[1]Department of Fish Wildlife and Conservation Ecology, New Mexico State University; [2]New Mexico Department of Game and Fish

Abstract: Migration enables ungulates to maximize fitness by exploiting high quality forage on seasonal ranges. The persistence of migration in some populations is threatened due to human-induced landscape alternations and activities, yet basic data on many migratory populations is lacking. To date, most studies of migratory ungulates in the US has been conducted in north temperate regions, mainly the northern Rocky Mountains. There is a lack of knowledge related to location and characteristics of migration routes and stopovers, and cross-species comparison of dietary constraints and life history characteristics, and how they are related to migration characteristics in southwestern landscapes. Our study will address these deficiencies in an effort to improve management of migration routes in New Mexico and across the U.S. Our specific objectives are to identify and map migration routes, stopovers, and seasonal ranges for migratory elk, mule deer, and pronghorn in northcentral New Mexico. In addition, we will evaluate the use of multi-scale (i.e., satellite and handheld sensors) NDVI data and forage conditions along migration routes. Further efforts to increase our understanding of migratory populations will allow for more informed management decisions and coordination between agencies to conserve migratory populations.

Presenter: Joanna Ennis
Status: Graduate Student
Presentation type: 10-minute talk

P2. Elucidating the Function of the Gene CG46385 During *Drosophila Melanogaster* Eye Development

Kyle Helms[1,2], Jacquelyn Galaviz[1,3], Jennifer Curtiss[1]

[1]Department of Biology, New Mexico State University; [2]MARC; [3]AMP

Abstract: The Pax6 transcription factor is essential for eye development in organisms ranging from fruit flies to humans. However, little is known about the identity and function of Pax6 transcriptional targets. Increasing this knowledge base will likely lead to therapeutics for human eye diseases. To identify novel targets of the *Drosophila melanogaster* Pax6 ortholog Eyeless, we compared a list of genes generated in our lab that are expressed in response to ectopic expression of Eyeless, with a list of genes bound by Eyeless during eye development. One gene present on both lists is CG46385, which is predicted to have RNA adenylyltransferase activity and to be involved in mRNA stabilization. One mammalian CG46385 ortholog, *TENT5A*, has a role in development, and has been linked to osteogenesis imperfecta and autosomal recessive retinitis pigmentosa in humans. We hypothesize that CG46385 functions during eye development in *Drosophila*. Studying the function of CG46385 in *Drosophila* eye development will provide insight into the function of *TENT5A* and other orthologs during eye development in mammals including humans. We have a toolkit of molecular and genetic techniques to evaluate the location and function of CG46385 in the eye. Using *in-situ* hybridizations (ISH) we localized the expression pattern of CG46385 during eye development. We will utilize genetic epistasis experiments and a tissue-specific (ts) CRISPR-Cas9 system to knockout CG46385 gene function during eye development. Knowing the function of CG46385 will offer insight into the highly-connected network of retinal determination (RD) genes, and possibly its human ortholog.

Presenter: Kyle Helms
Status: Undergraduate Student
Presentation type: Poster

T10. Some Like It Hot: How Urban Microclimate Across a Tropical City Impacts *Aedes* Mosquitoes Life History

Eduardo Hernandez-Acosta[1], Adam Hendy[2], Barbara Chaves[3], Eloane Andrade[3], Michaela Buenemann[4], Marcus Lacerda[3], Nikos Vasilakis[2], Kathryn A Hanley[1]

[1]Department of Biology, New Mexico State University; [2]Department of Pathology, University of Texas Medical Branch; [3]Fundação de Medicina Tropical Doutor Heitor Vieira Dourado; [4]Department of Geography, New Mexico State University

Abstract: Urbanization is accelerating and there is considerable concern about its impact on vector-borne diseases. In particular, changes in microclimate associated with "urban heat islands" may affect the biology of vector mosquitoes. To investigate this process, we first quantified microclimate in sites spanning three levels of the normalized different built-up index (NDBI) in Manaus, Brazil, a tropical city that experiences high levels of arbovirus transmission mediated by *Aedes aegypti* and *Ae. albopictus*. We found that *Ae. aegypti* were significantly more abundant at high NDBI, whereas *Ae. albopictus* were more abundant at low NDBI. We then experimentally tested the impact of high NDBI microclimate on mosquito life-history, simulating the temperature and humidity of high or control (forest-like conditions) NDBI. We also varied food availability to assess the interaction between microclimate and food. *Ae. aegypti* larvae reared with *ad libitum* food pupated faster than the food-restricted larvae, showing an independent effect of food availability ($P=0.0154$, $DF=1$, $F=7.348$). When food was restricted, high NDBI microclimate decreased the time to pupation relative to control NDBI ($P=0.0279$, $DF=6.11$, $t=-2.357$). Time from pupae to adult eclosion, which was only measured in *Ae. aegypti* with food restriction, was faster in larvae reared at high NDBI conditions ($P=0.046$, $DF=5.173$, $t=-2.-064$). Size of adult female mosquitoes was smaller at high NDBI ($P=0.0067$, $DF=1$, $F=7.721$), and larger at *ad libitum* feeding ($P<0.0001$, $DF=1$, $F=17.512$). Adult mosquito survival did not differ between food or NDBI conditions. These results suggest that NDBI may lead to greater vectorial capacity in *Ae. aegypti* mosquitos.

Presenter: Eduardo Hernandez-Acosta
Status: Graduate Student
Presentation type: 10-minute talk

P3. Biocrust Carbon Flux under Timed Light Incubation

Mikaela Hoellrich[1], Anthony Darrouzet-Nardi[2], Louis Santiago, Nicole Pietrasiak[1]

Abstract: Biological soil crusts (biocrusts) are living soil aggregates hosting diverse communities of lichens, bryophytes, cyanobacteria, and other microorganisms in the uppermost millimeters of dryland soils. Biocrusts array along a gradient of structural complexity, each biocrust type being distinguished by the dominant photoautotrophic community member. Consequentially, each type hosts a unique microbial community with different associated biogeochemical processes. This project aims to assess the carbon fixation capacity of biocrust types under varying incubation times and light regimes. Five biocrust types (light cyanobacterial, dark cyanobacterial, cyanolichen, chlorolichen, and moss crust) were collected from four locations in the Chihuahuan Desert. Carbon fixation rates were quantified using a LI-6400XT portable photosynthesis system. Measurements were taken after biocrust wetting and light incubation at five different time periods (30min, 2hr, 6hr, 12hr, 24hr). Preliminary data showed that different biocrust types display a different response to light exposure. Generally, carbon fixation and respiration were greater in thinner crusts, and net fixation increased over time for most crust types. Moss dominated crusts resulted in the lowest net fixation, while lichen crusts broadly generated greater net fixation than cyanobacterial crusts. This project will provide new insights into the dynamics of carbon flux in different Chihuahuan Desert biocrust types.

Presenter: Mikaela Hoellrich
Status: Graduate Student
Presentation type: 10-minute talk

P4. Bat Species Composition of Bridges Spanning the Rio Grande and Urban Density

Daniel Ibanez IV[1], Teri J. Orr[1]

[1]Department of Biology, New Mexico State University

Abstract: Many bat species utilize manmade structures when natural roosts are unavailable. In arid regions, it is unsurprising that bat activity centers around water. Previous studies suggest there is extensive use of bridges spanning the Rio Grande as bat roosts throughout Dona Ana county. However, it is unclear why bats utilize some bridges and not others. Thus, we sought to understand how human activity and seasonality, impact roosting behaviors. Bridges were regularly examined for presence of bats and species, sex and counts noted. We estimated species richness relative to the degree of urbanization (using GIS) at each site and changes in occupancy across time (seasons). We present preliminary data for the first 7 months of surveys from 8 bridges, each with diverse degrees of urbanization spanning 100 kilometers of the Rio Grande. We describe relationships to presence of people and relative urban density. To date we have documented 8 species of bats that occur differentially across sites and that seasonal patterns follow trends observed in the literature. The most abundant species, Mexican free-tailed bats appear to be resident at one site (Timber Bridge). One individual Townsends big-eared bat, a species not commonly observed at open roosts, was documented in July. We've also noted extensive use of bridges by females suggesting they use these sites as maternity roosts which we anticipate confirming this summer. This project will create a record of bats in the region and expand our understanding of how roost use is affected by urban density.

Presenter: Daniel Ibanez
Status: Undergraduate Student
Presentation type: Poster

P5. Development of a Live Cell Probe to Examine Polarity Reversal During the Epithelial-Mesenchymal Transitions in Sea Urchin Embryos

Ida-Victoria Ike-Newton[1], Zebib Abraha[1], Charles B. Shuster[1]

[1]Department of Biology, New Mexico State University

Abstract: Animal development is characterized by a series of coordinated cell movements whereby cells move individually or collectively to establish new embryonic territories or structures. A common feature of embryonic cell motility is the epithelial to mesenchymal transition (EMT), where epithelial cells detach from their neighbors and become motile. Given that EMT is a hallmark of both normal development and pathogenesis (cancer), it is imperative to understand both the regulation and mechanics of this process. In the sea urchin embryo, several dozen mesodermal cells undergo EMT during gastrulation, making this an excellent system to study this process, and work in the lab has identified several parameters that may specify when EMT occurs. In order to better understand the process of polarity reversal that initiates EMT, we wished to design a live cell probe for the centrosome, a microtubule organizing center whose position presumably flips from apical to basal prior to EMT. Based on previously published studies, we chose the PACT domain of AKAP450, which localizes to centrosomes. GFP-PACT was then cloned into a bicistronic expression vector that affords the ability to express two proteins (GFP-PACT and Lifeact-mCherry) from the same mRNA. Preliminary studies in both live sea urchin embryos and cultured cells suggest that GFP-PACT localized to centrosomes and co-localization with centriolar markers suggest that this construct labeled both mother and daughter centrosomes. Future experiments will use this construct to both label cell boundaries (with Lifeact-mCherry) and centrosomes in living cells as they undergo polarity reversal and EMT.

Presenter: Ida-Victoria Ike-Newton
Status: Undergraduate Student
Presentation type: Poster

P6. Competitively Inferior Ponderosa Pines Succumbed to Bark Beetle Attack at Low Latitudes due to Compromised Growth and Defense

Milda Kristupaitis[1], Carla Vázquez-González[2], Steven R. Lee[1], Scott Ferrenberg[1]

[1]Department of Biology, New Mexico State University; [2]Misión Biológica de Galicia, National Spanish Research Council, Pontevedra, Spain

Abstract: Over their lifespans, coniferous trees endure stress from abiotic and biotic factors. For defense, conifers utilize oleoresin (hereafter "resin") composed of various terpene compounds as a means of defense against biotic attackers which in true pines (*Pinus spp.*) are stored in specialized cells called "resin ducts." Retrospective efforts comparing resin duct and growth traits in high latitude pines that did and did not survive bark beetle outbreak have revealed that trees with a greater number of vertical resin ducts were more likely to survive. However, no studies have yet investigated resin duct traits in low latitude pine forests where drought stresses are hypothesized to be the leading driver of tree susceptibility to bark beetles. Thus, our goal in this study is to compare the growth rates and resin duct traits among ponderosa pine trees that died from bark beetle attack vs. those that survived attack during a 2002-2008 outbreak in the Gila National Forest, NM. I chronologically dated 37 pairs of live and dead pines and found resin duct counts and area for a 20-year period ending at the year of tree death in each pair. Overall, we found live trees to grow more and be better defended than dead trees, potentially because analysis indicated that non-surviving trees were 12.6% more impacted by intraspecific competition than surviving trees. Furthermore, we found no climate sensitivity differences between live and dead trees which countered our expectations. This study will be used to inform future forest management practices as bark beetle activity increases.

Presenter: Milda Kristupaitis
Status: Graduate Student
Presentation type: Poster

T1. Biological Controls on Net Primary Productivity: An Example from the Chihuahua Desert

Steven Lee[1], Sam Jordan[2], Scott Ferrenberg[1]

[1]Department of Biology, New Mexico State University; [2]School of Life Sciences, Arizona State University

Abstract: Assessments of above ground annual net primary production (ANPP) often utilize the physical parameters of precipitation and temperature. This makes sense in context of ecoregions, where such parameters are the defining limitation for carbon fixation. However, within region variability of ANPP can remain high, and more nuanced factors, such as interactions between biological organisms, can play a large role in the variation in ANPP observed across a landscape. Here we present an example from the Chihuahua Desert of ANPP estimates of Honey Mesquite (*Prosopis glandulosa*) and the influence of the native--cerambycid mesquite, twig girdling beetle (*Oncideres rhodosticta*). In 2019 and continuing through 2020, a large outbreak of *O. rhodosticta* was observed across much of the northern range of *P. glandulosa*. We developed allometric models to estimate the amount of biomass annually (2019-2020) killed by *O. rhodosticta* and total shrub (n=100) biomass at study sites located at the USDA Jornada Experimental Range. Overall, we found stem girdling to reduce total living shrub biomass by about 4% in 2019 and 2% for the 2020 growing season. These numbers were similar to the 4% mean change in ANPP observed for *P. glandulosa* for the region. Annual estimates of ANPP are essential for understanding temporal dynamics of primary productivity and monitoring change in terrestrial systems. However, it is important to think beyond just broad physical limitations. Common biological processes, such as natural enemy impacts—in this case, twig girdling can cause as much variation in ANPP as climate.

Presenter: Steven Lee
Status: Graduate Student
Presentation type: 10-minute talk

T11. Dryland Seed Mixes with Increased Functional Diversity Show Influence of Species Level Competitive Interactions

Savannah Meadors[1], David Hooper[1], Akasha Faist[1]

[1]Department of Animal and Range Science, New Mexico State University

Abstract: Dryland plant community assembly is often dictated by abiotic limitations, and when biotic interactions are considered, dryland community studies emphasize competition. Considering both competitive and facilitative interactions could benefit ecological restoration; understanding the importance of facilitative interactions might improve dryland restoration outcomes. We sought to determine if higher functional diversity within a seed mix would be correlated with increased facilitative interactions—and how this varied under different soil and nutrient conditions. Four seed mixes of different diversity levels (high+ nitrogen fixer, high, medium, low) were created from ten NM native species, with perennial grass *Bothriochloa barbinodis* as the target species. Mixes were grown in potting soil (control) and three native soils (sandy, loamy, silty) under ambient and enhanced nutrient conditions. The average target species biomass (aboveground) was greatest in the low diversity treatment. In higher diversity mixes, interspecific competition appears stronger than intraspecific competition and non-target species, such as *Digitaria californica,* may be driving competitive effects. Soil type had a strong effect on overall average biomass—potting soil had greatest average biomass followed by sandy, loamy, and silty soils respectively. Nutrient addition had a positive effect on average biomass across soil textures. Average biomass in native soils was significantly lower than potting soil in ambient nutrient conditions. Biomass differences between functional diversity treatments were most apparent in the enhanced nutrient condition. Interspecific competition, irrespective of functional diversity levels, may be driving biotic interactions. Facilitative interactions may not be as prevalent in higher functional diversity treatments as predicted.

Presenter: Savannah Meadors
Status: Graduate Student
Presentation type: Ignite talk

T14. Population Dynamics and Harvest Regulations of Crappies in Kansas Reservoirs

James R. Miazga[1], Zachary B. Klein[1], Jeff D. Koch[2]

[1]Department of Fish, Wildlife, and Conservation Ecology, New Mexico State University;
[2]Kansas Department of Wildlife, Parks, and Tourism

Abstract: Crappies *Pomoxis* spp. (White Crappie *P. annularis*, Black Crappie *P. nigromaculatus*) support socially and economically important sport fisheries in the United States. Due to the value of crappie fisheries, management of both species is a high priority in Kansas. Current fisheries surveys in Kansas primarily evaluate population abundance and size structure, providing little insight into the dynamics governing crappie populations (i.e. mortality, recruitment, growth). Furthermore, evaluations of crappie harvest regulations (i.e. minimum length limits) in Kansas have been restricted to a few prominent fisheries limiting the development of consistent, statewide harvest regulations. Given the paucity of information surrounding the management of crappie in Kansas, the objectives of our research are to 1) to describe the population dynamics of crappies in 47 impoundments in Kansas and 2) determine the influence of minimum length limits on yield, harvest, and size structure using equilibrium yield models. A total of 5,816 crappies were collected for age estimation between 2019 and 2020. Yield models indicate that a 254-mm minimum length limit would improve size structure and maximize yield in crappie populations with moderate to fast growth (e.g. t_{254} = age 3), low natural mortality (A<35%), and high angler exploitation (u >30%). Population dynamics data and yield model predictions will provide insight into the function of crappie populations and should help managers to identify when and where harvest regulations will be effective.

Presenter: James Miazga
Status: Graduate Student
Presentation type: 10-minute talk

T2. Should It Stay or Should It Go: Fixation Versus Reversion of Acquired Drug-Resistance Mutations in Dengue Virus

Brett Moehn[1], Jordan Gass[1], Stacey Scroggs[1], Kathryn Hanley[1]

[1]Department of Biology, New Mexico State University

Abstract: Dengue Virus (DENV) is a mosquito-borne pathogen that infects hundreds of millions of people annually, causing millions of cases of dengue fever and tens of thousands of deaths. Vaccine and drug design against DENV is difficult, and to date there are no effective vaccines or antivirals in use for DENV. Developing a novel drug and carrying it through FDA approval is expensive and time-consuming; one solution is repurposing drugs approved by the FDA for other uses as antivirals. We have previously shown that fluoroquinolones, broad-spectrum antibiotics, suppress DENV replication in cell culture. However, DENV evolves resistance to fluoroquinolones within ten passages. We have identified two envelope mutations, V15L and E417A, that arose in different lineages in association with evolution of resistance. A key determinant of potential long-term utility of fluoroquinolones is whether these mutations remain fixed or rapidly revert, as well as whether compensatory mutations arise in absence of the drug. In this study we tested the rate and consequences of reversion of drug resistance by subjecting triplicate lines of ciprofloxacin-resistant DENV, as well as passaged control DENV, to five passages in HEK-293 cells without ciprofloxacin. We sequenced the resulting viruses and found that the E417A mutation reverted to wild-type in one lineage, but in the other two lineages the V15L mutation remained fixed, while no other new mutations emerged in the envelope of any of the passaged viruses. Future work will assess whether revertant A417E DENV has reacquired drug-susceptibility or exhibits other phenotypic differences with implications for drug longevity.

Presenter: Brett Moehn
Status: Undergraduate student
Presentation type: 10-minute talk

T8. Warburg Effect in *Anopheles* Mosquito Anti-Bacterial Immunity

Alex Moon[1], Ashmita Pandey[1], Jiannong Xu[1]

[1]Department of Biology, New Mexico State University

Abstract: Otto Warburg discovered cancer cells favor increased glycolysis with pyruvate being converted to lactate rather than acetyl-CoA for the tricarboxylic acid cycle, and this is termed the Warburg effect. Warburg metabolism has been found to occur in mammalian rapidly proliferating cancer and immune cells. *Anopheles* species mosquitoes, the vectors for malaria, rely on their metabolic system to provide energy and intermediates for their innate immune system, so called immunometabolism. We posited Warburg metabolism is involved in *Anopheles* sp. mosquito's immune response. We designed an anti-bacterial immunity model using intrathoracic inoculations of *Escherichia coli* K12, avirulent bacterium, and *Enterobacter sp.* Ag1, virulent bacterium isolated from the *Anopheles* sp. midgut, to test the immunometabolism response. We found a statistically significant doubling in lactic acid upon *Ent sp.* immune challenge as compared to injection injury controls using a lactate assay (t-test, $p = 0.0016$). This provides evidence to support increased Warburg metabolism in immune challenged mosquitoes. We then fed *Anopheles* sp. mosquitoes dimethyl fumarate (DMF), a GAPDH inhibitor, and challenged the mosquitoes with *E. coli*. We found a significant mortality was observed in DMF treated mosquitoes compared to control (Mantel-Cox, $p < 0.001$). By inhibiting the utilization of glycolysis and Warburg metabolism, decreased survival related to immune challenge is observed, showing Warburg metabolism is crucial for mosquito immunity. We believe current cancer therapeutics targeting Warburg metabolism can be an effective vector control strategy to prevent mosquito-borne diseases.

Presenter: Alex Moon
Status: Graduate Student
Presentation type: 10-minute talk

P7. Applying High-Throughput Analysis to Understand Cell Proliferation under Different Adhesion Conditions

Clarissa Nuñez[1], Naghmana Ashraf[1], Charles B. Shuster[1]

[1]Department of Biology, New Mexico State University

Abstract: Mammalian cell culture is a staple of biomedical research, and yet it has long been recognized that the conditions in which cells are cultured do not reflect the cellular environment *in vivo*. Adherent cells are cultured on a plastic surface with an elastic modulus over 10,000-fold stiffer than what is experienced by neuronal, epithelial and muscle cells in living tissues. These altered conditions have a variety of effects on cellular behaviors, especially in regard to cell shape, motility and division. Previous work in the lab suggest that cell adhesion and motility play a role in the mechanics of cytokinesis in adherent cells. To test this hypothesis, we are conducting a study of the cell cycle and cell division dynamics of human Retinal Pigmented Epithelial (RPE1) cells cultured on substrates of differing mechanical properties. We have genetically engineered lines of RPE1 cells that express either a nuclear Red Fluorescent Protein (RFP) marker or a two-color fluorescent cell cycle biosensor that respectively quantify cell number and cell cycle timing using a high-throughput imaging system. The doubling time as well as the lengths of each phase of the cell cycle will be measured in cells grown in matrices with decreasing stiffness, and these experiments will also allow us to define a minimal matrix stiffness that will still afford successful cytokinesis. These data will then form the foundation for future studies where we perturb different components of the cytokinetic machinery and test the ability of cells to compensate through increased cell adhesion and motility.

Presenter: Clarissa Nuñez
Status: Undergraduate student
Presentation type: Poster

T6. Meiotic Resumption Induces Changes in The Mechanical Properties of the Oocyte Cortex Required for Establishment of the Embryonic Axis

Debadrita Pal[1], Maria F. Visconti[1], Clara Ross[1], Isabella Terrezas[1], Gabriela Reyes[1], Charles B. Shuster[1]

[1]Department of Biology, New Mexico State University

Abstract: After completing a final round of DNA replication, oocytes can remain arrested in G2 of meiosis I for weeks to decades depending on the species. Oocytes resume meiosis after stimulation with a maturation hormone, undergoing two highly asymmetric divisions to reduce ploidy while retaining most of the cytoplasm in the future haploid gamete. Previous studies of starfish oocyte maturation revealed that following hormone stimulation, oocytes remodel their cortical actin cytoskeleton by downregulating the small GTPase, Rho. This remodeling resulted in a change in the mechanical properties of the oocyte and occurred in the time period leading up to germinal vesicle breakdown. Similar phenomena are observed in mouse oocytes, but the functional role of this remodeling is unknown. To explore the physiological significance of Rho downregulation on oocyte maturation, activated and dominant negative mutants of Rho were expressed, and their effects on known meiotic processes were analyzed. Constitutively active Rho had no effect on polar body formation, nor did it affect cortical granule translocation to the cortex. However, Rho downregulation appeared to be necessary for Dishevelled (Dsh) localization to the vegetal cortex. Dsh is recruited to the vegetal cortex during meiosis and plays a crucial role in determining the site of gastrulation in the embryo. Thus, while there are likely multiple aspects of oocyte maturation affected by Rho and its downstream effectors, we have identified one critical element of meiotic maturation that requires Rho downregulation and cortical remodeling: **establishment of the embryonic axis.**

Presenter: Debadrita Pal
Status: Graduate Student
Presentation type: 10-minute talk

T4. Metformin Reduces Survival Rate, Fecundity and Immunity During Bacterial Challenge through AMPK Activation in Mosquitoes

Ashmita Pandey[1], Alex Moon[1], Aditi Kulkarni[1], Jiannong Xu[1]

[1]Department of Biology, New Mexico State University

Abstract: Metformin is a glucose lowering and insulin-sensitizing agent which helps to control blood sugar level in mammals through activation of 5′-AMP-activated protein kinase (AMPK). AMPK is an intracellular serine/threonine kinase and a key energy sensor that is activated under metabolic stress. AMPK governs a series of biological process to maintain the energy homeostasis in response to metabolic stresses through ATP depletion. AMPK is activated when cellular energy is low, which shuts down anabolic pathway and concurrently turns on the catabolic pathway to produce ATP. This process continues throughout the metformin feeding which creates a nutrient deficient environment and does not provide enough immunity against microbial community. We investigated the role of AMPK in regulating the ATP homeostasis by feeding *Aedes aegypti* with metformin and observing its effect on survival, fecundity and immunity against bacterial challenge. Our result demonstrated that AMPK activation through metformin increased mortality rate in dose dependent manner where 20mM had the greater mortality than 15mM, 10mM and 5mM respectively. Similarly, AMPK also significantly reduced the fecundity rate of these mosquito in a dose dependent manner (10mM < 5mM < 2mM < 0mM). Additionally, in response to larger bacterial load, we also saw dose-dependent mortality rate where 10mM concentration showed higher mortality than 5mM and 2mM in comparison to the control (Mantel-Cox, $P < 0.0001$).

Presenter: Ashmita Pandey
Status: Graduate Student
Presentation type: 10-minute talk

P8. Effects of Sexual Dimorphism on the Capture Rate of Introduced Rosy-Faced Lovebirds, *Agapornis roseicollis*

Valeria Perez[1], Dominique Hellmich[1], Timothy Wright[1]

[1]Department of Biology, New Mexico State University

Abstract: Birds show a wide variety of sexually dimorphic traits, from size and color, to sexual, social, or parental behavior. Some behaviors may affect the overall activity levels or movement patterns of one sex compared to the other, with implications for researchers attempting to use data on captured individuals to understand population demography. In this study we examined whether an introduced population of rosy-faced lovebirds, *Agapornis roseicollis*, show evidence of sexual dimorphism in both morphology and behavior. We hypothesize that sexual dimorphism in this species leads to the differential capture of each sex during the breeding season. We predict that as the breeding season progresses, females are less likely to be trapped compared to males and that they are also less likely to be captured in pairs or groups. To test this, lovebirds were trapped at a nesting colony in Tempe, AZ throughout the 2018 and 2019 breeding seasons. Physical measurements and blood samples were collected then the sex of each bird was determined using PCR. Our results indicate that the sexes do not vary significantly in morphology, but the proportion of males captured from May to July increases over time though there was no difference in average group size at time of capture. We conclude that demographic measurements could be biased if trapping efforts are not timed to coincide with the time periods that both sexes are most active, and this is likely due to sexual dimorphism in foraging behavior and parental care in the rosy-faced lovebird.

Presenter: Valeria Perez
Status: Undergraduate Student
Presentation type: Poster

P9. Physiological Responses of *Yucca elata* (Soaptree Yucca) to Nurse Shrub Conditions

Megan Rabinowich[1], Brooke Osborne[2], Sasha Reed[2], Akasha Faist[3], Scott Ferrenberg[1]

[1]Department of Biology, New Mexico State University; [2]Southwest Biological Science Center, U.S. Geological Sciences; [3]Department of Animal and Range Sciences, New Mexico State University

Abstract: Like most drylands, much of the Chihuahuan Desert is characterized by sparse vegetation with large unvegetated interspaces. Interspaces exposed to high solar radiation and evaporation are often unsuitable for plant recruitment, especially during the early most sensitive stages of development when plants are highly prone to desiccation. Nurse plants provide a refuge, slowing the rate of evaporation beneath the canopy and act as a physical barrier to trap organic material subsequently increasing nutrient availability through decomposition. These and several other mechanisms have been supported by empirical evidence, but the relative strengths of these relationships are not well understood, and some undoubtedly remain undiscovered. I sought to disentangle the physical effects of shading and the legacy effects of nurse shrubs on soil richness on protégé plant establishment. Soils collected from the interspaces and subcanopies of site dominated by two common shrubs; creosotebush (*Larrea tridentata*) and honey mesquite (*Prosopis glandulosa*) were divided with half placed under a shade cloth to mimic physical shading of a shrub canopy. Pots were seeded with locally collected *Yucca elata* and watered regularly. Germination and growth were recorded and at 55 days plants were harvested for additional measurements. Most plant responses between the shade and open treatment were very drastic with little response to soil origin. Notably, stomatal density was much higher in plants in the open compared to shade, suggesting trait plasticity for regulating water loss and photosynthesis. Interestingly, allometric relationships of biomass measurements did not differ among treatments suggesting allometry is less flexible than leaf traits for acclimation to environmental conditions in this species.

Presenter: Megan Rabinowich
Status: Graduate Student
Presentation type: Poster

P10. Testing the Importance of Soil Fertility for Nurse-Plant Effects in Desert Ecosystems

Allison Sedillos[1], Steven Lee[1], Megan Rabinowich[1], Brooke Osborne[2], Sasha Reed[2], Akasha Faist[3], Scott Ferrenberg[1]

[1]Department of Biology, New Mexico State University; [2]Southwest Biological Science Center, U.S. Geological Survey, Moab UT; [3]Department of Animal and Range Sciences, New Mexico State University

Abstract: In deserts, perennial shrubs can alter local environments and facilitate recruitment of co-occurring plant species—a phenomenon known as the "nurse plant effect" (NPE). Simultaneously, desert soils are notoriously low in nutrients and observations of enhanced fertility within zones beneath shrub canopies—linked to feedback among shrubs and soils—have been described as 'islands of fertility' (IOF). The various potential biotic and abiotic mechanisms underlying the NPE remain poorly quantified across deserts and disentangling direct effects of shrubs on understory plants from their indirect influences via IOF requires further study. In a combination of greenhouse and field-based experiments, we recently demonstrated that higher germination rate in soils beneath shrubs during a year with extreme heat and drought was primarily due to physical shading and only marginally linked to soil properties. This observation raised the question of whether shrubs affect seed germination and recruitment via IOF effects when water is not limiting. We addressed this question using a full-factorial greenhouse experiment to compare seed germination and seedling growth in soil collected from beneath two common desert shrubs (*Larea tridentata* and *Prosopis glandulosa*) vs. in soil from non-vegetated interspaces and crossed these soil provenances with nitrogen and phosphorus additions; we then used two- and three-way permutational ANOVA analyses to assess the relative influences of shrub provenance and fertility on plant responses. Results from our study support ongoing efforts to parse the importance of soil fertility from other possible drivers of the NPE in desert ecosystems.

Presenter: Allison Sedillos
Status: Undergraduate Student
Presentation type: Poster

T3. An Assessment of Genetic Variation Associated with Differential Response to Fire Among Populations of Cheatgrass (Poaceae, *Bromus tectorum*)

Rubin M. Tamrakar[1], Erik Lenhoff[2], Michaela Buenemann[3], C. Donovan Bailey[1]

[1]Department of Biology, New Mexico State University; [2]Department of Entomology, Plant Pathology and Weed Science, New Mexico State University; [3]Department of Geography, New Mexico State University

Abstract: *Bromus tectorum* (cheatgrass) is a noxious invasive weed from North Africa and Eurasia whose introduction and expansion in the US has particularly impacted grassland systems across the Great Basin and Colorado Plateau. Previous studies on US populations found lower inter- but higher intra-population genetic variation than the native old world populations. This finding is consistent with the presence of genetic variation in US populations being derived from multiple founder events that may be contributing to invasive genotypes. In northern New Mexico, BLM land managers have observed populations that differ in population recovery after fire. Some of populations demonstrate vigorous regrowth and even expansion while other do not. These observations suggest that cheatgrass in NM contains population genetic variation relevant to land management decisions. We have conducted a population genomic study using Angiosperms-353 genomic targets on 25 individuals for each of six populations from northern NM and 19 individuals from Red Bluff, Montana (as outgroups). Sequencing results obtained from enriched genomic libraries were used for locus reconstruction using HybPiper followed by SNP variant call analysis. Our preliminary analyses have found the populations are highly inbred, indicated by low heterozygosity ($He < 0.12$),. PCA and isolation by distancing analysis indicated genetic variation existed between populations. ADMIXTURE analysis selected the $K=4$ (cross-validation error = 0.485), with considerable within population variation. The findings provide evidence for distinct ancestral differences between populations. Further comparison with fire history data in these six geographical sites will determine whether genetic variation may correlate the observed response to fire and the potential for unique adaptation between populations.

Presenter: Rubin Tamrakar
Status: Graduate Student
Presentation type: 10-minute talk

P11. Cruel to Be Kind: The Ethics of Destructive Collecting of Pollinators

Matthew Tryc[1], Scott Ferrenberg[1]

[1]Department of Biology, New Mexico State University

Abstract: Most of the biological research of pollinators and other insects requires the trapping, killing and preservation of copious specimens. To many, this practice appears reckless; especially given the current concern for dwindling insect populations. However, these collections provide invaluable. Reliable records and genetic vouchers of species occurring at the locations being can inform future restoration efforts of pollinators. Additionally, many pollinator species are nearly impossible to identify to species level without viewing minute characteristics of preserved specimens—e.g. tongue morphology and wing-venation. Studies considering the negative influences of trapping on insect numbers have reported minimal impacts on insect populations when they are sampled, even when these efforts are intensive. One aspect of my research is beginning to describe the diversity of bees in the Jornada Basin of the Chihuahuan Desert and to date, approximately five thousand pollinators have been collected and stored which raises an interesting ethical dilemma. Overall, this seemingly archaic practice can lead to a greater understanding of the species being studied with minimal effect on the population size of these organisms when trapping is done responsibly.

Presenter: Matthew Tryc
Status: Graduate Student
Presentation type: Poster

P12. Effects of Chronic Stress on Vocal Learning

Alondra Villalba[1], J. Apodaca[1], J. Jawor, Timothy Wright[1]

[1]Department of Biology, New Mexico State University

Abstract: After a stressful event an organism will initiate a stress response. This neuroendocrine cascade begins with the hypothalamus-pituitary-adrenal (HPA) axis releasing glucocorticoid hormones (GC) that influence energy metabolism, memory, learning, and protein catabolism via GC receptors that act as transcription factors. While having glucocorticoid hormone mediated effects is necessary for survival, studies have shown that having prolonged stress can lead to behavioral and cognitive disorders. To better understand how prolonged stress affects vocal learning, we will use the budgerigar (*Melopsittacus undulatus*), a small parrot, that is capable of learning both as juveniles and adults. Vocal learning is associated with the neural expression of *Foxp2* in the magnocellular nucleus of the medial striatum (MMSt). To test the hypothesis that chronic stress diminishes the ability to learn new vocalizations, chronic stress was induced by introducing stressors at unpredictable intervals. Measure of physiological stress and expression of *Foxp2* indicate that chronic stress negatively affects vocal learning while the analysis of changes in vocalizations is currently ongoing.

Presenter: Alondra Villalba
Status: Graduate student
Presentation type: Poster

T7. Influence of Wildfire and Forest Management on Large Mammal Distribution, Habitat Use, and Co-Occurrence in the Jemez Mountains of New Mexico

Leah White[1], James W. Cain III[1], Fitsum Abadi[2], Jesse S. Lewis[3], Robert R. Parmenter[4]

[1]New Mexico Cooperative Fish and Wildlife Research Unit, Department of Fish, Wildlife, and Conservation Ecology, New Mexico State University; [2]Department of Fish, Wildlife, and Conservation Ecology, New Mexico State University; [3]College of Integrative Sciences and Arts, Arizona State University; [4]Valles Caldera National Preserve, National Park Service

Abstract: More than a century of logging and fire suppression has altered the structure and composition of many forests in the southwestern US, leaving them vulnerable to disturbance events with undesirable ecological consequences. Prescribed fire and forest thinning are used to restore functioning, resilient forests and to reduce the risk of costly megafires, but our understanding of ecological responses to these treatments is limited. Responses of large mammal distribution and interactions between carnivores and ungulates could have cascading effects on vegetation communities. We will evaluate large mammal habitat use in response to forest restoration treatments and wildfires in the southwestern Jemez Mountains of New Mexico, specifically accounting for the duration of post-disturbance recovery, burn severity, and spatial configuration. We will collect camera trap occurrence data for five species (mule deer [Odocoileus hemionus], elk [Cervus elaphus], coyote [Canis latrans], black bear [Ursus americanus], and mountain lion [Puma concolor]) and develop single- and multi-species occupancy models to evaluate the influence of disturbance history on probability of use and species co-occurrence. We predict that as available forage increases post-disturbance, wildlife use will increase. In addition, we expect that the presence of competitors, predators, or prey will be an important factor influencing animal use of an area. Understanding how wildlife species respond to changes in forest structure and composition over long term post-disturbance will inform design of prescribed burns, forest treatments, and wildfire management to reach desired conditions for both wildlife and forest objectives.

Presenter: Leah White
Status: Graduate Student
Presentation type: 10-minute talk