MEEC 2025 Oral and Poster Session Schedule and Abstracts

Oral Presentation Schedules

Oral Session I (Saturday 2-3pm)	Theme	Room Number	Time	University	Title
Klara Stevermer	Communities and Ecosystems I	B103	2:00-2:15pm	Kansas State University	Physiological responses to elevated atmospheric drought in three biochemical subtypes of warm season grass
Amanda Montgomery			2:15-2:30pm	Southern Illinois University Edwardsville	The Synergistic Effects of Road Salt and Invasive Leaf Litter on Amphibian Community Dynamics
Aleah Querns			2:30-2:45pm	Kansas State University	Battling Brome: How drought and competition from invasive species shape native grass restoration
Lingyu Ouyang			2:45-3:00pm	The Ohio State Univerisity	Exploring the impact spatial-temporal variation of mosquito and avian biodiversity in West Nile Virus transmission in the US
Rebecca Carranza	Entomology I	R121	2:00-2:15pm	University of Illinois Urbana-Champaign	Examining Ant Tending in a Treehopper-Ant Mutualism
George Todd			2:15-2:30pm	University of Missouri-St. Louis	Body Size Variation in Nearctic Hover Flies
Maria Guadalupe Munoz			2:30-2:45pm	University of Illinois Urbana-Champaign	Exploring How Plant Invasions Affect Tick-Borne Disease Risk across Northern, Central, and Southern Illinois
Samir Kuinkel			2:45-3:00pm	University of Missouri-St. Louis	Thermal exposure and physiological tolerance in native and invasive Polistes species
Isabel Pen	Evolution I	B104	2:00-2:15pm	The Ohio State Univerisity	*Bunodeopsis Bonanza*: Exploring the Identity, Ecology, and Biogeography of Tiny Caribbean Sea Anemones
Sarah Swiston			2:15-2:30pm	Washington University in Saint Louis	Modeling range evolution using ellipses in continuous space
Sarah White			2:30-2:45pm	The Ohio State Univerisity	Body size cascades from Neodiprion sawfly hosts to Perilampid parasitoids: An investigation of sequential divergence
Shikara Patel	Genetics	B102	2:00-2:15pm	Saint Louis University	Characterizing the genetic basis of cold responses in *Mimulus guttatus*
Jack Sytsma			2:15-2:30pm	Kansas State University	Taking genomics outdoors in the Great Plains: Linking local adaptation, trait variation, and gene expression of perennial grass ecotypes across a natural and experimental precipitation gradient
Vitor Vargas Schwan			2:30-2:45pm	Southern Illinois University Carbondale	How do plants communicate? A Novel Investigation into Gene Expression Changes in *Arabidopsis thaliana* Under Intraspecific Competition

Oral Session II (Saturday 3:30-4:30pm)	Theme	Room Number	Time	University	Title
Sophia Anner	Animal Behavior and Physiology I	B102	3:30-3:45pm	University of Louisville	New evidence for sexual selection in a fruit-infesting fly: female wing display and mutual courtship impact mating decisions
Justine Nguyen			3:45-4:00pm	Marquette University	Group composition buffers collective function from individual impairment
Isra Khan			4:00-4:15pm	Missouri Southern State University	Quantifying the effects of prey mass on blood-glucose in Eastern Kingsnakes (*Lampropeltis getula*)
Ellen Urquhart			4:15-4:30pm	Washington University in Saint Louis	Energetic costs of electrogenesis in a highly encephalized weakly electric fish
Belen Alvestegui Montalvo	Pollination	R121	3:30-3:45pm	University of Missouri-St. Louis	Pollination syndromes in neotropical Symbolanthus (Gentianaceae)
Sarah Willen-Nelson			3:45-4:00pm	University of Missouri-St. Louis	Does urbanization induce phenological mismatches in orchard pollinators?
Mohamed Abdulsattar			4:00-4:15pm	Maryville University	Winter Drought Dynamics: Understanding the Reproductive System of *Phlox divaricata*
Lindsey Dennison			4:15-4:30pm	University of Missouri-St. Louis	Achromatic visual cues facilitate faster foraging by Pallas's long-tongued bat (*Glossophaga soricina*) in a flight-cage experiment
Becky Hansis-O'Neill	Population Biology	B103	3:30-3:45pm	University of Missouri-St. Louis	Tarantula population monitoring in Missouri glade habitats
Binaya Adhikari			3:45-4:00pm	University of Kentucky	Patchy Distribution of Madrean Sky Island Squirrels Shaped by Historical Connectivity and Present-Day Habitat Area
Jesse Grooms			4:00-4:15pm	DePaul University	Mast-Seeding and Seed-Consumer Dynamics at a Continental Scale
Carson Arnold	Evolution II	B104	3:30-3:45pm	Missouri Science and Technology	Hybrid Introgression has resulted in Bleeding Shiners exhibiting Striped Shiner mitogenomes in certain Missouri Ozark streams
Jhan Carlos Salazar			3:45-4:00pm	Washington University in Saint Louis	Exploring thermal physiology evolution across mountain slopes
Maya Mahoney			4:00-4:15pm	DePaul University	Evolutionary implications of tooth function on jaw curvature in the mackerel shark family, Lamnidae (Elasmobranchii: Lamniformes)

Oral Session III (Sunday 2:30-3:30pm)	Theme	Room Number	Time	University	Title
Laura Tayon	Animal Behavior and Physiology II	B102	2:30-2:45pm	Southern Illinois University Edwardsville	The effect of incubation on ringed salamander (*Ambystoma annulatum*) survival and fitness
Alex Dunahoo			2:45-3:00pm	Miami University	A genomic tool for low-cost relatedness monitoring of an endangered freshwater mussel, *Lampsilis streckeri*
Allie Muschong			3:00-3:15pm	Eastern Michigan University	The Effects of Thiamine Deficiency Complex on Michigan Lake Trout Physiology and Survival Behavior
Alison Breakfield			3:15-3:30pm	Saint Louis University	Microplastic Ingestion and Reproductive Impacts in Freshwater Mussels
Eileen Patricia Schaub	Communities and Ecosystems II	B103	2:30-2:45pm	Saint Louis University	Climate drives early flowering of native species: analysis of a 38-year phenology dataset
Claire Utzman			2:45-3:00pm	Kansas State University	Flow permanence influences carbon dioxide and methane production in streambed sediments.
Bess Bookout			3:00-3:15pm	Kansas State University	Bison wallows bolster biodiversity in tallgrass prairie
Alissandra Ayala			3:15-3:30pm	University of Louisville	Predicting the future: are climate changes likely to result in a mismatch between the life cycles of spring ephemerals and their pollinators
Amanda Griffin	Botany	B104	2:30-2:45pm	University of Illinois Urbana-Champaign	The Role of Domestication and Breeding in Soybean-Bradyrhizobium Symbiosis: Changes in Biological Nitrogen Fixation Over Time
Leah Gath			2:45-3:00pm	Saint Louis University	Exploring the Vibrational Acoustic Niche: Signal Diversity Across Plant Structures
Paul Chambon			3:00-3:15pm	Purdue University	A Little Time Goes a Long Way: Macrophytes Reduce Fungicide Impact on Aquatic Life Over Time
Jeremy Howard	Entomology II	R121	2:30-2:45pm	University of Missouri-St. Louis	Understanding bumblebee navigation processes and their connection to anthropogenic changes
Naomi Frese			2:45-3:00pm	University of Louisville	Thriving Amongst Toxicity: The Wonderful Walnut Fly
Garrett Behrends			3:00-3:15pm	University of Missouri-St. Louis	Effect of Urbanization of Paper Wasp Nest Productivity

Poster Presentation Schedules

Poster Session I (Saturday 4:30-6pm)	University	Title
Adrianna Yoder	University of Missouri-St. Louis	Drivers of Red-headed Woodpecker overwintering patterns in northeastern Illinois
Allison Mettenburg	Southern Illinois University Edwardsville	Road Salt Effects on a Fall Breeding Salamander, Ambystoma opacum
Amber Hansen	St. Norbert College	Intraspecific Variation Between two Interacting Subspecies of Killifish
Amy Winstead	Kansas State University	Grazing affects plant and soil N stoichiometry independent of fire in a tallgrass prairie ecosystem.
Anna Grimes	University of Illinois Urbana-Champaign	Interacting Stressors in Freshwater Ecosystems: Pesticides, Predators, Parasites, and the Daphnia That Face Them
Antonio Armagno	DePaul University	Fossil vertebrate diversity of the uppermost Niobrara Chalk (Upper Cretaceous) in western Kansas, and its paleoecological implications
Helen Winters	Kansas State University	Common Garden Study of Local Adaptation in a Dominant Prairie Grass: Characterizing Climate Adaptation for Conservation and Restoration
Harriet S Seelam	Maryville University	Blooming Against the Odds: A study comparing the resilience of *Frasera caroliensis* across wetlands, forests, and glades.
Isabella Bastien	University of Louisville	Size Me Up: Variation in Sexual Selection on Body Size in Walnut-Infesting Fly
Jesse Wallace	The Ohio State Univerisity	Evaluation of Methods for Extracting Genomic DNA from Historical Wet Crayfish Specimens
Joseph Patrick Sharon	DePaul University	Fossil marine fishes from the middle Hartland Shale (Upper Cretaceous: u pper Cenomanian) in northcentral Kansas
Joshua Poland	Arkansas State University	From Container to Competitor: An overview and consequences of Wild Sugarcane's journey from the Panama Canal to the United States
Kaelin Reichmann	DePaul University	The Relationship Between Body Size and Tooth Size in the Extant Crocodile Shark, Pseudocarcharias kamoharai (Lamniformes: Pseudocarchariidae), and Its Paleobiological Application
Mara Dearth	Maryville University	A lover or a fighter? A study on the impacts of climate change on the reproductive biology of Rosa setigera.
Oscar Spatola	Maryville University	Reproductive Rivals: Comparing glade and prairie habitat effects on the reproductive biology of *Asclepias Tuberosa*
Owen Howard	DePaul University	Exploring the impacts of temperature-induced spinal anomalies on body shape in Astyanax mexicanus (Teleostei: Characidae)
Riley Adams	University of Missouri-St. Louis	Climate Change Effects on Boreal Conifer Cone Morphology Using Herbarium Specimens
Sabashton Tabor	Maryville University	Do I like it wet? A morphological study of *Liatris Pycnostachya* visitation success between Wetland and Prairie habitats
Sarah Johnson	University of Illinois	A Morphological Analysis of Terrestrial Arthropod Coprolites from Pennsylvanian Coal Balls of the Illinois Basin

Poster Session II (Sunday, 1-2:30pm)	University	Title
Anna Salem	DePaul University	Public and private tree diversity: A research design for examining the benefits of urban ecosystems to wildlife from neighborhood to hyper-local level
Anne-Danielle Aka	University of Illinois Urbana-Champaign	Secret Ultraviolet Signaling in Fish
April Jungo-Garcia	The Ohio State Univerisity	Modeling Canine Distemper Virus transmission among wildlife in Ohio
August Wilson	Washburn University	Preliminary analysis of the visual acuity of *Terrapene ornata*
Brianna Neubacher	University of Louisville	Balancing the options: female egg load impacts mating decisions in a walnut-infesting fly
Dariana Gomez	Saint Louis University	The effects of thermal stress on treehopper reproduction and sperm transfer
Erik S Johnson	University of Missouri-St. Louis	Asymmetry in Livebearing Fish
Franceska Isufaj	Maryville University	Blooming Resilience: The Impact of Winter Drought on *Phlox pilosa*
Gabby Canning and Grace Lough	Saint Louis University	Illuminating the Impact: Artificial Light at Night Enhances Herbivore Damage on Red Maple Trees
John de Abreu	DePaul University and Field Museum	Gene Flow and Species Delimitation in *Cladia aggregata*
Kaitlyn Scott	Washburn University	Comparison of the Thermal Ecology of Ornate Box turtles (*Terrapene ornata*) across two distinct populations
Kyle Curran	Saint Louis University	Effect of Microbial Mutualists on Floral Rewards and Biodiversity
Kyliyah Walker	University of Missouri-St. Louis	The Effect of Diet on Hydrogen Sulfide Tolerance of Extremophile Fishes
Maddie Smith	University of Missouri-St. Louis	Habitat disturbance and biodiversity in glade habitats
Madeline Green	Saint Louis University	Order of arrival of microbial partners impacts the outcome of mutualism
Sara Wuerstl	Maryville University	What are you doing in my swamp? How urbanization impacts the reproductive success of Missouri native species *Iris virginica*
Vanessa Palmero	Saint Louis University	Artificial Light at Night and its Impact on fall Color change: a two-year study of *Acer rubrum* on SLU's campus

Oral Session I, Saturday (April 26, 2:00 – 3:00pm)

Communities and Ecosystems I (Rm B103)

Klara Stevermer - Physiological responses to elevated atmospheric drought in three biochemical subtypes of warm season grass

Atmospheric drought, measured as changes in the vapor pressure deficit (VPD), is increasing in duration and severity as global temperatures continue to rise. C4-dominated grasslands are highly diverse and productive systems, accounting for nearly a quarter of global aboveground primary production. C4 grasslands evolved to persist in variable climate conditions, however, predicted shifts in water movement and availability will exacerbate the existing vulnerability of these ecosystems. There are three biochemical subtypes of C4 grasses (NADP-ME, NAD-ME, and PEP-CK), each adapted to the climatic conditions in which they evolved, and which utilize subtype-specific water use strategies. Despite a well-established understanding of soil moisture-induced drought stress, the plant physiological responses to atmospheric drought stress remain unknown, particularly in natural C4-dominated systems. This research aims to quantify the variability of water use, water movement, and productivity of each C4 subtype in a tallgrass prairie ecosystem. Preliminary results show physiological responses to elevated VPD, such as photosynthetic rate, stomatal conductance, and transpiration, are subtype-specific. Species from the NADP-ME subtype show the most sensitivity to atmospheric drought, and species from the NAD-ME subtype show the least sensitivity under elevated VPD. Establishing a stronger understanding of C4 subtype-specific responses would allow us to better quantify water and carbon movement in grasslands, improve existing and future climate models, and conserve remaining grasslands.

Amanda Montgomery - The Synergistic Effects of Road Salt and Invasive Leaf Litter on Amphibian Community Dynamics

Road salt intrusion and invasive honeysuckle are increasing ecological concerns in freshwater habitats. Amphibians are sensitive to these stressors due to their permeable skin. Salinization can lead to increased mortality, behavioral changes, and reduced growth. Invasive honeysuckle (Lonicera maackii) has been found to cause mass mortality in amphibians. Road salt and honeysuckle are likely to overlap in habitat near ephemeral pools, such as disturbed and edge habitats, which are utilized by amphibians. If these stressors were to synergistically interact, it could lead to a higher increase in mortality and behavioral changes. These negative impacts could ultimately lead to a shift in amphibian community dynamics. We investigated the synergistic effects of road salt and honeysuckle on the predator-prey interactions of small-mouth salamanders (Ambystoma texanum) and gray treefrogs (Hyla versicolor). Larval A. texanum (predator) and H. versicolor tadpoles (prey) were placed in cattle tanks with a control, honeysuckle, salt, or combined treatment. Half of the cattle tanks contained only A. texanum larvae and the other half contained both A. texanum larvae and H. versicolor tadpoles. Survivorship of H. versicolor tadpoles and A. texanum was monitored along with A. texanum body length, mass, and time to metamorphosis. We found that road salt and honeysuckle did not significantly impact metamorphosed A. texanum life history traits. However, we found that road salt significantly impacted some life history traits of larval A. texanum. Additionally, A. texanum predation ability was not impacted by road salt or honeysuckle.

Aleah Querns - Battling Brome: How drought and competition from invasive species shape native grass restoration

Understanding how abiotic and biotic factors influence plant establishment is critical for grassland restoration. Smooth brome (Bromus inermis), a perennial cool-season grass introduced to the Great Plains as cattle forage, often forms monocultures by outcompeting native species due to its rhizomatous growth. While smooth brome tolerates a wide range of environmental conditions, including drought, its combined effects with drought on native grass persistence during grassland restoration remain unclear. We investigated how rainfall reduction and competition from invasive smooth brome interact to affect the re-establishment of native grass species in a heavily invaded agricultural field. Using a split-plot factorial design, we manipulated rainfall with passive rainout shelters (66% reduction) and brome competition by reducing brome density. We introduced five native bunchgrass species via two methods—plugs and seeds—and monitored their survival and germination. We analyzed plug survival and seed germination using generalized linear models. Brome competition strongly suppressed plug survival, with effects persisting in the second year. In the first year, the response of plug survival to competition treatments differed between species, with some species experiencing stronger reductions than others. Rainfall reduction decreased plug survival only in year two. Germinant counts declined most under the combined pressures of high competition and reduced rainfall. These results underscore the importance of effective invasive species management during restoration and highlight the need for species-specific approaches.

Lingyu Ouyang - Exploring the impact spatial-temporal variation of mosquito and avian biodiversity in West Nile Virus transmission in the US

West Nile virus (WNV) can infect humans through bites of infected mosquitoes and, in some individuals, cause West Nile fever. Birds serve as amplifying hosts that maintain WNV. Avian species have varying capacities to serve as competent hosts; for example, passerine birds have been found to be highly competent. Previous research has found that, in specific locations, avian community composition can cause disease dilution and amplification effects and examined mechanisms related to avian species diversity. However, multiple Culex spp. mosquitoes also contribute to viral transmission and the mosquito community composition might also affect disease dynamics. This study examines how both mosquito and avian biodiversity affect human WNV cases at multiple sites in the National Ecological Observatory Network (NEON). Specifically, we analyzed three years of mosquito and bird biodiversity data (2022–2024) from NEON sites near large human populations (more than one million) where local public health departments also reported WNV cases in 2024. NEON sites analyzed included SOAP in CA, TEAK in CA, and SRER in AZ. Our hypothesis is that as non-passerine bird biodiversity and non-WNV-vector mosquito biodiversity increase, human WNV cases will decrease. Conversely, when non-passerine bird biodiversity and non-WNV-vector mosquito biodiversity decrease, human WNV cases will increase. However, when non-passerine bird diversity and non-WNV-vector mosquito biodiversity trend in opposite directions, the net effect on human cases will depend on whether bird or mosquito communities have the bigger effect on WNV dynamics, which can differ locally. We built multispecies mechanistic SIR-type models to test these hypotheses. This study aims to fill a gap in understanding how vector biodiversity influences the transmission of vector-borne diseases, offering new insights into the relationship between biodiversity and disease.

Entomology I (Rm R121)

Rebecca Carranza - Examining Ant Tending in a Treehopper-Ant Mutualism

The underlying mechanisms that play a role in facilitating interspecific relationships are of central interest in evolution and ecology research. One such relationship is the mutualism between ants and plant-feeding insects. Hemipterans like treehoppers can be tended by mutualist ants, which provide protection in exchange for food. The treehopper Entylia carinata (keeled treehoppers) is a plant-feeding insect described as a host plant generalist and is tended by six genera of ants throughout North America. To determine whether ant species were tended based on their relative abundance within a field, we conducted transect surveys and installed pitfall traps at three field sites in central Illinois. Surveys were conducted in early and late summer to assess treehopper host plant use, changes in ant species composition, and abundance.

George Todd – Body Size Variation in Nearctic Hover Flies

Animal body size variation occurs in response to many environmental and genetic factors. Intraspecific variation is particularly important in allowing for stabilization of population dynamics. Many body size patterns exist (e.g., Bergmann's Rule), although many insects have not been tested for this trend. Body size can also vary in relationship to morphological traits. For example, allometry exists in many body traits such as relative brain size. The cognitive buffer hypothesis is one potential explanation to explain the evolution of relatively larger brains. Although insects demonstrate complex cognition, this hypothesis has not been tested in this diverse group. Many insects have life history traits that complicate the degree to which they adhere to patterns of body size variation. Hover flies are an ecological relevant and understudied insect group that lack studies investigating body size variation. Thus, we decided to test Bergmann's Rule and the cognitive buffer hypothesis in 18 species of Nearctic hover flies. We photographed 1,636 hover fly specimens from two natural history museums and collected morphometric and geographical data from each specimen. Two species (M. virginiensis and P. femoralis) exhibited significant Bergmann clines. Three species (X. quadrimaculata, P. femoralis and E. tenax) exhibited significant correlations between relative brain size and latitude. Additionally, neither set of analyses yielded any significant phylogenetic effect. These results demonstrate that nearctic hover flies fail to broadly support Bergmann's Rule or the cognitive buffer hypothesis. We discuss potential reasons for these results relating to the likely migratory and hypometabolic nature of hover flies.

Maria Guadalupe Muñoz - Exploring How Plant Invasions Affect Tick-Borne Disease Risk across Northern, Central, and Southern Illinois

Invasive plant species have been shown to alter tick-borne disease risk via direct and indirect pathways. However, relatively few invasive plant species have been investigated, and their effects on tick-borne disease risk have been variable. We hypothesize that plant invasions share similar mechanisms that may affect tick abundance and their associated pathogens through changes in microclimate and host habitat conditions. Using a combination of drag sampling and CO2 trapping, we sampled ticks in various sites within northern, central, and southern Illinois and compared tick abundance between invaded and uninvaded habitats for multiple non-native plant species through drag sampling and CO2 trapping methods. To quantify the effects of plant invasions on tick survival, we conducted tick survival experiments in invaded and uninvaded areas in the central Illinois region. From tick abundance surveys, most ticks sampled were Amblyomma americanum collected from central and southern Illinois. Mean tick abundance was higher in autumn olive (Elaeagnus umbellata), comparable in bush honeysuckle (Lonicera spp.) and multiflora rose (Rosa multiflora), and lower in stilt grass (Microstegium vimineum), compared to native vegetation. Survival assays are ongoing but current results indicate that differences in tick survival between

invaded and uninvaded habitats may be limited. Collectively, these results demonstrate that multiple invasive plant species can impact human risk of exposure to tick-borne diseases.

Samir Kuinkel - Thermal exposure and physiological tolerance in native and invasive Polistes species

Understanding how temperature affects physiological limits helps predict species' responses to climate variability. We studied nest microclimate and thermal tolerance in three paper wasp species: the invasive P. dominula, the native P. metricus, and P. exclamans. Using iButton loggers, we recorded nest temperatures every 3 hours at six sites each for P. dominula and P. metricus in St. Louis. Some nests reached 47°C, exceeding their heat tolerance. Though average temperatures were similar (~23.7°C), we found significant site differences: P. metricus nests at Site 2 were 3.6°C warmer than P. dominula sites, while P. dominula nests at Site 5 were 2.6°C warmer than P. metricus sites. Thermal safety margins were narrowest at the hottest sites, sometimes negative, indicating potential physiological stress despite no site-level effect on CTmax or CTmin. CTmax and CTmin were measured across three acclimation treatments (18°C, 24°C, 30°C). P. metricus showed the highest heat tolerance (CTmax: 47.9°C), followed by P. dominula (45.1°C) and P. exclamans (44.5°C). For cold tolerance, P. exclamans performed best (CTmin: 1.0°C), followed by P. metricus (4.8°C) and P. dominula (6.0°C). P. dominula exhibited higher heat plasticity (0.6°C per 1°C acclimation) while P. metricus showed greater CTmin plasticity (0.2°C/°C). Though P. metricus has better overall tolerance, P. dominula's superior heat adaptability may aid its invasion success, especially in urban areas. With warming climates, P. exclamans may face greater challenges due to limited heat tolerance. This research shows the importance of linking field temperatures with lab measurements to assess species' climate change vulnerability.

Evolution I (Rm B104)

Isabel Pen - *Bunodeopsis Bonanza*: Exploring the Identity, Ecology, and Biogeography of Tiny Caribbean Sea Anemones

Marine ecoregions of the Caribbean host three fascinating species in the genus Bunodeopsis: B. antilliensis, B. globulifera, and B. pelagica. These tiny sea anemones, found on blades of seagrass, exhibit remarkable traits such as rapid regeneration, active movement, and diurnal body contortion. Despite their intriguing characteristics, the evolutionary relationships between species in this genus remain unresolved due to overlapping distributions and limited morphological divergence. My project seeks to determine whether the observed diversity reflects distinct evolutionary lineages or developmental stages of a single species by integrating molecular, morphological, ecological, and behavioral data. To address this, I conducted fieldwork in Colombia, Panamá, Curaçao, and Belize in summer 2024 and Puerto Rico in spring 2025. Field observations documented habitat conditions, behavior, and morphological characteristics. Specimens were preserved for histological examination and molecular analysis using genome-skimming. Behavioral data, including predation by nemerteans and sacoglossans, provided ecological context. Preliminary analyses revealed significant variation within three morphological groups, identifying as many as 15 distinct morphotypes and underscoring the complexity of species delimitation. This integrative study combines molecular, morphological, ecological, and behavioral data to clarify species boundaries and investigate mitochondrial anomalies reported in related taxa. By resolving phylogenetic relationships within Bunodeopsis, this research enhances understanding of evolutionary mechanisms in cryptic marine organisms. Findings hold significance for taxonomy and systematics, addressing broader biodiversity and species delimitation questions. Future efforts include sampling Mexico, Bermuda, and the Lesser Antilles, broadening genetic analyses and strengthening conclusions about this captivating genus.

Sarah Swiston - Modeling range evolution using ellipses in continuous space

Phylogenetic methods of historical biogeography model the evolution of species ranges in order to reconstruct how species may have moved and split through time. To characterize species ranges, existing approaches typically discretize space, or model a set of points. Here, we present EMPIRE, an ellipse-based, continuous-space model of range evolution that incorporates range size, location, and orientation, as well as different range inheritance scenarios at speciation. Under a Bayesian likelihood-based framework, we use the model to infer rate parameters, ancestral ranges, and discrete cladogenetic event types from data.

Sarah White - Body size cascades from Neodiprion sawfly hosts to Perilampid parasitoids: An investigation of sequential divergence

Ecological speciation drives divergence across different environments, as seen in plant-eating insects. It can also cause shifts across multiple trophic levels in a cascading effect of "sequential divergence." This pattern, where divergence at one trophic level generates parallel specialization in closely associated organisms, may increase parasitoid diversity in plant-insect-parasitoid systems. However, sequential divergence has rarely been identified in empirical studies, and it has never been confirmed among externally feeding insects and their parasitoids. To address this gap, we consider the Pinus-Neodiprion-Perilampus neodiprioni system. Here, externally feeding Neodiprion sawflies exhibit ecological divergence, where pine host associations drive differentiation between sawfly species, as evidenced by body size as a magic trait. If sequential divergence occurs, this body size differentiation may cascade to Neodiprion's parasitoids. Therefore, we asked, "Does P. neodiprioni exhibit host-specific divergence in body size that parallels patterns in its Neodiprion hosts?" Using by-catch samples, we photographed and measured body size across a wide geographic range of male and female P. neodiprioni, reared from Neodiprion lecontei and Neodiprion pinetum hosts. We analyzed body size variation as predicted by sawfly host species, sawfly host sex, sawfly host size, parasitoid sex, latitude, and the interactions of these variables. We found that P. neodiprioni demonstrates sawfly host-associated body size variation, with trends parallel to Neodiprion hosts. Latitude and host body size also play key roles in predicting parasitoid body size. This parallel body size differentiation among hosts and parasitoids suggests sequential divergence is possible in this system, prompting further investigation.

Genetics (Rm B102)

Shikara Patel - Characterizing the genetic basis of cold responses in *Mimulus guttatus*

To maximize survival and reproduction, plants time life stage transitions, such as germination, in response to environmental cues like temperature and day length. Extended periods of cold can signal the approach of spring and favorable growing conditions. Mistiming these transitions can reduce both survival and reproductive success. As climate change alters the reliability of environmental cues, understanding the genetic pathways that regulate these transitions can help identify species or populations at risk. We investigate this question in Mimulus guttatus (now Erythranthe guttata), a wildflower native to the west coast of North America. Previous studies across diverse populations have shown that germination can occur with or without exposure to cold. A follow-up study within a single population confirmed this pattern for most maternal families, but one family showed cold-induced seed dormancy—failing to germinate after cold exposure. This segregating mutation offers a unique

opportunity to investigate the genetic basis of cold response. We identified four genotypes through inbreeding and germination screens: two wild-type and two mutants which were selected for seed RNA sequencing. Once RNA-seq data are available, we will compare gene expression patterns across genotypes and cold treatments to identify the genes expressed in the seeds that are involved in cold sensing and germination timing. We predict that mutant genotypes will exhibit significant changes in gene expression in response to cold, while wild types will not. This work will advance our understanding of the molecular mechanisms underlying germination timing and how they may respond to environmental change.

Jack Sytsma - Taking genomics outdoors in the Great Plains: Linking local adaptation, trait variation, and gene expression of perennial grass ecotypes across a natural and experimental precipitation gradient

Under predicted climate change, understanding local adaptation to drought is crucial. We study local adaptation and drought tolerance using wet and dry ecotypes the dominant grass Andropogon gerardi. We utilize a long-term reciprocal garden platform, in place for over a decade, measuring performance across a natural rainfall gradient from dry to wet sites (MAP 480-1167mmyr-1) and experimentally manipulate rainfall to test response to drought. We measured cover and biomass, traits, and RNAseq to identify differentially expressed genes (DEGs) of ecotypes, linking phenotype to gene expression with co-expression networks. We hypothesized: the local ecotype showing highest performance, the dry ecotype exhibiting traits associated with drought tolerance and DEGs related to water stress, the wet ecotype demonstrating traits associated with light competition with DEGs associated with growth.
We found the local ecotype had the highest cover and biomass, demonstrating local adaptation. The dry ecotype exhibited traits associated with stress tolerance (reduced stature, increased water-use efficiency) and DEGs associated with stress tolerance. The wet ecotype showed increased height and biomass, with DEGs associated with growth. Under rainouts, both ecotypes exhibited DEGs related to stress response. We identified genes involved in tissue generation and growth hormone signaling co-expressed with increased biomass of the wet ecotype at its home site. In the dry ecotype, DEGs involved in photosynthesis and drought response were co-expressed with gas exchange at its home site. Our work bridges ecological and genomic perspectives to enhance our understanding of local adaptation to rainfall, ensuring long-term persistence of species in a changing climate.

Vitor Vargas Schwan - How do plants communicate? A Novel Investigation into Gene Expression Changes in *Arabidopsis thaliana* Under Intraspecific Competition

In plant ecology, intraspecific competition is an important factor that influences growth, resource exploitation, and evolutionary fitness of plants. This study aimed to evaluate the molecular responses of Arabidopsis thaliana under intraspecific competitive conditions by comparing gene expression in plants grown in isolation (1 plant per pot) with those in high-density environments (49 plants per pot). Transcriptomic analyses were conducted using RNA sequencing on both root and shoot tissues 37 days after planting (flowering stage). The study focuses on well-established responses, including shade avoidance and alterations in root architecture, while also exploring potential novel genetic components of pathways that contribute to plant-plant signaling under competition stresses. Differential expression analyses reveal significant upregulation and downregulation of root/shoot genes under competition. Gene lists contrasting genes increased/suppressed during competition particular to only shoot and roots and as well as their interaction were created and submitted to PantherGO for enrichment analysis, and a new hormone is being proposed, derived from the Eicosanoid pathway. These results reveal novel signaling and stress response genes that support the adaptive strategies of Arabidopsis thaliana under high-density conditions. Further steps will be focused on validating candidate genes identified, through qPCR and

mutant knockouts with the goal of clarifying their specific roles in intraspecific competition plant adaptive responses.

Oral Session II, Saturday (April 26, 3:30 – 4:30pm)

Animal Behavior and Physiology I (Rm B102)

Sophia Anner - New evidence for sexual selection in a fruit-infesting fly: female wing display and mutual courtship impact mating decisions

Phytophagous insects face strong host-related selection that can drive trait and species divergence but additional barriers to reproduction are often crucial to the speciation process. Flies in the genus Rhagoletis are well known for host-associated mating and temporal isolation that reduce gene flow between species. However, sexual isolation is retained between species even when host-related barriers are experimentally removed. Further, flies perform a distinctive wing display during courtship that has been understudied as a potential metric of mate choice. I characterized phenotypic trait variation within a population of R. pomonella by performing 28 no-choice mating trials, extracting detailed behaviors, and measuring morphological variation. Our most striking result was that female wing display effort is sexually selected: successful copulations were associated with higher female effort. Further, both males and females performed the conspicuous wing display, and display effort was dependent on that of the other fly, highlighting the importance of alternating or simultaneous signaling between the male and female flies. Our data also suggest that mate choice decisions depend on female condition. We also found sexual dimorphism in body size, wing shape, and wing pigmentation, but these traits did not predict mating outcomes and so are unlikely to be sexually selected via mate choice.

Justine Nguyen - Group composition buffers collective function from individual impairment

Characterizing the mechanisms behind the coordination of collective behavior is vital to understand how animals will respond to environmental changes. We used fanning, a collective thermoregulatory behavior in the eusocial Western honeybee (Apis mellifera) workers, as a case study. Fanning depends on both social and thermal contexts, and our previous work established that social interactions between individuals play a role in driving the fanning response. Oxytetracycline, an apiculture antibiotic, is known to disrupt honeybee physiology and has become an environmental pollutant. Our previous work has shown that oxytetracycline decreases social interactions within small groups, leading to a reduced fanning response. However, we do not know whether honeybee groups can still coordinate their collective fanning response when a portion of the group is impaired by antibiotic treatment. To test our hypothesis that group composition can buffer adverse effects in individuals, we performed behavioral assays of novel mixed groups. We predicted that heterogeneous groups (containing both treated and untreated bees) would interact more and subsequently fan more compared to fully treated groups in response to thermal change. We found that social dynamics in heterogeneous groups were dominated by interactions between treated and untreated bees, which may have allowed these groups to fan at levels comparable to homogeneous untreated groups. Our results emphasize how collective behavior emerges from individual information transfer and highlights the resiliency of social animal groups.

Isra Khan - Quantifying the effects of prey mass on blood-glucose in Eastern Kingsnakes (*Lampropeltis getula*)

Snakes are highly adaptable, ectothermic predators that have complex digestive systems and diverse physiological processes. While snake digestive and feeding behavior have been studied extensively, little work has been done on snake hematology, and it is unknown how blood glucose varies by the feeding habit of the animal. Snakes are known to modify their digestive and overall metabolic processes in response to different prey sizes, and suffer an energy cost when doing so, due to the SDA effect. In theory, this means meals are only favorable when gain is larger than cost. The goal of the study is to determine the relationship between prey volume and blood glucose level, which will inform meal size favorability. The use of glucometers has been robustly validated to measure glucose in snakes. To collect blood in repeated measurements, a novel capillary puncture technique was employed at the cloaca, using the effect of gravity on circulation. This method can be employed in the field and on any species, maximizing animal welfare and hematological data. A high-metabolism snake, Lampropeltis getula, was fed 5%, 10%, 15%, and 20% of their body weight on a randomized bi-weekly schedule (n=10 snakes). Plasma glucose was measured immediately, 8 hours, and 24 hours post-feeding. Results found statistically significant elevations in glucose in the 15% and 20% (high-volume) groups, but no elevation in the 5% and 10% (low-volume) groups. The understanding of meal favorability will produce an understanding of risk-taking behavior and tropic activity of snakes in ecology.

Ellen Urquhart - Energetic costs of electrogenesis in a highly encephalized weakly electric fish

Adaptive traits such as a large brain and sensory specializations offer novel ecological and social benefits, allowing organisms to occupy and adapt to new niches. However, evolution of these traits may come with high energetic costs. Mormyrids, a group of African weakly electric fishes, possess unusually large brains and both passive and active electrosensory systems, including an electrogenic organ. The combination of extreme encephalization and an active electrosensory system with an electrogenic organ is unique to mormyrids, prompting investigation of the question of how do mormyrids energetically accommodate these expensive traits? Here, we quantify how much energy is devoted to electric organ discharge (EOD) production in the mormyrid species Brienomyrus brachyistius. Using whole animal respirometry, we compared oxygen consumption rates between fish with intact and surgically silenced electric organs. We predicted that intact fish would have higher oxygen consumption rates than silent fish, since electrogenesis has been estimated to be metabolically costly in another electric fish group, the South American gymnotiforms. However, we show that there is no difference in oxygen consumption rates between intact and silent fish. This suggests that metabolic rates in this species may be constrained and a fixed aspect of evolved physiology. Therefore, we conclude that silent B. brachyistius are reallocating their energy typically spent on EOD production to some other energetic demand, continuing to maintain this constrained metabolic rate.

Pollination (Rm R121)

Belen Alvestegui Montalvo - Pollination syndromes in neotropical Symbolanthus (Gentianaceae)

Research carried out during the last 20 years has revealed that Symbolanthus (Gentianaceae) has a particularly high floral diversity. There are at least 38 Symbolanthus species that are present from Bolivia in the south to Costa

Rica in the north, with outliers on the tepuis in Venezuela and Guyana (on the Guiana Shield) and in the Lesser Antilles in the Caribbean. Their up to 12-cm long conspicuous corollas present variable shape, symmetry, and color patterns, with basic colors ranging from green, white, and yellow to pink and red, depending on the species. Pollinator information is remarkably poor for such a large-flowered taxon, and based solely on floral phenotypes we predicted traditional pollination syndromes: species with bright-colored, tubular flowers with UV-reflecting nectar guides would be visited by hummingbirds, and dull-colored, bell-shaped species would be visited by bats. Field observations of species in Bolivia and Colombia confirmed that red-flowered species are primarily pollinated by hummingbirds. However, against predicted, we determined that both bats and hummingbirds frequently visit and aid in pollen transfer of white-flowered species and pink-yellow-flowered species. Bats and hummingbirds select contrasting floral phenotypes that preclude generalization to both. The flower-width trade-off limits generalization to both, because narrower corollas are better at guiding hummingbird bills, but wider flowers are better at fitting bat snouts. However, in Symbolanthus the corona, a tubular structure within the flower that holds nectar may be mitigating this trade-off by acting as a narrower tube that guides hummingbird bills and allowing the maintenance of a wider flower for bat heads.

Sarah Willen-Nelson - Does urbanization induce phenological mismatches in orchard pollinators?

Many urban areas are considered food deserts as they lack resources that provide nutritional food options. Urban orchards can provide healthy food to residents that may otherwise go without. The success of urban orchards depends on synchronized plant and pollinator phenology that result in bee emergence times that align with plant flowering periods. However, rapid urbanization experienced in many of these food deserts can have harmful effects on local ecology. Disproportionately higher urban temperatures may be detrimental to phenological matching of plants and pollinators if air and soil temperatures are not warming at similar rates. If phenoevents of these species become asynchronous, pollination services required for optimal fruit set could be negatively impacted. This study documented the phenological alignment of fruit trees and their insect pollinators in ten community orchards along an urbanization gradient. In the spring of 2022, 2023, and 2024, pollinator activity schedules were obtained every 7 days and fruit tree flowering phenology was observed every 4.33 days, on average. Linear mixed models indicate significant differences in phenology for insects and fruit trees along an urban gradient. Fruit trees and their pollinators emerged earlier with increasing impervious surface area ($R^2 = 0.58$, $P < 0.001$, $F = 8.91$, and $R^2 = 0.52$, $P < 0.001$, $F = 11.11$ respectively). However, there was no significant effect of impervious surface on the phenological alignment between fruit trees and their pollinators ($P = 0.22$). Generally, fruit trees initiated flowering one week prior to bee foraging activity, regardless of impervious land cover.

Mohamed Abdulsattar - Winter Drought Dynamics: Understanding the Reproductive System of *Phlox divaricata*

Climate and environmental factors, like drought winters, can influence a plant's morphology, reproductive systems, and how it attracts pollinators. In this study, we examined the effects of drought winters on the morphology and pollination system of Phlox divaricata, a self-incompatible perennial wildflower found in the Missouri woodlands. Using data collected from 2014-2024 at Shaw Nature Reserve, we investigated: (1) the occurrence of drought winters, (2) the impact of drought on plant morphology, (3) changes in pollination systems during drought years, (4) the relationship between display size and pollinator visitation, and (5) the presence of pollen limitation during drought and non-drought years. Our data showed that Shaw Nature Reserve experienced drought winters in 2023 and 2024. There was no statistical difference in plant morphology, meaning a change in height, floral display, and corolla span between drought and non-drought years. Pollination systems on the other hand, did have a shift during drought years, with mid-sized pollinators such as Apis mellifera and Lepidoptera dominating, while during non-drought years, we saw a higher activity from smaller pollinators like syrphids and

halictid bees. Even though we did see a change in some pollinators, there was no evidence of pollen limitation in either drought or non-drought years. There was also no correlation found between floral display size and pollinator visitation rates. Our findings suggest that Phlox divaricata is a robust native species with a flexible, generalist pollination system that ensures reproductive success under varying environmental conditions. This resilience highlights its potential to positively impact ecosystems that are experiencing climate change. Future research could explore how this wildflower can help sustain pollinator diversity in times of environmental stress.

Lindsey Dennison - Achromatic visual cues facilitate faster foraging by Pallas's long-tongued bat (*Glossophaga soricina*) in a flight-cage experiment

Sensory systems are an integral component of the relationship between plants and their animal pollinators. Foraging pollinators may use multiple senses to locate and identify plants as potential food sources. In turn, plants may exhibit certain characteristics, advertising themselves to potential pollinators or signaling the availability of a nectar reward. In bat pollination systems, plant characteristics such as floral shape, presentation of a flower, and the presence of sulfur-containing compounds are commonly noted. These characteristics can be directly linked to sensory modalities that are well-studied in bats: echolocation and olfaction. Although less emphasized, bat vision could also be an important sensory modality for foraging nectarivores. Many bat-pollinated plants are pale in coloration, potentially serving as bright visual signals to foraging bats and contrasting strongly with the dark background foliage in a forest at night. We tested Pallas's long-tongued bat (Glossophaga soricina) in flight cage experiments involving a simple foraging task. Bats had to locate a nectar reward from a white artificial flower, randomly positioned within a large array, and against three possible types of backgrounds: white, black, or mixed. We found that the time to complete the foraging task was lowest when the white flower was presented against a black background. These results add support to the hypotheses that pale coloration in bat-pollinated plants/floral structures increases visibility and facilitates visitation by foraging bats in a dark environment.

Population Biology (Rm B103)

Becky Hansis-O'Neill - Tarantula population monitoring in Missouri glade habitats

The tarantula, Aphonopelma hentzi has not been a species of concern for arachnologists in North America. In Missouri, A. hentzi tend to inhabit glade habitats. Glades have been affected by changing fire regimes resulting in the proliferation of red cedar in some areas. Red cedar contributes to habitat degradation, making glades less favorable for glade specialist species. Small predators like lizards, and possibly arachnids, can reduce damage to native plants by controlling herbivorous insect populations. The effects of tarantulas on ecosystems they inhabit has not been well studied but they may be important for controlling herbivorous insects. Therefore, tarantulas may be important for maintaining glade habitats in addition to their intrinsic and cultural value. In three central Missouri glades, we have found A. hentzi populations that appear to be much smaller than we expected given population densities in other parts of North America. Partnering with the Missouri Department of Conservation, we have monitored these populations for the past three summers and will be adding new sites in the coming field season to understand if small populations are a widespread phenomenon in Missouri glades. We believe these tarantula populations are likely at risk from habitat fragmentation and degradation, edge of range effects, and illegal collecting. In addition to population monitoring, we have been working on monitoring habitat disturbance, natural history, population genetics, and wild tarantula welfare.

Binaya Adhikari - Patchy Distribution of Madrean Sky Island Squirrels Shaped by Historical Connectivity and Present-Day Habitat Area

Sky islands—high-elevation forests isolated by surrounding arid lowlands—create natural archipelagos where species distributions are influenced not only by the amount of available habitat but also by historical dispersal barriers. Focusing exclusively on Sciurus arizonensis in the Madrean Archipelago, our study tests the hypothesis that both present-day habitat area and historical connectivity have shaped its current occupancy. To address this, we used the occurrence records of preserved specimen, developed binary presence/absence matrix for 43 mountain “islands” (above 1500 m), and modeled species distributions across four key time periods: the Last Glacial Maximum, the Mid-Holocene, the Present, and a future projection for 2100. We quantified suitable habitat by estimating habitat area and calculating least-cost pathways from mainland populations as proxies for colonization costs. Subsequent statistical analyses—including logistic regression, LASSO, and random forest models—revealed that while current habitat area positively influences occupancy, the legacy of historical connectivity plays a decisive role. Specifically, higher Mid-Holocene colonization costs were associated with reduced present occupancy, reflecting limited opportunities for recolonization as isolation increased. Interestingly, higher LGM costs were positively associated with occupancy, suggesting that population establishment may have occurred during periods of improved connectivity not fully captured by our aggregate LGM cost metric. Once established, populations likely persisted even as connectivity declined. The best-fitting logistic model (AIC = 23.026; AUC = 0.9474) confirmed that integrating both contemporary and historical factors best explains the present distribution of Sciurus arizonensis. These findings underscore the need for conservation strategies that combine habitat preservation with the restoration of dispersal corridors to mitigate fragmentation and address climate change impacts.

Jesse Grooms - Mast-Seeding and Seed-Consumer Dynamics at a Continental Scale

Animal population dynamics can be spatially and temporally synchronized across large areas, driven in part by climatic patterns. Climate variability across large spatial scales can manifest through climate dipoles, which are two opposite states of weather occurring across a continental scale. Climate dipoles affect the level of synchrony of ecological processes, for example the magnitude of seed production by trees and irruption patterns of birds, creating phenomena known as 'ecological dipoles'. Mast seeding (the synchronous production of a large quantity of seed crops by a population of perennial plants) produces an ecological dipole that manifests as reproductive synchrony in tree populations at locations up to 2,000 km apart in North America and as anti-synchrony at a continental scale. Seed-eating small mammal populations increase reproduction with an abundant food supply. We thus expect that the ecological dipole of mast-seeding patterns has cascading implications across the food web of seed consumers. However, prior studies have only observed these implications at local scales or have been limited by the availability of population data. Our objective is to test for ecological dipoles that connect tree reproduction and seed eating small mammal populations. We are using tree reproduction data collected by our lab at 25 National Ecological Observatory Network (NEON) sites, as well as NEON small mammal, temperature, and vegetation structure data. We hypothesize that continental-scale temperature patterns will affect tree reproduction, which will affect seed eating small-mammal abundance. This research fills a knowledge gap to understand what drives population dynamics at macrosystems scales.

Evolution II (Rm B104)

Carson Arnold - Hybrid Introgression has resulted in Bleeding Shiners exhibiting Striped Shiner mitogenomes in certain Missouri Ozark streams

Hybridization is common among minnow species with historical precedent for mitochondrial introgression events throughout the Luxilus genus. Within the Ozarks, hybrid introgression has led to L. chrysocephalus populations that exhibit the mitogenomes of a congener, L. cornutus. Preliminary surveys of another shiner species, L. zonatus, suggested another hybrid mitochondrial genome replacement with L. chrysocephalus. The objective of our study was to sample L. zonatus and L. chrysocephalus throughout the Ozarks to document the geographic extent of hybrid introgression. We sequenced the ND2 gene and constructed a maximum likelihood mitochondrial phylogeny. Our work revealed that only L. zonatus from the Black River drainage in the southern Ozarks formed a monophyletic group with sister species L. pilsbryi and L. cardinalis. Populations of L. zonatus from the St. Francis, Meramec, Gasconade, and Osage Rivers all exhibit the mitogenomes of L. chrysocephalus. This is interesting because L. chrysocephalus in those drainages possesses L. cornutus mitogenomes. We hypothesize that historical hybrid introgression between L. chrysocephalus and L. zonatus preceded hybrid introgression between L. cornutus and L. chrysocephalus to account for these findings. Our results have practical implications because the use of mitochondrial genomes for environmental DNA metabarcoding has become widespread and introgressive hybridization events such as these have the potential to cause misidentification of species.

Jhan Carlos Salazar Salazar - Exploring thermal physiology evolution across mountain slopes

Since Darwin, researchers have tried to understand how species adapt to different elevations. Tropical reptiles are typically diverse in warm, lowland environments, yet some have successfully colonized high elevation environments on both islands and the mainland. However, how common such transitions has remained unknown. The occurrence of high elevation species on multiple mountain ranges could reflect a single lowland-to-highland transition followed by subsequent divergence into multiple species or, alternatively, could result from multiple, convergent, evolutionary transitions. Here, we test these alternatives for anole lizards which, though predominantly found in tropical lowlands, now inhabit multiple mountain ranges in Central and South American and the Caribbean. Analyzing extensive climatic and distributional data for 303 species, we found that invasion of high-elevation regions has been more frequent than the reverse on both islands and the mainland and that biogeographic movements across mountains and climatic niche shifts are distributed non-randomly across the phylogeny. As mountains uplifted in the past, anoles dispersed gradually rather than rapidly colonizing new high-elevation habitats, and their adaptations to colder climates occurred at a slow evolutionary pace.

Maya Mahoney - Evolutionary implications of tooth function on jaw curvature in the mackerel shark family, Lamnidae (Elasmobranchii: Lamniformes)

Lamnidae (Elasmobranchii: Lamniformes) is a mackerel shark family consisting of three genera and five species: Lamna ditropis (salmon shark), L. nasus (porbeagle), Isurus oxyrinchus (shortfin mako), I. paucus (longfin mako), and Carcharodon carcharias (white shark). Although a relatively small family, the three genera show a wide range of dental morphology, particularly in their anterior teeth: narrow, non-serrated piercing-type teeth in Lamna and Isurus, and broad, serrated cutting-type teeth in Carcharodon. However, the morphological range of their jaws has been poorly investigated. We used 3D geometric morphometrics to examine the difference in jaw curvature among the five lamnid species, and how they may be related to the quantified ‘acuteness’ of their respective anterior

teeth as a proxy for their tooth function. Our study demonstrates that the jaws of Lamna are more similar to those of Isurus, in comparison to the jaws of Carcharodon. The crown acuteness values of anterior teeth are also more similar between Lamna and Isurus compared to the values of Carcharodon, quantitatively showing that C. carcharias has much broader teeth than the other lamnid species, consistent with their cutting function. Our study represents the first quantitative analysis linking tooth function with jaw curvature in sharks, where the cutting-type teeth are interpreted to be associated with a gently curved jaw to promote their 'sawing effect.' Because cutting-type teeth are generally regarded to be derived relative to piecing-type teeth, our unique jaw curvature data of C. carcharias within Lamnidae are also interpreted to be a derived condition.

Oral Session III, Sunday (April 27, 2:30 – 3:30pm)

Animal Behavior and Physiology II (Rm B102)

Laura Tayon - The effect of incubation on ringed salamander (*Ambystoma annulatum*) survival and fitness

Climate change is a primary driver of the worldwide decline in amphibians, whose functioning is highly dependent on local climate. In salamanders, temperature influences many physiological processes, including embryo development rate. This effect has been studied in many salamanders in the genus Ambystoma, but not in the ringed salamander (Ambystoma annulatum), a species of conservation concern in Missouri, USA. Determining A. annulatum's response to rising egg incubation temperatures is crucial to conservation and management efforts and contributes to the scientific literature on this understudied species. We determined the effect of incubation temperature on survival, larval size, and egg incubation period in A. annulatum. Ambystoma annulatum eggs were collected from three wild populations in the St. Louis, Missouri, USA area, subjected to three different incubation temperature treatments, and monitored for five months after hatching. We predict that survival, larval size, and egg incubation period will be reduced at greater incubation temperatures.

Alex Dunahoo - A genomic tool for low-cost relatedness monitoring of an endangered freshwater mussel, A genomic tool for low-cost relatedness monitoring of an endangered freshwater mussel, *Lampsilis streckeri*

Poorly designed propagation, augmentation, and reintroduction (PAR) efforts can adversely affect the genetic variation of target populations. To address this challenge for the endangered speckled pocketbook mussel (Lampsilis streckeri), we developed a genomic tool to monitor relatedness of both captive broods and wild populations. Highly informative single nucleotide polymorphisms (SNPs) were identified from genomic sequencing and used to design a targeted genotyping panel. With this panel, we genotyped mothers used for propagation and their captively raised offspring. Fathers could not be genotyped because mothers were fertilized in the wild before capture. Parentage assignment was performed using a maximum-likelihood approach to assess the panel's accuracy and investigate patterns of relatedness within captive L. streckeri broods. Our panel of just 60 SNPs had 100% assignment accuracy for juveniles with known mothers, which validated the panel's ability to correctly assign parental relationships with a limited number of genetic markers. When applied to juveniles raised in "mixed" cages that contained offspring from multiple mothers, our panel showed that a few mothers produced the majority of genotyped juveniles. Unequal parental contributions can cause a loss of genetic variation due to

incidental founder effects and should be mitigated during PAR. Our panel also identified multiple paternity in L. streckeri, with an average of 9.3, and a maximum of 18, putative fathers assigned to the offspring of each mother. Because of this high rate of multiple paternity, it is likely that using relatively few mothers for PAR will still maintain adequate genetic variation for L. streckeri, as long as females are fertilized in the wild. Our study identified unique patterns of relatedness in captive L. streckeri broods that will inform future PAR efforts, while demonstrating a simple and cost-effective workflow for developing similar genomic tools for other freshwater mollusk species.

Allie Muschong - The Effects of Thiamine Deficiency Complex on Michigan Lake Trout Physiology and Survival Behavior

The Great Lakes top predator Salvelinus namaycush (lake trout) suffers from Thiamine Deficiency Complex (TDC) due to an enzyme produced by its prey, Alosa pseudoharengus (alewife). Lake trout populations are unstable due to TDC and previous decades of invasive competitors, necessitating state-funded stocking practices. Since invasive competitors have largely been extirpated, could treatment options and further investigation of TDC boost natural recruitment and restore the Great Lakes lake trout to its former glory? In collaboration with the USGS Great Lakes Science Center, we explore effects of TDC and thiamine treatments on thermal tolerance and foraging boldness of fall 2024 lake trout fry.

Alison Breakfield - Microplastic Ingestion and Reproductive Impacts in Freshwater Mussels

Freshwater mussels are integral organisms in our aquatic environments, found globally, and one of the most threatened groups of taxa in the world, yet these species remain understudied. Mussels provide multiple ecosystem services, including filtering of particles and suspended materials from the water column which influences primary production and the cycling of nutrients, the creation of habitats for other benthic organisms, and serving as a source of food for fish and humans. Nevertheless, mussels face a variety of threats at various points in their lives that may be species specific and that are primarily driven by anthropogenic factors. These main threats include recruitment failure, over harvest, changes in land use which leads to changes in freshwater habitat, climate change, and pollution. Reproductive success is vital in maintaining thriving populations. One of these threats are microplastics, which have been shown to cause health issues ranging from reproductive failure, decrease in growth, inflammation, oxidative stress, and reductions in food consumption in many aquatic organisms such as fish, mussels, small crustaceans, and macroinvertebrates. The goal of this study, using a combined field and lab approach, is to characterize potential impacts of microplastics on the reproductive outputs in freshwater mussels.

Communities and Ecosystems II (Rm B103)

Claire Utzman - Flow permanence influences carbon dioxide and methane production in streambed sediments.

Climate change will increase drought and reduce stream permanence, expanding non-perennial streams and affecting microbial communities and ecosystem functions. We examined microbial structure and carbon cycling in sediments from perennial and non-perennial streams across the US Rocky Mountains (RM), Great Plains (GP), and Southeast Forests (SE). Sediments from pool and riffle habitats were incubated under three treatments: saturated, unsaturated, and fluctuating (flux). Microbial respiration and methane production were measured using

a Picarro spectrometer. We hypothesized that microbial activity would decline under fluctuating conditions in perennial sediments and regions with stable flow. Aerobic respiration varied by region ($P<0.001$) and was weakest in GP, where reach and habitat had no effect. CO_2 production was lowest in unsaturated sediments and highest in saturated conditions across GP and MW ($P<0.001$), but not in non-perennial SE sediments ($P=0.003$). Habitat influences were inconsistent, likely due to sediment texture and organic matter content. CH_4 efflux was highest in saturated non-perennial sediments ($P<0.010$). Aerobic respiration was less responsive to water fluctuation in regions with lower flow permanence, though local factors played a role. Non-perennial sediments exhibited unexpected respiration and CH_4 efflux patterns. These results enhance understanding of microbial responses to hydrologic change and their contributions to the greenhouse gas balance in lotic ecosystems facing reduced flow permanence.

Eileen Patricia Schaub - Climate drives early flowering of native species: analysis of a 38-year phenology dataset

Long-term phenology records are an important tool to understand plant community responses to rapidly changing climate. Here, we present results from a 38-year flowering phenology dataset recorded at Cuivre River State Park, covering 355 native Missouri species. Flowering was monitored in 10-day intervals, documenting flower emergence and presence for each species throughout the growing season. Using linear mixed effect models, we asked whether date of first flowering changed during the period observed (1978 – 2015) and whether these phenological changes are correlated with environmental drivers. We find that mean first flowering date is occurring earlier across our dataset, though there is variation in species responses throughout the record period. Additionally, we found a significant interaction between year and annual mean temperature; where increasing temperatures further accelerated flowering. We also found a significant interaction between year and growing season precipitation, as measured by the Standardized Precipitation Evapotranspiration Index (SPEI), with higher precipitation driving later flowering. To disentangle the variation in species responses over time, we tested whether species seasonality of flowering time impacts the direction and strength of phenological change. We find that species that flower later in the year (e.g. during summer and fall) respond more strongly than spring-flowering species. That is, that they are experiencing a greater shift in first flowering date. Our results suggest that native species flowering phenology is sensitive to changing climate, and that these effects are likely increasing over time.

Bess Bookout - Bison wallows bolster biodiversity in tallgrass prairie

Plains bison (Bison bison) were an important species that once roamed the Great Plains in the millions but have now largely been replaced by domestic cattle. While cattle and bison share similar ecological roles within grasslands, bison, unlike cattle, create bare-earth depressions (wallows) through dust-bathing. Historically, as bison followed fire across the Plains, wallows would have been abandoned from months to years, likely creating a mosaic of unique plant communities and ephemeral wetlands. This study takes advantage of a long-term bison reintroduction (30 years), which is factorially crossed with fire frequency (1, 2, 4, and 20-year fire intervals) at Konza Prairie Biological Station (KPBS), a native, unplowed tallgrass prairie. I conducted plant surveys in 120 plots (fenced and unfenced wallows and non-wallows; n = 24) to determine if wallows contribute to plant diversity in tallgrass prairie, and thus if bison provide distinct services that cattle do not. My results show that wallows support unique plant communities, increase overall plant diversity, and increase phylogenetic diversity, which may contribute to increased functional diversity and resilience. Wallows also house unique soil microsites with greater clay content, and in some wallows (about 20%), long periods of standing water and/or high salt concentrations similar to brackish wetlands. Our results suggest that the removal of bison from Great Plains tallgrass prairie may have reduced the plant biodiversity and the extent of semi-aquatic ecosystems.

Alissandra Ayala - Predicting the future: are climate changes likely to result in a mismatch between the life cycles of spring ephemerals and their pollinators

For many interspecies interactions, timing is everything. The mutualistic relationship between pollinators and flowers is included. Predicted to be particularly sensitive to a successful phenological overlap are spring ephemeral flowers, which only bloom between the last snowmelt and forest canopy closure. Native pollinators such as solitary cavity-nesting bees depend on these early spring floral resources after emergence for sustenance and reproduction. Temperature is an important common phenological cue. My work investigates how the Urban Heat Island Effect (UHI), the phenomenon in which urban areas experience heightened temperatures compared to their surrounding rural areas, influences both guilds' phenology. The UHI is a unique opportunity to model the rise in temperature we expect to experience in the next few decades. Louisville has one of the strongest UHIs in the United States, with average temperatures being 3 to 7 degrees Celsius higher than surrounding natural areas. This encompasses the 1.5-2 degrees Celsius rise in temperature predicted by the IPCC between 2030 and 2052. To answer these questions, I built and monitored clear-sided trap nests for emergence and reproductive activity of solitary bees in 15 sites across an urban-rural gradient. Four transects were established in the cardinal directions radiating from the trap nests. Along these transects, 1-meter quadrats were used to assess the spring ephemeral floral resources available to pollinators. Here we found that urbanization was a significant predictor of emergence and reproductive phenology in bees and flowering in spring ephemerals. This research suggests that the UHI has major implications for these species' phenology.

Botany (Rm B104)

Amanda Griffin - The Role of Domestication and Breeding in Soybean-Bradyrhizobium Symbiosis: Changes in Biological Nitrogen Fixation Over Time

Soybean (Glycine max) is a globally significant crop that forms a symbiotic relationship with nitrogen-fixing Bradyrhizobium. While domestication has improved agronomic traits, it may have unintentionally altered plant-microbe interactions. Domesticated crops, including maize, have exhibited reduced microbial recruitment, potentially influencing nutrient acquisition. This study investigates how domestication impacts Bradyrhizobium recruitment, and the symbiotic benefits conferred to Glycine max compared to its wild progenitor, Glycine soja. A factorial greenhouse experiment was conducted using 50 soybean genotypes (45 Glycine max and 5 Glycine soja). Plants were grown under two treatments: inoculation with a mixed Bradyrhizobium inoculum (20 Bradyrhizobium japonicum and Bradyrhizobium diazoefficiens strains) or a phosphate-buffered saline (PBS 1X) control. Each genotype-treatment combination was replicated five times, resulting in 500 total soybean pots. Growth metrics such as biomass, nodulation, and chlorophyll were measured to assess the impact of domestication on soybean-Bradyrhizobium symbiosis. Domesticated Glycine max exhibited a greater response to Bradyrhizobium inoculation than wild Glycine soja, contradicting the initial hypothesis that there would be an inverse relationship between cultivar release year and response to Bradyrhizobium. However, no significant correlation was found between cultivar release year and response to inoculation. The lower response of Glycine soja may be attributed to strain specificity, as the selected Bradyrhizobium strains may not have been optimal for the selected wild soybean genotypes. These findings highlight the complexity of domestication effects on soybean-Bradyrhizobium symbiosis and the need for further research. Understanding these mechanisms can guide future breeding programs to optimize biological nitrogen fixation.

Leah Gath - Exploring the Vibrational Acoustic Niche: Signal Diversity Across Plant Structures

Global declines in insect diversity call for a better understanding of the factors shaping insect communities. Here, we investigate a potentially important, but unstudied, factor that could constrain local insect diversity – the vibrational acoustic niche. Over 93% of acoustic insects use substrate-borne vibrations (i.e. vibrational signals) to communicate. In contrast to airborne acoustic signals, vibrational signals travel through solid substrata, like plant stems and leaves. Thus, the transmission properties of plants, as well as the surrounding acoustic environment, could limit the available vibrational niche space by constraining which vibrational signals are effectively transmitted, and therefore which insect species can utilize a habitat to communicate. We examined whether vibrational signals differed across plants of different structural types and across different prairies in the Saint Louis region. We first developed equipment for high throughput recording of vibrational signals, and then recorded hundreds of hours of vibrational signals from four plant structural types. We analyzed the resulting sound files to identify the number of unique signals on each plant, and then to categorize the signals based on their spectral and temporal properties. We conducted an analysis to assess signal diversity, signal types, and their potential drivers of variation. We discuss how our research will assist in understanding the potential impacts of a relatively unexplored niche concept on local assemblages of insect communities.

Paul Chambon - A Little Time Goes a Long Way: Macrophytes Reduce Fungicide Impact on Aquatic Life Over Time

Fungal pathogens are emerging globally, leading to increased fungicide production and use. Many strobilurin fungicides exhibit acute toxicity to aquatic species, raising concerns about their ecological impact. Thus, assessing their effects and exploring mitigation strategies is crucial. We wanted to explore whether macrophytes, found across aquatic ecosystems, could mitigate these toxic effects. Macrophytes can reduce pesticide toxicity in aquatic systems, but their role in mitigating strobilurin fungicides remains unclear. We investigated whether different macrophyte species could lessen the toxicity of pyraclostrobin over time for Daphnia magna, a model macroinvertebrate. Using controlled experiments, we exposed macrophytes to pyraclostrobin at varying densities for 2, 6, or 10 hours before adding Daphnia, after which we monitored Daphnia survival. We found that a longer delay significantly improved Daphnia survival, with the 10-hour exposure yielding the highest survival rates. While we did not observe significant effects on survival between species or density at 10 hours, we detected an overall interactive effect on Daphnia survival between delay, species, and density. These findings indicate that pyraclostrobin is acutely toxic to Daphnia, but macrophytes can mitigate its effects when they have sufficient time (≥10 hours) before exposure. Further research is needed to clarify the mechanisms driving this interaction.

Entomology II (Rm R121)

Jeremy Howard - Understanding bumblebee navigation processes and their connection to anthropogenic changes

Bumblebees are vital native pollinators for plant reproduction worldwide, relying on flowering plants for pollen and nectar to support their colony. In order to accomplish foraging tasks, bumblebees need to successfully navigate to and from their colonies and food sources. As part of their navigational toolkit, bumblebees have a diverse set of processes to perceive cues in their environment to aid in movement based decision-making. This presentation provides an overview of bumblebee (Bombus) navigation processes, how these processes relate to environmental

changes, and suggestions for future areas of research. Ultimately, understanding these navigation processes of bumblebees reveals large connections to anthropogenic changes (e.g., urbanization, pesticides) that disrupt their senses and affect navigation tasks required for successful survival and reproduction. This connection highlights the need for additional studies to not only delve deeper into bumblebee sensory ecology and cognition, but to continue to explore the extent of disruption so that necessary conservation practices can be implemented.

Naomi Frese - Thriving Amongst Toxicity: The Wonderful Walnut Fly

Rhagoletis suavis, a fruit infesting insect, have adapted to living in their walnut host as larvae, despite the allelopathic chemical composition of walnut fruit. To investigate whether the presence of this chemical component (juglone) contributed to increased survival, we divided larvae into 4 experimental categories containing either no walnut or varying combinations of walnut-soaked water and ground up walnut husk. We measured the survival from larvae to pupae was measured twice during incubation (pre-winter and mid-winter). The results of this experiment show that the introduction of walnut husk into the developmental environments of larvae yields a higher rate of pupae and adult survival across all life stages. A follow up substrate experiment confirmed that higher moisture retention and a lower pH may contribute to higher survival in the walnut husk treatment.

Garrett Behrends - Effect of Urbanization of Paper Wasp Nest Productivity

Paper wasps (Genus: Polistes) are cosmopolitan social insects that serve a unique role as pollinators and predators in human-modified landscapes. Notable pest control services Polistes provide include those to combat caterpillar pests (Order: Lepidoptera) of sugarcane, maize, tobacco, cabbage, broccoli, and cotton, with potential services extending beyond the agricultural sector. Maintaining these services demands an understanding of the environmental factors affecting paper wasp nest productivity in human-modified landscapes. I gathered 239 nests from 4 Polistes species across an urban gradient in St. Louis, MO and assessed nest productivity by calculating nest cell number, and the proportion of nest cells with honey, parasites, or reared young. Then, using generalized linear regression models, I determined the relationship between landscape variables (i.e., percent impervious surfaces, percent surface water, percent tree cover, etc.) and each nest productivity metric. I found that the models including percent impervious surface (a proxy for urbanization) as the sole predictor variable best explained the variation in most nesting success metrics. I also found evidence for niche partitioning. Each species inhabited significantly distinct urbanization bands. Overall, results suggest that although the Polistes can be successful in urban settings, there is an optimal range of urbanization for each study species' productivity.

Poster Session I, Saturday (April 26, 4:30 – 6:00pm)

Adrianna Yoder - Drivers of Red-headed Woodpecker overwintering patterns in northeastern Illinois

Red-headed Woodpeckers are a species of concern in Illinois, having declined due to oak savanna habitat loss and lack of available tree decay from urbanization. Red-headed woodpeckers are facultative migrators in northeastern Illinois, which means some individuals will migrate while others will overwinter in the area. The

factors driving the pattern of Red-headed Woodpecker overwintering at larger spatial scales is currently unknown. We hypothesize acorn quantity, a primary winter food source, affects their pattern of winter residency. Acorn production is highly spatiotemporally variable due to oak mast-seeding, the variable and synchronous acorn production in a population. We use long-term oak masting data, collected at 13 sites across northeastern Illinois, alongside calculated Red-headed Woodpecker abundance for the sites to test our hypothesis. We use generalized linear mixed models to calculate their estimated abundance from eBird data and to determine the drivers of their overwintering. Understanding the factors that influence Red-headed Woodpecker winter residency at greater spatial scales will inform conservation tactics that should aim to sustain Red-headed Woodpeckers year-round.

Allison Mettenburg - Road Salt Effects on a Fall Breeding Salamander, *Ambystoma opacum*

Salinization caused by road salts is a growing ecological threat to freshwater ecosystems. While previous studies have shown that various trophic levels are negatively affected by salinization, few study the effects on caudata (salamanders) and none include Ambystoma opacum (marbled salamanders). This study investigates if salt concentrations affect the development and survivorship of A. opacum larvae. We hypothesize that the higher salt concentrations will result in reduced size and survivorship. Through a controlled experiment, A. opacum eggs were collected, incubated, and randomly assigned to tanks with differing salt treatments. Measurements and observations have been collected to assess survival and size. Preliminary results suggest that higher salt concentration decreases survivorship and may decrease size. This study will provide information on the impacts of road salts on amphibians, and aid in the conservation of freshwater ecosystems.

Amber Hansen - Intraspecific Variation Between two Interacting Subspecies of Killifish

Secondary contact occurs when separated populations of the same species that are genetically distinct come back into direct contact. Understanding the results of secondary contact is important for predicting broader effects, such as impacts on biodiversity. A few possible outcomes include: one population outcompetes the other, the two interbreed, creating a hybrid swarm, or the two populations remain genetically isolated. In assessing possible outcomes, it is first important to understand phenotypic variation between the separated populations. Here, we report on the naturally occurring secondary contact between the Eastern Banded (Fundulus diaphanus diaphanus) and the Western Banded (Fundulus diaphanus menona) killifish in streams and lakes in Wisconsin, USA, where the Eastern population is invading Western territory. Limited information has been collected on phenotypic variances between populations, which raises questions about the significance of their secondary contact for biodiversity or ecosystem services. In this study, we collected ~100 banded killifish from historic Eastern and Western sites and analyzed them for body shape, weight, length, and scale counts. No significant differences were identified between Eastern and Western populations with the exception of average scale count variations, which had previously been reported as a distinguishing characteristic between the subspecies. The results of this study suggest that the populations are similar among several phenotypic axes, raising questions about the effects of their secondary contact. This result reinforces the importance of understanding intraspecific variation as a first step for predicting the consequences of secondary contact, and may have implications for management of phenotypically similar invasive populations.

Amy Winstead - Grazing affects plant and soil N stoichiometry independent of fire in a tallgrass prairie ecosystem.

In tallgrass prairies, the nitrogen (N) cycle is controlled by grazing and fire: Bison maintain significant levels of soil available N, while fires volatilize plant litter N, preventing its return to the soil. While previous research shows that

N retention in this ecosystem can be promoted by burning, the relative effect of grazing on the fate and concentration of soil N is not well constrained. Soil was collected from a gradient of fire frequency treatments in ungrazed and bison grazed areas, and were analyzed for total carbon (C), N, and phosphorus (P), microbial biomass C and N, and grass tissue C and N. We predicted that retained N concentrations would be higher in soils undergoing N-limiting management treatments like frequent burns and lack of grazing. Initial results show that %N was unaffected by grazing but was higher in infrequently burned areas than in frequently burned, which is related to higher total organic matter concentrations rather than differences in N retention. Comparisons of soil molar C:N reveal ratios that are lower in grazed soils, as well as the infrequently burned areas, with no interaction between fire and grazing. In annually burned watersheds, grass C:N was lower in grazed treatment while microbial biomass C:N was not affected by bison grazing; analysis is ongoing. There is evidence for greater plant N pools in grazed prairie. These results will provide information for future prairie management and move towards a more comprehensive understanding of the cycling of N within grazed grassland ecosystems.

Anna Grimes - Interacting Stressors in Freshwater Ecosystems: Pesticides, Predators, Parasites, and the Daphnia That Face Them

Aquatic ecosystems play a crucial role in maintaining biodiversity. As global pesticide production continues to rise, agrichemicals run off from fields into nearby water bodies and contaminate aquatic environments. This contamination introduces an additional stressor to already vulnerable ecosystems. The long-term effects of widely used neonicotinoid insecticides on ecosystem health remain poorly understood. Understanding how contaminants interact with natural ecological stressors is essential for predicting broader ecological impacts. Daphnia, a keystone genus in freshwater food webs, plays a critical role in energy transfer. This zooplanktonic crustacean serves as both a primary consumer of algae and a preferred prey item for fish, amphibians, and invertebrate predators. Stressors that impact Daphnia survival, reproduction, or disease susceptibility can disrupt ecosystem function. Predators and parasites are natural stressors that regulate Daphnia populations. This study examines the interactive effects of environmentally realistic concentrations of the neonicotinoid insecticide imidacloprid, predatory kairomones, and the fungal parasite Metschnikowia bicuspidata on the life history traits of Daphnia dentifera. Using a fully factorial design, life tables were constructed to assess survival, reproduction, and infection rates. Results indicate that imidacloprid exposure reduces D. dentifera fitness. These findings highlight the complex interplay of chemical and biological stressors in aquatic environments and provide a more nuanced understanding of neonicotinoid impacts.

Antonio Armagno - Fossil vertebrate diversity of the uppermost Niobrara Chalk (Upper Cretaceous) in western Kansas, and its paleoecological implications

The Smoky Hill Chalk, which is the upper member of the Niobrara Chalk Formation, is a sedimentary rock unit deposited under the Late Cretaceous Western Interior Seaway in North America during a regressive phase of the Niobrara Cyclothem. The Smoky Hill Chalk is known to contain a diverse array of fossil invertebrates and vertebrates, but the taxonomic composition of its vertebrate fauna, particularly smaller taxa in its uppermost part, is less understood. Although vertebrate fossils are generally distributed sparsely in the Smoky Hill Chalk, a stratigraphic horizon rich in vertebrate remains was discovered near the uppermost part of the stratigraphic member, approximately 5 m below the contact with the overlying Pierre Shale Formation, in Logan County, Kansas. Recovered fossil taxa include two identifiable chondrichthyans, at least seven osteichthyan fishes, and three tetrapods. Whereas the most abundant identifiable vertebrate fossils are teeth and palatine bones of Enchodus petrosus, this assemblage encompassed a wide range of trophic regimes. They include small pelagic bony fishes (e.g., Pachyrhizodus, Cimolichthys, and Enchodus), a durophagous benthic fish (Rhinobatos), a shark known as an opportunist or scavenger (Squalicorax), two examples of predatory marine reptiles (mosasaur and

plesiosaur), and a piscivorous diving bird (hesperiornithiform). The collection also includes small phosphatic pebbles interpreted to be coprolites of uncertain origins, some of which contain fragmentary bones of small teleosts as inclusions. This study represents the first collective study of fossil vertebrates from a single stratigraphic horizon within the uppermost part of the Niobrara Chalk.

Helen Winters - Common Garden Study of Local Adaptation in a Dominant Prairie Grass: Characterizing Climate Adaptation for Conservation and Restoration

Tallgrass prairie has been severely degraded in North America and is further threatened by increasing drought and temperatures. Big bluestem (Andropogon gerardi) is a dominant prairie grass that is ecologically and agriculturally important, with a wide native distribution. The purpose of this research was to characterize climate adaptation in A. gerardi to predict future climate responses. Our main question was how 13 A. gerardi populations (CO-NC; TX-Canada) differ based on their climate of origin and what variable (e.g. precipitation or temperature) has the greatest effect on plant traits. We hypothesized that big bluestem would be strongly adapted to precipitation or aridity, with populations from drier sites expressing more traits associated with increased drought tolerance (e.g. thicker and narrower leaves). To test this, plants sourced from across mean annual precipitation (MAP, 475-1275mm/yr) and mean annual temperature (2.5-19.8°C) gradients were planted in a common garden in Manhattan, KS, selected for its high climatic suitability for the species. We measured morphological and physiological traits, then associated these with climate. Precipitation or aridity had the greatest effect on morphology and physiology. Populations from drier climates had decreased biomass, narrower and thicker leaves, more negative leaf water potential, and higher photosynthetic rates, compared to populations from wetter climates. PCA axis 1 explained 68% of the variation and was related to MAP. Results suggest that more drought-tolerant populations of A. gerardi could be planted where increasing drought is predicted. This could help ensure that A. gerardi and the prairie ecosystem is more resilient to drought.

Harriet S Seelam - Blooming Against the Odds: A study comparing the resilience of *Frasera caroliensis* across wetlands, forests, and glades

The reproductive biology of plants can be influenced by environmental factors in which they grow, including variation in habitat (Aguilar et al., 2006), Soil pH, morphological changes, and pollinator visitation (Whitney & Glover, 2007); all of these can affect the seed set production and reproductive success of the plant (Baskin & Baskin, 1986; Brown & Mitchell, 2001). Frasera caroliniensis is a native herbaceous plant widely spread in various habitats in the Midwestern United States. This study investigated how wetlands, glades, and forests affect their morphology, pollination, and reproductive success. We compared soil pH, plant and raceme height, pollinator visitation, and seed set across populations at Shaw Nature Reserve in Gray Summit, MO. Wetland habits exhibit significantly lower soil pH than glade ($p=0.021$), and F. caroliniensis in wetlands produces significantly larger racemes than in forests ($p=0.027$). Despite this, no significant differences in pollinator identity or seed set were found across habits($p=0.34$), with Bombus being the main pollinator over 90% of observed pollination. Additionally, the raceme's position (top and bottom) did not affect the seed set ($p=0.63$). These results show that while habitat influences certain morphological traits, F. caroliniensis maintains consistent pollination and reproductive success across habitats. This ecological resilience of F. caroliniensis highlights its potential value in pollinator conservation in a diverse and changing environment.

Isabella Bastien - Size Me Up: Variation in Sexual Selection on Body Size in Walnut-Infesting Fly

Sexual selection, or the process that favors traits for acquiring mates, is a powerful evolutionary mechanism that can drive trait variation. Body size is one trait that is commonly under sexual selection, but the target and direction of selection for body size is highly variable across mating systems and taxa. When males compete for females, larger males are more successful and there is strong selection for increased male size, such as with elephant seals and stalk eyed flies. In insects, selection often favors increased female size as larger females are able to produce more eggs. We evaluated the potential for sexual selection on body size in Rhagoletis juglandis, a walnut-infesting fly that exhibits both courtship and competition behaviors. We conducted mating trials with one female and two males to assess if females choose a mate based on male body size. Further, we evaluated body size variation in R. juglandis as well as two additional related species (R. completa and R. suavis) to understand how this trait differs between species and the potential implications for variation in sexual selection.

Jesse Wallace - Evaluation of Methods for Extracting Genomic DNA from Historical Wet Crayfish Specimens

Museum collections serve as an indispensable historical archive of biodiversity. Specimens preserved in scientific collections provide a tangible dataset that spans from historical range data to individual structural morphology. More recently, they have also become integral sources of genetic information from historical and ancient populations. This has become popular as DNA extraction methods have improved. However, the action of preserving biological specimens can be highly variable which can produce highly variable amounts of DNA available for capture. This can have significant downstream effects as to what type and quality of data is available from a given specimen in the future. This study set out to evaluate differing methods of DNA extraction on wet museum specimens of Faxonius rusticus. Samples were acquired from the Ohio State University Museum of Biological Diversity (OSUMBD). Sample ages spanned from the earliest available specimen (1871) to freshly acquired individuals (2024). Our investigation measured the mean differences in DNA yield between treatment types, as well as the effects of tissue mass and sample age. Our investigation found that treatment type had a significant effect on DNA yield, with a homemade lysis buffer method beating out commercial kits. Additionally, we also found a weakly positive association between year and yield, and no significant correlation between sample mass and DNA output. Our results suggest that obtaining DNA from museum wet specimens can be possible and cost-effective.

Joseph Patrick Sharon - Fossil marine fishes from the middle Hartland Shale (Upper Cretaceous: u pper Cenomanian) in northcentral Kansas

The Hartland Shale Member of the Greenhorn Limestone, that is distributed in parts of the Midwestern United States, is a sedimentary rock unit deposited in the Western Interior Seaway of North America during the Late Cretaceous. Fossil invertebrates have been well documented from the Hartland Shale, but the overall vertebrate fossil record for the stratigraphic member remains poorly known. Here, we report the first occurrence of nine taxa including chondrichthyans (Microcarcharias saskatchewanensis, Squalicorax curvatus and Scyliorhinidae indet.) and osteichthyans (cf. Caturidae indet., Plethodidae indet., Pachyrizhodus minimus, cf. Strarodus sp., Enchodus gladiolus, E. shumardi, and minimally two additional teleostan taxa) from the middle portion (= upper Cenomanian part) of the Hartland Shale in Washington County, Kansas. The occurrence of these fish taxa from the Hartland Shale is not surprising from the stratigraphic standpoint as most of them have previously been reported from rock units above and below the stratigraphic horizon. However, the relatively large quantity of fossil contents (<150 taxonomically identifiable specimens) and taxonomic diversity (<10 fish taxa) recovered in this study were not

necessarily predicted from the previous interpretation that the deposition of the Hartland Shale took place in an oxygen-poor environment. This present study indicates that the water held a sufficient amount of dissolved oxygen to support these marine taxa that likely formed a complex marine ecosystem during the deposition of the middle Hartland Shale in Kansas.

Joshua Poland - From Container to Competitor: An overview and consequences of Wild Sugarcane's journey from the Panama Canal to the United States

Wild sugarcane (Saccharum spontaneum), a C4 perennial grass, is a highly invasive species in the Panama Canal watershed, where it threatens biodiversity, alters fire regimes, and disrupts ecosystems. Cargo, specifically refrigerated containers, transiting the canal may be global dispersal vectors for sugarcane seeds, which have been demonstrated to be the most abundant taxon entering the U.S. on the air-intake grilles. While wild sugarcane has established disparate populations in Florida, its distribution success is less pronounced in the U.S. as compared to Panama. This study aims to: (1) quantify the abundance of wild sugarcane seeds relative to non-sugarcane seeds at both terminals of the Panama Canal, (2) assess plant community composition in and around the port terminals, (3) investigate microbial interactions between wild sugarcane and other Florida grasses, and (4) integrate ecological and economic models to assess invasion risks and potential impacts. The microbial dynamics and competitive mechanisms between wild sugarcane and native plants, including changes to soil chemistry and habitat suitability, will be explored to understand their role in sugarcane establishment. Additionally, species distribution models combined with economic impact models will be used to evaluate potential costs of widespread wild sugarcane invasion in the U.S. The findings from these projects are to inform biosecurity and management strategies for controlling and/or preventing the spread of this invasive grass species and mitigating its negative impacts.

Kaelin Reichmann - The Relationship Between Body Size and Tooth Size in the Extant Crocodile Shark, Pseudocarcharias kamoharai (Lamniformes: Pseudocarchariidae), and Its Paleobiological Application

The crocodile shark, Pseudocarcharias kamoharai (Matsubara), is an extant lamniform shark. Many aspects of its biology are still poorly understood, including the ontogenetic development of teeth. In this study, we used linear regression analyses to examine the relationship between the total body length (TL) and the tooth crown height (CH) of each tooth in 14 individuals of P. kamoharai ranging from 72-109 cm TL collected from the Pacific and Indian Oceans. The resulting regression equations suggest that the increase in CH of teeth through tooth replacement is generally proportional to an increase in TL, with a high coefficient of determination between TL and CH and high predictability of TL from CH (as high as $r^2 = 0.8937$; $p < 0.0001$) found in teeth located anteriorly (i.e. the so-called "anterior teeth"). This study is significant because it allows TL estimations for the genus Pseudocarcharias in the fossil record, which is represented only by teeth. For example, previously published Pseudocarcharias teeth from the middle Miocene of Italy, include anterior teeth with a complete or nearly complete crown. If our regression equations for the anterior teeth are applied to those fossil teeth, their TL estimates range from 105-231 cm. These estimates are significant because they are considerably larger than the longest recorded TL for the extant P. kamoharai (122 cm), providing new insights into the ancient marine ecosystem.

Mara Dearth - A lover or a fighter? A study on the impacts of climate change on the reproductive biology of Rosa setigera

This study investigates how Rosa setigera, Missouri's native climbing rose, responds to climate change through shifts in reproductive and defensive traits—critical for understanding long-term pollination network stability. By comparing historical herbarium samples from 1836 to the present with field data collected during the 2024 growing season at Shaw Nature Reserve in Gray Summit, MO, we assess changes in bloom timing, plant morphology, and pollinator interactions. This research tests the trade-off hypothesis, which suggests that plants must allocate limited resources between reproduction and defense when faced with environmental stress. Morphological traits such as thorn ratio, flower ratio, and fruit ratio are measured, and pollinator identity is determined through field observations and pollen load analysis. Hand pollinations and fluorescent microscopy are used to assess pollen limitation through pollen tube counts. Results show an earlier bloom season in recent decades, likely due to warming trends, and indicate that R. setigera continues to prioritize reproductive traits over defensive investment. While Bombus spp. remain the dominant pollinators. These findings provide insight into how native species adapt to environmental stress, informing conservation and ecosystem management.

Oscar Spatola - Reproductive Rivals: Comparing glade and prairie habitat effects on the reproductive biology of *Asclepias Tuberosa*

Asclepias tuberosa is a milkweed found in both glade and prairie habitats that could be useful in supporting and restoring pollinator networks in Missouri. This study focuses on the native Missouri plant Asclepias tuberosa in both glade and prairie habitats found at Shaw Nature Reserve. This study also focuses on both abiotic and biotic factors of the two habits and how they impact A. tuberosa's reproductive success and pollination system. Measurements of morphology (height, corolla span, umbel width, inflorescence number, and bud number) and habitat pH were collected. In addition to pollination observations, open and supplemental pollen tube experiments were conducted to determine if reproduction was affected by visitation differences. This study provides a new understanding of the adaptability of A. tuberosa to different habitats and helps evaluate its potential role as a supporter of diverse pollinator networks.

Owen Howard - Exploring the impacts of temperature-induced spinal anomalies on body shape in Astyanax mexicanus (Teleostei: Characidae)

Human-driven climate change is causing global ecological destruction. Notably, the introduction of environmental pollutants and increased water temperatures in aquatic habitats is causing fish populations to experience behavioral and developmental changes, including the emergence of deformities of the spine and vertebrae. In turn, impaired development of the spine can reduce fish fitness by worsening swimming capacity and potentially compromising typical body shape, an adaptively important trait associated with a population's lifestyle and habitat. While temperature is known to influence the development of the spine, it is not well understood how temperature-induced spinal deformities impact external body shape. Here, we describe how temperature-induced spinal anomalies influence the body shape of the Mexican tetra (Astyanax mexicanus). Vertebral fusions, vertebral compressions, vertebral curvatures, and anomalies of the hemal and neural spines were identified in 888 A. mexicanus specimens reared in the lab under different temperature treatments. Geometric morphometrics will be employed to determine the body shape changes associated with spinal anomalies of different categories, quantities, and locations. Based on preliminary data, we anticipate significant shape changes associated with each anomaly type and affected region; in particular, we expect a trend of deeper bodies in individuals with vertebral compressions and the greatest body shape divergence in individuals with hemal and neural anomalies.

Riley Adams - Climate Change Effects on Boreal Conifer Cone Morphology Using Herbarium Specimens

Interactions between climate change drivers and the impacts on tree reproduction and forest regeneration are critical when assessing how forests respond to global change. Regions at higher latitudes have been highly impacted by climate change. The boreal forest is one of the world's most prominent carbon sinks and is experiencing some of the most dramatic warming and precipitation events. Though much research has been done on climate change impacts on mature trees, little has been studied on different life stages, such as tree reproduction. There is a gap in knowledge regarding how forests and reproduction have already changed to adapt to rising CO2 and temperature. The aim of our research is to examine how climate drivers (e.g. temperature, CO2, precipitation) alter cone morphology and seed quantity at broad spatial and temporal scales within the North American boreal forest. We will use herbarium specimens of white spruce (Picea glauca) and black spruce (P. mariana) from between the 1800s to the present and climate variables. Our research objectives are to 1) document variability in cone morphology (e.g., cone length, number of scales, and seed number) over time and 2) relate cone morphology to spatiotemporal patterns of global change. In addition to effects on seeds, this research has broad implications, because seed availability is a key driver in seed consumer populations such as small mammals, birds, and insects.

Sabashton Tabor - Do I like it wet? A morphological study of *Liatris Pycnostachya* visitation success between Wetland and Prairie habitats

Habitat, including both abiotic factors such as pH and biotic factors such as pollination, can play a key role in the reproductive success of a plant. This study investigates the role of habitats in the reproductive success of Liatris pycnostachya, which is a Missouri native species found in both wetland and prairies. Specifically, we examined differences in soil pH, plant morphology, pollinator visitation, and the reproductive success across these habitats. The data was gathered at two wetland and two prairie populations within Shaw Nature Reserve. Soil pH, morphological traits (raceme height, stigma length), pollinator observations, and hand-pollination experiments were done. The results showed no significant differences in soil pH or plant morphology between habitats. The main pollinator was Bombus spp. (99.96%) in both habitats, with no variation in visitation rates and no correlation between floral display size and visitation. However, reproductive success differed by habitat: wetland populations exhibited pollen limitation ($p=0.04$), while prairie populations did not ($p=0.46$). These findings suggest that even with similar pollinator activity and morphology, wetland populations of Liatris pycnostachya experienced lower reproductive success, showing potential constraints on phenotypic adaptability in certain habitats. Further study needed to determine the reasons for lower reproductive success in the wetland habitat populations.

Sarah Johnson - A Morphological Analysis of Terrestrial Arthropod Coprolites from Pennsylvanian Coal Balls of the Illinois Basin

Coal balls are permineralizations originating from the Pennsylvanian subperiod and provide a unique insight into the feeding behaviors of terrestrial arthropods in tropical peat-forming swamps. They form by the precipitation of calcium carbonate in the surface layers of peat, preserving plant fragments and other trace fossils down to the cellular level. Arthropod coprolites (fossilized fecal material) are abundant within coal balls. The size, shape, content, and spatial distribution of coprolites can help determine the arthropods present in these environments and their feeding behaviors. Previous work has assigned coprolites into morphotype categories using visual identification alone. This contribution aims to categorize coprolites originating from coal balls of the Illinois Basin into morphotype categories using a statistical analysis method. The data set consists of over 4200 coprolites sampled from the Phillip's Coal Ball Collection at the University of Illinois–the largest and most significant

collection of coal balls in the world. Dimensional measurements, visual appearance (shape, mastication, contents), and spatial distribution were recorded as characteristics for each coprolite. Coprolites were partitioned into morphotypes using a principal coordinate analysis to cluster coprolites with similar characteristics. The integration of statistical analysis will further the development of coprolite morphotypes and improve our understanding of Pennsylvanian arthropod feeding behaviors.

Poster Session II, Sunday (April 27, 1:00 – 2:30pm)

Anna Salem - Public and private tree diversity: A research design for examining the benefits of urban ecosystems to wildlife from neighborhood to hyper-local level

The research proposed here will examine the tree diversity of historical public trees, recently planted public trees, and private residential trees in Chicago equity areas at three levels in the spatial scale: neighborhood (community area), local (a few city blocks comprising a census tract), and hyperlocal (along individual street segments) levels. Data from field collection will be statistically assessed to measure species richness and diversity index of the native and non-native tree species at each spatial level. Additional literature analysis will compare the biodiversity and nativeness of tree species to their wildlife benefits. I hypothesize that across spatial levels of analysis (1) public historical trees will demonstrate the lowest species diversity, (2) recently planted public trees will demonstrate slightly higher species diversity, and (3) private trees will demonstrate the highest species diversity, when comparing across the three subpopulations. Public and private tree diversity also has implications for the use of trees to manage urban heat, stormwater, and air pollution, and thus can inform urban planners, policy makers, and forestry management in creating long-term sustainable ecosystems.

Anne-Danielle Aka - Secret Ultraviolet Signaling in Fish

Many animals use coloration to communicate, sending signals detected by others and prompting a response. In aquatic environments, signaling varies due to lighting changes caused by depth and dissolved materials. Teleost fishes exhibit remarkable visual diversity, including UV-sensitive cone cells. While some species display UV patterns, the scope of UV vision and coloration in North American fish remains elusive. Hypotheses about UV signaling evolution include its connection to sexual selection, where UV signals distinguish sexes or correlate with male traits. Another theory suggests UV signals act as private communication channels, hidden from predators and effective at close range. A third hypothesis highlights UV markings as aids in individual recognition, often around facial patterns. Lastly, UV coloration may camouflage species, even those without UV sensitivity. My research investigates the evolution of visual systems and UV color patterns in Midwestern fish. I will assay UV patterns, color vision, and lighting conditions in Illinois stream fish to assess phenotypic diversity within a shared visual environment. By imaging different species under visible and UV light with UV-sensitive imaging systems, I will determine which species have a presence (or absence) of UV coloration and whether it is sexually dimorphic. Additionally, I will use Illumina through retinal sequencing to determine which species possess the primary opsin for UV light detection, SWS1. Documenting the diverse perspectives of understudied teleosts provides insight into fitness-related activities (e.g., mate advertising, conspecific competition, and predator avoidance). This work contributes to understanding species-specific ecologies and illustrates sexual selection's influence on visual communication.

April Jungo-Garcia - Modeling Canine Distemper Virus transmission among wildlife in Ohio

Gray fox populations have declined in the Midwest, with a tenfold decrease in minimum harvest levels from 1980 to 2015. Potential causes include habitat loss, competition, and disease, with canine distemper virus (CDV)—which causes fever, respiratory, and neurological issues—emerging as a likely contributor. In Ohio, from 2015 to 2017, CDV was the leading cause of mortality among collared gray foxes, suggesting its possible role in population decline. However, the source of CDV transmission remains unclear. It is uncertain whether Ohio's gray fox populations are large enough to sustain CDV transmission or if they contract the virus from other species. To investigate, we developed a susceptible-infected-removed (SIR) model representing multiple wildlife populations and varying contact rates. The model was calibrated using field data and peer-reviewed literature to estimate CDV transmission within gray fox populations. The results indicated that if an epidemic were occurring, case counts would be very low (1-3 infected individuals per year). This suggests that gray foxes are not experiencing a widespread outbreak or that prevalence is too low to detect without a large sample size. Overall, low case counts imply that CDV alone is unlikely to be the primary cause of gray fox population declines. The results of this study can help wildlife management make informed decisions about which aspects of gray fox decline should be prioritized.

August Wilson - Preliminary analysis of the visual acuity of *Terrapene ornata*

Visual acuity is a measure of the finest detail an organism can resolve. Visual acuity is relevant to ecological studies to build a more robust profile of the species and by providing insight into an animal's ability to perceive their environment. It provides context for how animals obtain resources, move within their home-range, and interact with others. For example, navigation in a dense grassland habitat should require acute vision to discern the movement of grass blades versus threats or possible food items. One standard measure of visual acuity is cycles per degree (cpd), which can be tested using high contrast, evenly spaced vertical grating, where the smallest distinguishable grating size is represented in cpd[1]. This study assessed the visual acuity in cpd of 70 wild ornate box turtles, Terrapene ornata, using moving grating cycles. The movement stimulated the turtles' optokinetic response/reflex (OKR) as head movements following the grating. These head movements allowed their visual acuity to be tested without the need for extensive training or invasive procedures. Preliminary data analysis indicates the visual acuity of Terrapene ornata positively relates to distance from the focal point, with no significant relationships with morphometric variables. It also indicates testing responsiveness trends with sex. These finds of visual acuity are novel in the study of Terrapene ornata; they provide new context for study of the turtle's foraging, movement, and responses to threats, and add a common parameter for comparison across species.

Brianna Neubacher - Balancing the options: female egg load impacts mating decisions in a walnut-infesting fly

Courtship behaviors set the stage for mate choice by allowing for the display of mating traits or the evaluation of a potential mate's species, sex, or quality. But, how an individual makes mate choice decisions can also be dependent on intrinsic traits. One trait that be highly impactful is egg load. For example, females that are approaching the ideal time to lay eggs often show relaxed choice to lower quality males; by decreasing choosiness, they avoid missing out on the chance entirely to fertilize their eggs. Larger individuals that can invest more resources into egg production increase their opportunities for mating and, in turn, their choosiness. We evaluated how egg load impacts mating decisions in Rhagoletis juglandis, a walnut-infesting fly. We recorded mating trials and calculated latency to copulation and copulation duration, then dissected the females to tally egg

count. Preliminary results show that females with more eggs are older, larger, and more eager to mate. Future work will investigate how this trait differs between species and the potential implications for variation in sexual selection.

Dariana Gomez - The effects of thermal stress on treehopper reproduction and sperm transfer

Temperature experienced across the life cycle--from early development to temperatures during mating--affect nearly every aspect of reproduction in insects, from mating behavior to reproductive output. Thermal stress--both cold and hot stress--can have particularly disruptive effects on reproduction, and these effects can be highly sensitive to the timing of exposure. Here, we tested the effects of cold stress and hot stress experienced at different life stages in a plant-feeding insect, Enchenopa binotata treehoppers. We collected recently-hatched juveniles from the field, maintained them at 23ºC on plants in the laboratory, and exposed them to either three days of cold stress (18ºC) or three days of hot stress (28ºC), or no stress, at three different life stages: late juvenile stage, early adult stage, and just prior to mating. Next, we paired individuals from the same treatment groups in mating trials at 23ºC and quantified the likelihood of mating, the number of mating attempts, and the latency and duration of mating in successful trials. We then dissected mated females to retrieve the sperm storage organ and counted sperm transferred with a hemocytometer. We found that cold stress, but not hot stress, affected the likelihood of mating, with increased mating rates when cold stress was experienced during juvenile and early adult stages. We found no effects of thermal stress on any other behaviors measured, nor on sperm transfer. These results demonstrate that thermal stress on different life stages can have an impact on mating behaviors, which can shape fitness and population dynamics.

Erik Johnson - Asymmetry in Livebearing Fish

Asymetric traits are ubiquitous among animal families including livebearing fishes. Some livebearers express asymmetric genital structures, including species in the genera Carlhubbsia, Phallicthys, Phalloceros, Poeciliopsis, and Xenophallus. In all but Phalloceros, asymmetry occurs in the male genitalia, in a structure known as the gonopodium, the modified anal fin used in sperm transfer. While the asymmetric structure of the gonopodium in these species is well-described, why this asymmetry occurs is not known. And we know relatively little about asymmetric behavior and brain lateralization in these fishes, and how these relate to gonopodium asymmetry. My research systematically tackles the paradox of handedness. Building on work I have already completed, I am now focused on understanding the origin and maintenance of trait asymmetries in livebearers.

Franceska Isufaj - Blooming Resilience: The Impact of Winter Drought on *Phlox pilosa*

Drought winters can impact reproductive biology and plant-pollinator networks, potentially altering ecosystem dynamics. This study investigates how drought winters affect the reproductive biology of Phlox pilosa, a native Missouri flowering plant at Shaw Nature Reserve, which experiences drought winters. Specifically, we addressed four key questions: (1) Does the morphology of P. pilosa differ between drought and non-drought winters? (2) Who are the primary pollinators during drought and non-drought winters? (3) Is there a correlation between display size and pollinator visitation rate? (4) Are P. pilosa pollen-limited in drought or non-drought winters? From 2021 to 2024, we assessed morphology, pollinator visitation, and pollen limitation. In the extreme drought winter of 2024, P. pilosa showed significant morphological changes, such as reduced plant height, smaller corolla size, and larger floral tube openings. Halictid bees were the primary pollinators most years, but during the drought winter, pollination rates dropped, and a wider variety of visitors contributed. No correlation was found between floral display size and pollinator visitation. Despite these changes, hand-pollination experiments revealed that P. pilosa was not pollen-limited, demonstrating its reproductive resilience. These findings suggest that drought winters

affect the morphology and pollination dynamics of P. pilosa, yet the species remains robust under changing climates. Its resilience underscores the potential of P. pilosa as a valuable resource for pollinator conservation in the face of climate change. Further research is needed to explore its role in supporting pollinator diversity in climate-impacted ecosystems.

Gabby Canning and Grace Lough - Illuminating the Impact: Artificial Light at Night Enhances Herbivore Damage on Red Maple Trees

Artificial Light at Night (ALAN) can have a biological effect on both plants and animals. In this study, we looked at how ALAN affected leaf herbivory on Acer rubrum trees on an urban university campus. Using a light meter, we determined the dark side (least lit) and the highest light intensity side of 34 A. rubrum trees on St. Louis University's north campus. Four randomly selected leaves were taken from each side at two time points in the fall, totaling 16 leaves per tree (n=544 leaves total). We used the LeafByte software to measure the damage percentage for each leaf. We found that trees with the most light intensity had the greatest percentage of herbivory damage ($p<0.001$), but only on the well lit side of the tree. This suggests that increased ALAN in urban environments may increase herbivore damage for urban plants. Further studies should consider increasing sample size beyond SLU's campus and examining other tree species. By examining how ALAN intensity impacts urban ecosystems, we hope to contribute more information on the limited ALAN observational studies.

John de Abreu - Gene Flow and Species Delimitation in *Cladia aggregata*

Cladia aggregata is a group of lichen-forming fungi comprising multiple species which are difficult to differentiate. C. aggregata has a wide distribution on several different continents but is primarily found in the southern hemisphere. We aimed to further delimit the species complex while also investigating the relationships between the different species, where they can be found geographically, and what phenotypic traits they possess. We used Restriction Site Associated DNA Sequencing (RADseq) to compare thousands of loci across 90 individuals from the Americas, Asia, and Australasia. We used several methods to study the phylogenetics and populations genetics of our samples. Our results suggest that the samples from Asia represent a distinct species and that there is potentially a distinct South America Species. It is difficult to differentiate between incomplete linage sorting and maintained gene flow.

Kaitlyn Scott - Comparison of the Thermal Ecology of Ornate Box turtles (*Terrapene ornata*) across two distinct populations

Thermal ecology includes investigating interactions between temperature and organismal function . These temperature interactions can influence an organism's physiology, their relationship with the environment, as well as their behavioral patterns. Body temperature also plays a role in an organism's metabolism, digestion rate, growth rate, heart rate, and immune function. Studying the bioenergetics of an animal can provide more information on their overall health and performance (including movement, disease spread/parasitism, mating, and reproduction). Currently, the effects of climate change are being studied in agriculture, species range shifting, and changing ocean dynamics, yet little is known about the effects of temperature change with respect to some of Kansas' local fauna, especially with respect to ectotherms. In our study, we investigated the thermal ecology of two distinct populations of Ornate Box Turtles (Terrapene ornata) by closely monitoring their shell temperature (as a proxy for body temperature) simultaneously with their movement patterns, microhabitat use, range size, and mating behaviors. Our findings show clear differences in average temperature and variability within and between populations of turtles and distinctly differently temperature profiles during their primary morning active period which likely has important consequences for individual fitness and population-level persistence in the face of

changing climate. These data will also serve as an important baseline when examining box turtle thermal ecology in future studies.

Kyle Curran - Effect of Microbial Mutualists on Floral Rewards and Biodiversity

Insect pollinators are facing declines in diversity and abundance. Habitat fragmentation and increased climate variability reduce pollinator habitat and can lead to a mismatch on the timing of flowering and when pollinators are present. Floral rewards (pollen and nectar) serve as the bulk of a pollinator's diet, providing the essential nutrients they need to survive. Perturbations like nutrient enrichment of ecosystems could alter the balance of interspecific interactions like the mutualism between plants and pollinators, as changes in resource supply have been demonstrated to cause mutualistic interactions to become more antagonistic. Similarly, plants' ability to invest in floral rewards might be reduced if the resource mutualisms between plants and beneficial microbes break down. For example, associations with rhizobia increase plant nitrogen access, which may influence the nutritional content of legume floral rewards. Rhizobia-associated legumes have been known to receive more pollinator visits than rhizobia-free legumes, despite not producing more flowers. This suggests that microbial symbionts may have indirect positive effects on the plant-pollinator mutualisms, particularly the floral rewards of the plant. To test if greater microbial diversity has beneficial effects on floral rewards, we will conduct field surveys at several different sites on an urbanization gradient with different soil use histories. I expect to observe an increase in floral reward quality and quantity from sites with greater microbial diversity, when compared to those with less diverse soil. I also expect to observe higher rates of pollinator visitation and greater plant and pollinator biodiversity in sites with greater microbial diversity.

Kyliyah Walker - The Effect of Diet on Hydrogen Sulfide Tolerance of Extremophile Fishes

Poecilia mexicana are a species of live-bearing fish that have adapted to surviving in hydrogen sulfide (H2S) abundant waters. Sites that are high in toxic H2S are also characterized by low levels of oxygen, making any organism that inhabits these tough conditions to be deemed extremophiles. Tolerance of these multiple stressors is impacted by numerous external environmental factors. The question being addressed in this study is if diet affects how well these fish tolerate H2S. I used 80 laboratory-bred female P. mexicana originating from two sulfidic and non-sulfidic population. Half of the fish from each population were separated into control and low-food groups. The low food group was fed three days per week while the control group was fed daily. The weights of the two groups were measured and compared at 30-day intervals. After a reduction in body mass is observed in fish from the low-food diet, all fish will undergo sulfide tolerance trials and results will be compared of the differing groups and populations. Results of these trials are still underway, but I expect to see higher H2S tolerance in the sulfidic population and for them to be less affected by a poor diet, as fish who naturally reside in sulfidic environments have lesser-quality diets.

Maddie Smith - Habitat disturbance and biodiversity in glade habitats

The Ozark glades are home to a variety of reptiles, amphibians, rodents, and invertebrates such as tarantulas and scorpions. Glade inhabitants face challenges like habitat fragmentation and degradation, but they could be facing even bigger challenges as outdoor recreation becomes more popular. People looking for wildlife to photograph or collect often look under rocks without leaving them how they were found. This study focused on monitoring rock disturbance at two protected glades- Shaw Nature Preserve and a more accessible undisclosed glade in Jefferson County. Disturbing the glade habitat to look for wildlife is prohibited at both sites. Twenty rocks at each site were chosen at random and monitored from June to October of 2024. During each visit we measured the amount of displacement and biodiversity under each rock.. The rocks were all left in the positions they were found. At the end of the study, we determined that the biodiversity under disturbed rocks was less than undisturbed rocks. This

could mean that wildlife prefers rocks that have not been displaced. In addition, the glade in Jefferson County had a higher percentage of rocks moved by the end of the study than at Shaw Nature Preserve. Disturbance was evident at both sites, indicating that people are looking under the rocks without replacing them correctly, regardless of local rules. Visitors to the glades might not realize the impact they could have on wildlife when they disturb these rocky habitats.

Madeline Green - Order of arrival of microbial partners impacts the outcome of mutualism

Below ground plant mutualists offer many benefits to plant hosts, ranging from assistance in nutrient and water uptake, to nitrogen-fixation. The relationship between plants and their mutualists depends on the resources traded, and could result in different outcomes depending on the order of arrival of microbial mutualists. In addition, stressors can significantly impact plant growth and their ability to fix carbon needed for trading with microbial mutualists. Shade, specifically, limits photosynthesis and can impact carbon allocation to above and belowground structures. Here, we test the effects of order of arrival and shading on the outcome of mutualisms between plants, rhizobia, and arbuscular mycorrhizal fungi. In a full factorial greenhouse experiment, we manipulated shade, presence, and timing of inoculation with rhizobia and mycorrhizae for replicate Chamaecrista fasciculata individuals (shade x 2 + inoculum x 6 + 32 replicates = 384 individuals). We hypothesized that plants growing under ambient light would grow more and be better able to associate and benefit from interactions with microbial mutualists. Additionally, we expected plants growing with more than one mutualist to have greater biomass than those associated only with one. Using linear mixed effect models, we tested the impact of shade and inoculation type on aboveground and belowground biomass. Across all treatments, we find that plants grew less under shade. However, we found that when inoculation with rhizobia happened before or concurrently with mycorrhizae, the benefits of mutualism were greater than when plants were inoculated with mycorrhizae first. Our results suggest that order of arrival in the rhizobia, mycorrhizae and plant mutualisms impacts the outcome of the interaction.

Sara Wuerstl - What are you doing in my swamp? How urbanization impacts the reproductive success of Missouri native species *Iris virginica*

Plant-pollinator networks can be negatively impacted by habitat loss with one of the main contributors being urbanization. Comparing the differences found in the rural and urban habitats can be important in restoring the highly urbanized areas and protecting the existing rural ones. To compare the potential impacts of habitat on reproductive success, Iris virginica was studied in a rural population at Shaw Nature Reserve and in an urban population at Litzsinger Road Ecology Center. In this study, I. virginica is analyzed by examining morphological differences and the pollination system based on the habitat location. Morphological measurements for height of plant, corolla span, and stamen length. Nectar collection was done hourly to demonstrate if the plant was able to replenish nectar levels. Nectar levels are expected to decrease throughout the day with little replenishment due to nectar robbing. Soil samples were collected from each habitat to determine pH. Pollination observations were done at twenty-minute increments combined with insect pollen loads to determine the main pollinator. Hand pollination treatments were done at each population. Pollen tubes were counted from each treatment to determine if I. virginica was pollen limited. After data collection was complete, it was determined that the urban habitat in 2024 was significantly shorter. Nectar production also increased this year but still followed the same trend of decreasing nectar levels throughout the day. This study addresses how abiotic environmental factors, morphology, nectar production, and pollination rates impact the reproductive success of I. virginica in its wetland environment. The information from this study can be further applied to restorative efforts.

Vanessa Palmero - Artificial Light at Night and its Impact on fall Color change: a two-year study of *Acer rubrum* on SLU's campus

Artificial light at night (ALAN) can trigger physiological responses in plants that influence their phenology, growth, and resource allocation. However, recent studies have primarily focused on its effects on spring phenology. Previous studies on fall phenology are limited and show mixed results on the impact of ALAN on changes in leaf color or leaf senescence. This study aims to quantify the effects of ALAN on Acer rubrum fall leaf color change over two years. In 2023, 32 A. rubrum trees were surveyed for leaf color change across Saint Louis University's north campus. We measured leaf color change using the ImageJ program to calculate the proportion of red and green in each leaf at each time point. In the fall of 2024, we re-surveyed light intensity for these same trees, using a Lux meter to gain a more accurate measure of nighttime light levels. Leaves were again analyzed using the same methods as in 2023. Results showed that leaf color change (proportion red) decreased with increasing ALAN intensity, but this trend was only significant in 2024 ($p=0.02$). This suggests that ALAN may delay fall color change in A. rubrum, but the impact may vary by year. Future research should incorporate a third year of data using consistent light measurement methods to clarify the relationship between ALAN and fall leaf color change.