40TH ANNIVERSARY

NATURAL BRIDGE STATE RESORT PARK

Student Poster Session Abstracts

Join us to learn about the botanical research Kentucky's higher education students are conducting during KNPS's 2nd Wildflower Weekend Student Poster Session!

The poster session is walk-through and should be enjoyed at your own pace.

Location: **Woodland Center at Natural Bridge State Resort Park**

Saturday, April 18th – 8:00 - 9:00AM Student Poster Session #1	
Alexander Boyken	University of Kentucky
Will Gibson	University of Kentucky
Isabella Gilliam	Morehead State University
Zach Hackworth	University of Kentucky
Ira Hager	Eastern Kentucky University
Savannah Merriman	Morehead State University

Saturday, April 18th – 12:30 - 1:30PM Student Poster Session #2	
Makaya Brashares	University of Kentucky
Emily Campbell	University of Kentucky
Patricia Leake	University of Kentucky
Zoe McComas	University of Kentucky
Allison Neltner	University of Kentucky
Alexandra Taylor	University of Kentucky

Alexander Boyken
University of Kentucky
Forestry & Natural Resources

Influences of Bark pH and Hardness on Epiphytic Lichen Cover among Rural and Urban Central Hardwood Trees

The drivers of lichen community structure are immensely understudied in Central Hardwood forests. Corticolous (tree-dwelling) lichen cover is driven by several factors, including chemical and physical bark characteristics. We initiated a study to quantify bark characteristics (pH and hardness) and their subsequent influence on lichen development for three central hardwood species: American elm (*Ulmus americana*), common hackberry (*Celtis occidentalis*), and honeylocust (*Gleditsia triacanthos*). For each species, we selected 30 sample trees (15 in rural and 15 in urban settings) and recorded DBH, bark hardness (using a durometer), and lichen cover. Bark samples were collected and processed in the lab to determine pH. Lichen cover varied per a site x species interaction: American elm and honeylocust supported higher lichen covers in urban settings, while lichen cover on common hackberry was higher in rural settings. Among all species, strong differences in bark hardness and pH between rural and urban trees were apparent. Notably, tree DBH and bark hardness were positively related in rural settings for all species, but there was no relationship found among urban trees. To our knowledge, this study presents the first empirical data describing the influence of bark hardness on lichen development. Further data collection will illuminate the role of chemical and physical bark characteristics on lichens colonizing other central hardwood species.

Will Gibson
University of Kentucky
Forestry & Natural Resources

Quantifying Habitat Characteristics of Venus Flytraps in Fire-Dominated Longleaf Pine Savanna

The Venus flytrap (*Dionaea muscipula*) is a carnivorous plant endemic to the Coastal Plain of North and South Carolina. The species is classified as state threatened/endangered across its native range, with habitat degradation/loss cited as primary threats. Despite widespread familiarity in horticulture, data on the species' ecology outside a captive setting are sparse, precluding a meaningful understanding of its habitat needs and the development of effective conservation strategies. We aimed to develop effective monitoring protocols for this species that maximize detection probability and quantify landscape- and micro-scale habitat associations in its native range and primary habitat, longleaf pine (*Pinus palustris*) savanna. Single-season occupancy models revealed that flytrap detection probability was maximized during flowering ($p = 0.84$; non-flowering, $p = 0.30$). At a micro-habitat scale, time-since-burn (via prescribed fire) was the greatest predictor of flytrap occupancy. At a landscape scale, various biotic (e.g., distance to mature pine forest) and abiotic factors (e.g., elevation) yielded highest probability of occurrence along wetland edges. Using our landscape model, we plotted flytrap habitat quality across a well-managed longleaf pine savanna and found quality flytrap habitat (probability > 0.8) to be relatively rare (1.35% of landscape). Still, our field testing of the model with 60 transects revealed three previously undiscovered subpopulations. Collectively, these data provide a rigorous examination of the factors influencing flytrap occurrence, detection, and occupancy. Our results suggest that land managers aiming to conserve flytraps should target longleaf pine savanna where a short fire return interval (< 2 yr) is employed along wetland ecotones.

Isabella Gilliam
Morehead State University
Biology

Species/Area Relationships of Lichens and Bryophytes within a Stream Mesohabitat at the Ed Mabry - Laurel Gorge Wildlife Management Area

Biodiversity patterns have long been an area of fascination for ecologists. This research project is part of a long-term study aimed at examining the species/area relationships of lichens and bryophytes across a range of scales and mesohabitats in forest ecosystems. Lichens are living partnerships between a fungus and a photosynthetic partner (usually algae or cyanobacteria) that function together as a single organism. Bryophytes include mosses, liverworts, and hornworts. Lichens and bryophytes serve as habitats for many animals and are effective indicators of air quality since they are highly sensitive to pollution. The Ed Mabry – Laurel Gorge Wildlife Management Area is a protected natural area in western Elliott County, Kentucky. The area is characterized by sandstone gorges, steep slopes, and rocky outcrops, creating variation in moisture, light availability, and substrate type. The stream mesohabitat in these gorges is dominated by *Tsuga canadensis*, *Tilia americana*, *Acer saccharum*, *Liriodendron tulipifera*, and *Platanus occidentalis*. The objective of this project is to examine species/area relationships for bryophytes and lichens across increasing plot sizes within a stream mesohabitat of Clifty Creek, a tributary of Laurel Creek.

Field sampling was conducted across multiple microhabitats within a stream mesohabitat. Microhabitats surveyed included sandstone boulders, limestone boulders, sandstone cobbles, limestone cobbles, limestone outcrops, sandy soil, litterfall, logs with bark, logs without bark, living trees, and *Rhododendron* leaves. Lichen and bryophyte species were inventoried within plots at four scales: $1m^2$, $5m^2$, $100m^2$, and $1000m^2$. Lichen and bryophyte specimens were collected in paper bags and allowed to dry. Specimens were examined using dissecting and compound microscopes. Lichen identification was supported by standard chemical spot tests, including 10% KOH (K test), full-strength sodium hypochlorite (C test), para-phenylenediamine (P test), and ultraviolet (UV) fluorescence. Identification keys were used to confirm species determinations. Logarithmic functions were used to summarize the species/area relationships for bryophytes and lichens together, lichens only, and bryophytes only. This function was then used to predict species richness for bryophytes and lichens at the $2500m^2$, $5000m^2$, and $10000m^2$ scales. The mean number of species of bryophytes and lichens at the $1m^2$, $5m^2$, $100m^2$, and $1000m^2$ was 2, 5, 54, and 134, respectively. Of these, the average number of lichen species was 0.5, 0, 22, and 42, while bryophyte species accounted for 1.5, 5, 32, and 92 species. The equation for the logarithmic function for both bryophytes and lichens was $y=19.063*\ln(x)-3.789$ ($R^2=0.9078$). Based on this equation, the estimated number of species of lichens and bryophytes collectively at the $2500m^2$, $5000m^2$, and $10000m^2$ plots would be 135, 149, and 162, respectively. At these same scales, the predicted number of lichen species would be 45, 49, and 54, and the number of species of bryophytes would be 91, 99, and 108, respectively.

Zach Hackworth
University of Kentucky
Forestry & Natural Resources

Allelopathic Effects of Dahurian Buckthorn (*Rhamnus davurica*) on Seed Germination

A native of east Asia, Dahurian buckthorn (*Rhamnus davurica* Pall.) is an exotic plant spreading across many peri-urban areas of the USA, including central Kentucky. Since ecological impacts of Dahurian buckthorn to native ecosystems remain largely unstudied, we implemented a study to understand the potential allelopathic influences of Dahurian buckthorn phytochemicals on seed germination. We prepared aqueous solutions of leaf and fruit extract with the following concentrations: 0 (control-water only), 10, 20, 30, and 40 g/L. For each extract and concentration, we prepared 5 Petri dishes, each with 30 radish (*Raphanus sativus*) seeds. 5 mL of extract was applied to the appropriate Petri dish. Seed germination was tallied daily for one week. This experiment was replicated thrice. Although there was no apparent effect of buckthorn fruit, radish seed germination declined with increasing concentration of buckthorn leaf extract. At the highest concentration (40 g/L), radish germination was approximately 40% after 1 week, compared to 99% germination in the control. The results of this study suggest that the propagation of Dahurian buckthorn will likely impair early plant development in central Kentucky ecosystems. More work is needed to understand Dahurian buckthorn's influence on native plant growth.

Ira Hager
Eastern Kentucky University
Biology

Ecology and Seed Germination of *Monarda clinopodia*

There is a growing movement to include native plants in landscapes to foster ecosystem prosperity. As this interest in native plant habitats increases, research on the ecology, cultivation, and conservation of native plant species is needed. *Monarda* L., commonly known as beebalm, is a genus of flowering plants in the mint family (Lamiaceae) that remains largely understudied despite its ecological and horticultural importance, as well as its peak of diversity within the southeastern United States. Utilizing *Monarda clinopodia* as a focal study system, this research seeks to understand seed germination in response to cold-moist stratification and elevated spring temperatures, outline phenological patterns through field observations and a common garden experiment, and to determine if pollinator visitation impacts viable seed production. Results from this study will provide important information for species conservation and restoration efforts, native plant horticulture, and the general public.

Savannah Merriman
Morehead State University
Biology

Investigating Species Richness and Beta Diversity of Lichen and Bryophyte Communities within a Stream Mesohabitat of the Ed Mabry-Laurel Gorge Wildlife Management Area in Northeastern Kentucky

Ecology is the study of distribution and abundance patterns of organisms. This study examined how lichen and bryophyte species distributions and community composition vary across microhabitats within a stream mesohabitat. Lichens are formed from a symbiotic relationship between a fungus and a photosynthetic organism, either an alga or cyanobacterium, while bryophytes are small, non-vascular, spore-producing plants. Both groups are important in biomonitoring, serve as nesting material for birds and arthropods, and possess antibacterial properties with potential pharmaceutical applications. In this study, lichens and bryophytes were collected along the stream mesohabitat of Clifty Creek within the Ed Mabry Laurel Gorge Wildlife Management Area in western Elliott County, Kentucky. The area is geologically characterized by sandstone cliffs above the stream, limestone strata at and just above stream level, and a creek bed composed predominantly of sandstone cobble with some limestone. Microhabitats sampled include sandstone and limestone cobble, sandstone boulders, litterfall, decorticated and bark-covered logs, soil along the stream, and epiphytes on eastern hemlock (Tsuga canadensis) and deciduous trees. Samples were collected from a 1,114 m^2 plot within the study area, placed into paper bags, and later identified in the laboratory at Morehead State University using compound and dissecting microscopes, as well as applicable UV and chemical tests. We evaluated similarity (ranging from 0.0 to 1.0 with 1.0 indicating 100% similarity) between the composition of 23 microhabitats using the Jaccard Index CJ = J/(a+b-j) and determined the species richness values of each microhabitat.

The highest species richness values for both groups by microhabitat were sandstone boulders (43), litterfall from *Tsuga canadensis* (39), living *Tsuga canadensis* (33), and living *Hamamelis virginiana* (22). The Jaccard Index yielded values of 0.04 for the comparison between sandstone and limestone boulders, 0.16 between *Tsuga canadensis* and the living angiosperms collectively, 0.17 between *Hamamelis virginiana* and all other trees, and 0.26 between *Tsuga canadensis* and *Hamamelis virginiana*. High species richness values and the presence of distinctive lichen and bryophyte communities on the eastern hemlock suggest that this tree species is a significant substrate for numerous bryophyte and lichen taxa. Currently, *Tsuga canadensis* populations are significantly declining due to the pervasiveness of hemlock wooly adelgid (*Adelges tsugae*) which may, in turn, directly impact the species richness of lichen and bryophyte communities of eastern Kentucky's forests. The high species richness of epiphytes on *Hamamelis virginiana* was unexpected and occurred on living trees that stretched horizontally across the stream.

Makaya Brashares
University of Kentucky
Entomology

Documenting Connections: A Framework For Database Deposition of Molecular Data And Interacting Taxa

Genetic databases are being expanded rapidly due to the increasing accessibility of molecular tools. However, information being deposited into these databases lacks standardization, limiting the reproducibility of studies especially when species interactions are involved. Pollen barcoding is a method that can be used to gather floral interaction data from museum specimens, which tend to lack this information. The interaction data can be used to better understand what resources a particular bee species currently or previously relied on. This project aims to develop a framework for depositing molecular species data of interacting taxa alongside metadata describing the interaction and the primer sets used in DNA barcoding.

Museum bee specimens from three bee species were selected based on age and presence of visible pollen. We extracted bee and plant DNA from specimen legs using Qiagen DNeasy Blood and Tissue kits, followed by PCR amplification targeting the COI region of the bees and the rbcL and ITS2 regions of the pollen. We sequenced the PCR products using Sanger sequencing and have had success in barcode generation for both bees and associated pollen. Standardizing molecular data deposition with interacting taxa metadata will improve reproducibility and data accessibility. This will support comparative studies on molecular data and streamline ecological research by providing taxa interaction information in databases.

Emily Campbell
University of Kentucky
Agricultural & Medical
Biotechnology

Effect of Tornado Damage and Post-Tornado Management on Forest Soil Microbial Communities in South-Central Kentucky

Tornados are increasing in frequency and intensity in the Southeastern United States, with recent studies suggesting a geographical shift towards south-central Kentucky due to changing climate patterns. While salvage logging is often employed to recover economic value from damaged timber, the heavy machinery used during such operations can compact soil, disrupt its physical structure and alter the recovering plant communities. Collectively, these factors can result in altered microbial populations that are essential for nutrient cycling and ecosystem recovery. Previous research has documented the effect of tornadoes and salvage logging on plant communities; however, there remains a significant gap in understanding how these disturbances—and subsequent plant community recovery—affect soil microbial populations.

To address this gap in knowledge, we stablished a study at Clay Hill Memorial Forest, a 130 ha. nature preserve in Taylor County, Kentucky, where an EF3 tornado disturbed 20 ha. in December 2021. Affected areas were divided into four types based on soil classification, slope, altitude, and aspect. Twelve plots were established, including tornado-disturbed, tornado plus salvage-logged, and undisturbed plots for each plot type. Vegetation surveys were conducted in spring and fall of 2023 and 2024, and soil samples were collected for prokaryotic and fungal community analysis using a metabarcoding approach. Results for the first two years show significant changes in diversity and composition of prokaryote and fungal communities among treatments. Ongoing analyses aim to compare prokaryotic and fungal community composition across disturbance types, identify differently abundant taxa, and assess correlations between microbial communities and plant community composition. We hypothesize fungal and prokaryotic diversity among disturbance levels (tornado vs tornado-salvage) will be different across treatments, and that plant diversity will be an important variable predicting microbial composition. By elucidating microbial responses to tornado and salvage logging, this work will provide critical insights to inform the development of evidence-based, site specific forest management strategies that promote ecosystem recovery and long-term soil health after severe storm damage.

Patricia Leake
University of Kentucky
Agricultural & Medical
Biotechnology

Identifying Bee-Plant Interaction Networks in Diversified Organic Kentucky Farms Using Molecular Tools

Plant-pollinator networks are crucial systems in both agricultural and environmental sustainability. These networks are a system in a defined area that includes all species of flowering plants and the animals that visit those plants. In agriculture, bee pollination is essential for many crops, including watermelon. In our research project, we focus on the interactions between bees and watermelons, as well as the other flowering plants in the landscape. Our objective is to see which bee and plant species interact before, during, and after watermelon bloom. A varied diet is crucial for healthy bee populations and supporting diverse bee communities, as bees will seek different pollen and nectar sources to meet their nutritional needs. Since many flowering crops do not bloom for the entire season, it is important for farmers to provide a variety of floral resources for the bees during the entire growing season. Using the data collected, we seek to provide an effective bee-plant network for farmers growing watermelon crops.

Over the summer of 2025, we visited 5 organic farms in Kentucky growing watermelon before, during, and after the watermelon bloom. During each visit, we collected bees using hand netting and pan traps within a 150m radius of the watermelon plot. While collecting bees via hand netting, we documented the flower species that the bee was collected from. We identified bees to species in the lab using both morphological characteristics and DNA barcoding to identify morphologically difficult taxa, such as *Lasioglossum*. Overall, 1,629 bees were captured, consisting of 63 species in 25 genera. We then used the species interaction data we generated involving comprised of 1,274 bee-plant interactions on 104 floral species to construct interaction networks for bees and plants before, during, and after watermelon bloom. This data can be used to inform planting strategies that increase bee diversity and stability of bee communities, while bolstering those species populations that aid in watermelon pollination.

Zoe McComas
University of Kentucky
Environmental &
Sustainability Studies

The Impact of Emerald Ash Borers and Purple Wintercreeper on Ash Trees in Reforested Urban Sites

Emerald ash borer can threaten ash colonization and regeneration in urban forest fragments. Our study aims to evaluate how multiple invasive species (purple wintercreeper and emerald ash borer) interact to influence ash regeneration in planted urban forest fragments. We surveyed ash regeneration and infestation status, as well as groundcover by invasive species in 10 m fixed radius plots in 3 cells in each of 20 planted forest sites representing a chronosequence from newly planted to over 20 years old. Additionally, we conducted site-wide surveys to classify ash trees' health status, species, and age. We found that ash trees are regenerating in older plantings; however, these trees are experiencing die off due to infestation before reaching overstory size class. We also found no relationship between purple wintercreeper and site age, suggesting that the purple winter creeper colonizes the planting sites soon after planting. This study provides a precedence for studying ash regeneration in reforested urban sites. Furthermore, it clarifies the potentially interacting roles of multiple invasive species on forest health. This research contributes to the growing body of literature underscoring invasive species as a management concern in urban forests. Urban forests are critical for human and environmental health; invasive species management will be necessary to support long-term, sustainable forest health.

Allison Neltner
University of Kentucky
Biology

Field and Postharvest Production Methods of Natural Yellow and Orange Dyes from *Tagetes erecta*, *Tagetes patula*, and *Cosmos sulphureus*

In recent years, there has been a movement to return to natural fiber dyes considering negative side effects of synthetic dye use. Three prominent natural dye sources (*Tagetes patula*, 3 varieties; *Tagetes erecta*, 5 varieties; *Cosmos sulphureus*, 3 varieties) were planted in both a commercial field plasticulture system and a garden bed setting (a full sun plot and/or a shaded plot) to test production efficiency and dye quality. A detailed log of harvesting data was collected and used to determine the yields of plants at each site. After harvesting, plant material was dried on greenhouse benches or in a drying oven for long-term storage. Bench drying methods included covering with black out cloth (99% light deprivation), knitted shade cloth (90% light deprivation), and charcoal fiberglass window screen mesh (no light deprivation). Plant material was removed when dried. Oven-drying was completed at 140 °F over a 48-hour period. Preliminary results found that *Tagetes erecta* outperformed other tested plant material for both fresh and dry weight production, and that oven drying was the most efficient processing method. This study underscores the need for future, focused horticultural natural dye research, whilst providing proof of concept for both localized production and home gardening.

Alexandra Taylor
University of Kentucky
Agricultural & Medical
Biotechnology

Genetic Diversity of Asteraceae on the University of Kentucky's Campus

When planning pollinator gardens, the focus is often on planting for the pollinating insects themselves and exploring the benefits of regionally native host plants. However, there is potential here to utilize these pollinator gardens not only for pollinator conservation, but also to conserve the diversity of the plants themselves. Unfortunately, not much data has been collected to be able to test this theory. In this study, I will be looking at the current genetic diversity that the University of Kentucky (Lexington, KY, USA) has within its pollinator gardens. Native plants within the family Asteraceae will be the focus of this project, as it is a large family with many common native species that are chosen for pollinator garden use. Samples will be taken from individuals across 13 pollinator gardens that are identified to be species in the family Asteraceae. A representative sample of the main stem, mature leaves, flowers, and any other diagnostic traits will be collected to be scanned in a high-resolution scanner with a scale to make proper identification easier, and to be able to observe and measure any morphological diversity present. Three main rounds of sampling will be done (fall 2025, spring 2026, summer 2026), allowing us to capture more accurate data across a variety of seasons. So far, 35 individuals within 18 species from the fall blooming cohort have been identified, sampled, and accessioned. Once scanned and accessioned, young leaves and buds will be plucked and stored in labeled vials in −80 C storage for DNA extraction and genomic sequencing. After sequencing, intraspecific genetic diversity throughout the campus will be analyzed and the overall species richness can be modeled. This study seeks to inventory the current diversity within Asteraceae on the University of Kentucky’s campus, and hopes to provide information that will be useful in guiding future decisions and research regarding urban pollinator gardens and their role in conservation.