



4<sup>th</sup> Annual  
St. Louis Ecology, Evolution, and Conservation (SLEEC)  
Retreat  
Southern Illinois University Edwardsville

September 27, 2014  
Schedule

0800 **Bagels and coffee**; signing in; setting up posters and talks

**First morning session:**

0900 Welcome and Introduction: Bob Marquis (UMSL and the Harris Center)

0905 Greetings from Southern Illinois University Edwardsville: Dr. Aldemaro Romero, Jr.,  
Dean College Arts and Sciences, SIUE

0915 DUVERNELL, DAVID (SIUE). Historical phylogeography and contemporary interactions  
among members of a topminnow species complex.

0930 CALLEN, STEVEN T., and Allison J. Miller (SLU). Signatures of niche shift following  
the introduction of kudzu (*Pueraria montana*) into North America.

0945 GUTIÉRREZ-JIMÉNEZ, LETICIA, and Robert E. Ricklefs (UMSL). Tales of  
biodiversity, rodents and pathogens: Can we reduce disease risk?

1000 MERZ, BOB (STL Zoo). American burying beetle conservation.

1015 MILLER, JAMES (MOBOT). Using available plant specimen data for rapid conservation  
assessments.

1030 **Coffee and posters**

**Second morning session:**

1100 SMITH, JEFF, Joan E. Strassmann, and David C. Queller (WashU). Fine-scale spatial  
ecology drives relatedness in a cooperative amoeba

1115 ESSNER, RICK (SIUE). Landing in basal frogs: evidence of saltational patterns in the evolution of anuran locomotion.

1130 FOWLER-FINN, KASEY D., and Rafael L. Rodriguez (SLU). Mate choice as a mechanism for local adaptation and ecological divergence.

1145 HART, ROBBIE (UMSL). Climate Impacts on Himalayan plant phenology: insights from ecology, natural history collections, and traditional knowledge.

1200 REED, LEIGHTON (MOBOT). How and where should we restore tropical forests?

**1215 Lunch break and posters**

**Afternoon session**

1400 SUKHUM, KIMBERLEY, Megan Freiler, Robert Wang, Bruce A. Carlson (WashU). The costs of extreme encephalization: Bigger brains result in increased energetic demand and reduced hypoxia tolerance in weakly electric African fishes.

1415 Lv, Jie, and ZHENGUO LIN (SLU). Highly heterogeneous patterns of genome divergence between different yeast lineages.

1430 TAYLOR, CHARLOTTE and Burgund Bassüner (MOBOT). Diversity patterns in neotropical plants: The Rubiaceae (quinine) family.

1445 QI, XINSHUAI, Cynthia Vigueira, BK Song, Yan Liu, Ana Caicedo, Yulin Jia, and Kenneth M. Olsen (WashU). Comparative QTL mapping, population genetics, and the parallel evolution of weedy rice.

1500 MILLER, ELIOTT (UMSL), Sarah K. Wagner, Mark Westoby, Robert E. Ricklefs. [Habitat and niche relationships across the phylogeny of Australian honeyeaters](#)

**1515 Coffee and posters**

**Keynote address**

1615 PETERSON, TOWNSEND (The University of Kansas Biodiversity Institute): How complex is biological diversification: What simple virtual species can teach us

1715 Concluding remarks

**1830 Happy Hour and Dinner**

ST. LOUIS SLEEC FALL 2014 RETREAT  
ORAL PRESENTATIONS

CALLEN, STEVEN T. (scallen@slu.edu); Allison J. Miller (amille75@slu.edu). Department of Biology, Saint Louis University. 3507 Laclede Ave, Saint Louis, MO 63103. Signatures of niche shift following the introduction of kudzu (*Pueraria montana*) into North America.

Climate is an important factor limiting organismal distributions in native and introduced ranges. Some species' introduced ranges retain the climatic characteristics of their native range (stability/conservatism), whereas others undergo a niche shift. Recent advances further partition niche shift into unfilling and expansion components. Kudzu (*Pueraria montana*) is an aggressive, introduced species in the United States. We compare kudzu's introduced and native climatic niches in climate and geographic spaces using ordination analyses, niche hypothesis tests, and GIS modeling. Results suggest kudzu underwent a niche shift following introduction into North America, expanding into both warmer and colder climates and environments with greater precipitation during dry periods. While some areas occupied in the introduced range were climatically similar to those occupied in the native range, others constituted novel environments. Further, large areas exist in the US where kudzu has not been recorded, but which have analogous climates experienced in the native range.

DUVERNELL, DAVID (dduvern@siue.edu) Southern Illinois University Edwardsville, Edwardsville, IL 62025. Historical phylogeography and contemporary interactions among members of a topminnow species complex.

The *Fundulus notatus* species complex includes multiple species of topminnows with similar ecological requirements and broadly overlapping distributions. The blackstripe topminnow (*F. notatus*) and the black spotted topminnow (*F. olivaceus*) co-occur in numerous drainages throughout the central and southern United States. In drainages where they both occur *F. olivaceus* is typically (though not exclusively) found in headwater habitats, and *F. notatus* is usually restricted to large river habitats. Differences in life history characteristics are generally consistent with predictions for headwater and large river specialists, respectively. Contact zones usually occur at river/tributary confluences where ecological gradients are steep. The prevalence of hybridization varies substantially among contact zones and is greatest in habitats where ecological transitions are most abrupt. Phylogeographic studies establish the reciprocal monophyly of both species. The occurrence of substantial geographic population genetic structure in *F. notatus* compared to that found in *F. olivaceus* indicates a relatively older distribution for *F. notatus*. Throughout most drainages where they both occur, contact has occurred secondarily through more recent range expansion of *F. olivaceus*.

ESSNER, RICK (ressner@siue.edu) Department of Biological Sciences, Southern Illinois University Edwardsville, Edwardsville, IL 62026. Landing in basal frogs: evidence of saltational patterns in the evolution of anuran locomotion.

All frogs are assumed to jump in a similar manner by rapidly extending hindlimbs during the propulsive phase and rotating the limbs forward during flight in order to land forelimbs first. However, studies of jumping behavior are lacking in frogs of the family Leiopelmatidae which diverged from all other frogs (*Lalagobatrachia*) over 200 mya. These semi-aquatic or terrestrial anurans retain a suite of plesiomorphic morphological features and are unique in using an asynchronous (trot-like) rather than synchronous "frog-kick" swimming gait of other frogs. We compared jumping behavior in leiopelmatids to more derived frogs and found that leiopelmatids maintain extended hindlimbs throughout flight and landing phases and do not land on adducted forelimbs. These "belly-flop" landings limit the ability for repeated jumps and are consistent with a riparian origin of jumping in frogs. The unique behavior of leiopelmatids shows that frogs evolved jumping before they perfected landing. Moreover, an inability to rapidly cycle the limbs may provide a functional explanation for the absence of synchronous swimming in leiopelmatids.

FOWLER-FINN, KASEY D. (fowlerfinn@slu.edu) Department of Biology, Saint Louis University. 3507 Laclede Ave, Saint Louis, MO 63103; Rafael L. Rodriguez (rafa@uwm.edu) Department of Biological Sciences, University of Wisconsin-Milwaukee, 3209 N. Maryland Ave, Milwaukee WI 53211. Mate choice as a mechanism for local adaptation and ecological divergence.

Adaptation resulting from mate choice provides a mechanism for the rapid creation of ecological differences among populations. We test the hypothesis that adaptation occurs via mate choice using a quantitative genetics breeding design and two species of *Enchenopa binotata* treehoppers (Hemiptera: Membracidae). These plant-feeding insects show a pattern of diversification in female mate preferences and male mating signals that corresponds to shifts in host plant use. If sexual selection leads to adaptation, we expect that (i) male signals indicate ecological performance, and (ii) females prefer signals of the highest performing males. We found that, in one species, male signals indicate ecological performance, but females do not prefer high-performing genotypes. In the second species, male signals do not indicate ecological performance. Thus, the relative importance of ecological and sexual selection appears to vary across species. Our results unify a diverse suite of expectations about how adaptation and divergence proceed.

GUTIÉRREZ-JIMÉNEZ, LETICIA (letigutierrez@gmail.com) and Robert E. Ricklefs. University of Missouri at Saint Louis, Biology Department, One University Blvd, 63121-4400. Tales of biodiversity, rodents and pathogens: Can we reduce disease risk?

The effect of mammal diversity on human disease risk is poorly known for rodent and tick-borne diseases, especially as relates to their transmission, prevalence, and contagion. The Greater Yellowstone Ecosystem is one of the last remaining locations in the United States which has a high diversity of mammalian species across trophic levels, including top carnivores and large ungulates. This makes the Greater Yellowstone Ecosystem a unique area to explore the dilution effect hypothesis for vector-borne pathogens. Accordingly, areas protected from human disturbance, where top predators and mesocarnivores depress the abundance of rodent species, should exhibit reduced prevalence of vector-borne blood parasites. Controversially, there was a 50% higher rodent density and diversity in the disturbed locations. No significant change was observed in the haemoparasite diversity, although those are more similar in disturbed locations. Understanding how the rodent community moderates disease risk and pathogen transmission emphasizes the public health benefits of rich trophic networks and complex mammalian community assemblages.

HART, ROBBIE (robbiehart@gmail.com) University of Missouri St. Louis. Climate Impacts on Himalayan plant phenology: insights from ecology, natural history collections, and traditional knowledge.

Unsurpassed diversity, endemism, and beauty of rhododendrons in the eastern Himalaya make the genus iconic. Observations by scientists, horticulturalists, and indigenous peoples suggest that temporal patterns (flowering phenology) within and among species are changing with the rapid effects of climate change in the region. Focusing on Yulong Mountain, in the Eastern Himalaya, we investigated change in rhododendron phenology through three lines of evidence: 1) a detailed observational study of rhododendron flowering times among species and elevations on Yulong Mountain; 2) flowering times from more than 10,000 historical specimens of Yulong rhododendron species collected by plant hunters and botanists 1884-2009, now preserved in

natural history collections worldwide and 3) interviews with the indigenous Naxi and Yi residents of the Yulong Mountain area about their traditional ecological knowledge of phenology and their observations of change. Together, these data complement and reinforce each other to paint a picture of an intricate spatial and temporal patterning that is subject to disruption by climate change, and to demonstrate the use of data from disparate domains in inferring past change.

Lv, Jie ([jie.lv@rice.edu](mailto:jie.lv@rice.edu)), Department of Ecology and Evolutionary Biology, Rice University, and LIN, ZHENGUO ([zhenguolin@slu.edu](mailto:zhenguolin@slu.edu)), Department of Biology, Saint Louis University, 3507 Laclede Ave, Saint Louis, MO 63103. Highly heterogeneous patterns of genome divergence between different yeast lineages.

The availability of large numbers of complete genomes in many yeast species offers an unprecedented opportunity to examine how genomes have diverged over time and its impacts on the evolution of biodiversity. The budding yeasts and fission yeasts diverged about 500 million years ago, but there is a huge disparity in species richness between the two lineages (~1000 budding yeast species vs. 4 fission yeast species), which is remain unexplained. Here, we employed comparative genomics methods to comprehensively characterize and compare the genome divergence patterns for the two lineages. Our study revealed that the rate of gene order divergence in fission yeasts is about four times slower than that of budding yeasts. In addition, the divergence of gene content in fission yeasts is highly limited. The different evolutionary patterns of genome architecture and gene content between the two lineages may have contributed to the disparity in species richness.

MERZ, BOB ([merz@stlzoo.org](mailto:merz@stlzoo.org)), Zoological Manager of Invertebrates, Saint Louis Zoo, One Government Drive, St. Louis MO 63110. American burying beetle conservation.

As a bright red-orange insect that embalms carrion with naturally secreted fluid, the American Burying Beetle is a necessary part of our ecosystem. These insects are responsible for recycling decomposing components back into the environment. Unfortunately, the American burying beetle has been on decline for many years now. The Saint Louis Zoo is committed to working with conservation organizations to assist with declining populations of native flora and fauna. The Center has successfully bred thousands of American burying beetles on the Zoo campus. Working with U.S. Fish & Wildlife Service, the Missouri Department of Conservation and The Nature Conservancy, the Zoo is reintroducing captive beetles to Southwest Missouri since 2012.

MILLER, ELIOT ([eliot.isaac@gmail.com](mailto:eliot.isaac@gmail.com)), Department of Biology, University of Missouri-St. Louis, One University Blvd., St. Louis, MO 63121, Sarah K. Wagner, U. of Colorado, Mark Westoby, Macquarie University, Robert E. Ricklefs, UMSL. [Habitat and niche relationships across the phylogeny of Australian honeyeaters.](#)

Recent evidence strongly supports the notion that, on a continental scale, phylogenetic niche conservatism influences which species occur where. What about that other cherished ecological force, competition? Does it influence species' distributions? Do species partition available niche space? What does available niche space even look like? We detail our approach for quantifying [foraging](#) niche size and partitioning among 75 Australian honeyeater species. We show that species tend to occupy characteristic and somewhat restricted portions of niche space, but that [extensive](#) niche overlap is the overriding signal among co-occurring species. Instead of occupying smaller niches, more finely partitioning available niche space, or occupying larger

total assemblage niche space, species from **species-rich** regions simply overlap more in niche space. We discuss implications for community assembly processes.

MILLER, JAMES (james.miller@mobot.org), Research Division, Missouri Botanical Garden, PO Box 299, St Louis, MO 63166-0299. Using available plant specimen data for rapid conservation assessments.

It has been estimated that more than a quarter and perhaps even close to half of the world's plant species are in some danger of possible extinction in the next 50 years. Several systems for assessing the conservation status of plants have been developed and are in wide use but none have completed assessments for more than a tiny percentage of known plant species. The most widely used method, the IUCN's Red List, which can be used for many kinds of organisms and has been very successful in completing assessments for mammals, birds, and amphibians, has completed assessments for only about 15,000 species. The Red List process is complicated and data demanding. A new method that provides a simple approximation of Red List assessments was developed based on calculated Extent of Occurrence (EOO) from locality data taken from herbarium specimens with data available in databases. Those species with EOO values less than 20,000 km<sup>2</sup> are considered "At Risk," a term chosen to not overlap with IUCN's terminology but roughly equivalent to the Red List category of Threatened. Analysis of the 2,025 native species of plants from Puerto Rico identifies 570 with EOO values less than 20,000 km<sup>2</sup>, and therefore At Risk. A more complete analysis using procedures for IUCN's Red List produces nearly identical results, indicating that even limited available specimen data provide a reliable predictor of conservation status.

PETERSON, TOWNSEND (town@ku.edu), Department of Ecology & Evolutionary Biology, University of Kansas Biodiversity Institute, 1450 Jayhawk Blvd, Lawrence, KS 66045. How complex is biological diversification: What simple virtual species can tell us.

Biodiversity is assorted unevenly across the surface of the planet. Well-known patterns include greater diversity in lowland tropical areas compared with montane tropical areas, on continents as compared with on islands, and at low latitudes compared with high latitudes, but the processes underlying global patterns remain elusive and poorly understood. Here, I present a series of explorations of real and virtual species, illustrating geographic and ecological processes that have led to diversification. In particular, I analyze a series of simple virtual species (yes, attend this seminar and you will learn about the marvelous "Kansas Species"!), and explore lessons that they can teach regarding biological diversification on regional, continental, and global scales.

QI, XINSHUAI (qxs@wustl.edu), Cynthia Vigueira, BK Song, Yan Liu, Ana Caicedo, Yulin Jia, Kenneth M. Olsen. Department of Biology, Washington University in St. Louis, St. Louis, MO 63130. Comparative QTL mapping, population genetics, and the parallel evolution of weedy rice.

Agricultural weeds related to crops are especially challenging to agriculture. Understanding the origin and evolutionary history of these weeds is not only essential for weed control, but also of great interest to evolutionary biologists. In recent years, a worldwide crop mimic, weedy rice (*Oryza sativa* L., also called red rice), has infested rice fields and caused major reductions in crop yield. In the US, there are two major weedy rice strains, straw hull (SH) and black hull awned (BHA), that have been identified. Genetic surveys have demonstrated that they were derived from two Asian domesticated rice varieties: *indica* and *aus*. However, it is still unclear whether this parallel evolution of weediness has occurred through shared genetic mechanisms or

not. Another question is the extent to which weedy rice populations found in world regions with wild *Oryza* species, such as Southeast Asia, have been influenced by genetic introgression from the wild populations. Here we first used GBS-derived SNPs to construct genetic maps of two F5 recombinant inbred line populations, derived from crosses between each US weed form and *indica* rice. With dense SNPs across the rice genome, we were able to create two fine scale linkage maps, and identified 53 weedy rice QTLs. The mapping results showed that the similar phenotypic traits in the two US weedy rice strains are primarily controlled by different genetic mechanisms. We then did a parallel population genetic study focusing on the comparative weedy rice origins between the US, South Korea and Southeast Asia. *STRUCTURE* and PCoA analyses suggest that weedy rice populations in Cambodia, Thailand, Vietnam and Indonesia has a genetic admixture of crop and wild rice, which is different from the US, South Korea and Malaysian weedy rice. Our studies demonstrate multiple, parallel origins of weedy rice. This knowledge of weed origins is essential for future weedy rice control strategies.

REED, LEIGHTON (j.leighton.reid@gmail.com), Center for Conservation and Sustainable Development, Missouri Botanical Garden, PO Box 299, St Louis, MO 63166-0299. How and where should we restore tropical forests?

The pace and extent of tropical forest regeneration on former agricultural lands will partially determine what proportion of global biodiversity persists into the 22nd century. To this end, I aim to understand how and where we can best expend resources to accelerate forest succession. In a restoration experiment in southern Costa Rica, planting trees attracted fruit-eating birds (but not bats), enriching seed rain and seedling recruitment. Small tree islands accelerated forest development to a similar degree as extensive tree plantations, suggesting that these may be a cost-effective alternative. Whereas tree planting can stimulate recolonization by plants and animals on severely degraded or isolated sites, in many places secondary forests are regenerating on their own. Will these new forests last long enough to become habitat for deep-forest species? If not, are there ways to accelerate development of old-growth forest attributes?

SMITH, JEFF (jeffsmith@wustl.edu); Joan E. Strassmann; David C. Queller. Department of Biology, Washington University in St. Louis, St. Louis, MO 63130. Fine-scale spatial ecology drives relatedness in a cooperative amoeba.

The outcome of social evolution depends critically on the genetic structure of social interactions -- who interacts with whom. Microbes participate in a wide variety of social behaviors, but the determinants of microbial social structure are largely unknown. Here we show that social structure among cooperative *Dictyostelium* amoebae is strongly determined by the spatial population ecology of dispersal at surprisingly small scales. Grazing amoebae do not intermix much, creating substantial genetic relatedness in multicellular fruiting bodies when the cells colonizing a feeding site are separated on average by just a few millimeters. Even adjacent fruiting bodies can consist of substantially different genotypes. Soil populations of amoebae are sparse enough to create substantial relatedness through spatial structure alone. These results account for the otherwise unexplained high relatedness in fruiting bodies from natural habitats and show how microbial social structure is determined by the interaction between spatial population ecology and cellular behavior.

SUKHUM, KIMBERLEY (kvsukhum@gmail.com), Megan Freiler, Robert Wang, Bruce A. Carlson. Department of Biology, Washington University in St. Louis, St. Louis, MO 63130. The

costs of extreme encephalization: Bigger brains result in increased energetic demand and reduced hypoxia tolerance in weakly electric African fishes.

A large brain offers several advantages including an increased ability to adapt to new environments, forage for food, and develop social networks. However, brain tissue is very energetically costly. So how do animals balance the costs of extreme encephalization? Multiple hypotheses have been suggested for how a species could accommodate the costs of an increase in brain tissue, including decreasing the size of other energetically expensive tissues or increasing overall energy consumption. We show that in the mormyrid family of electric fishes, there is not a trade-off in organ size, but instead large-brained fish have increased basal metabolic rates. We also show that an increase in brain size and energy demand comes with decreased hypoxia tolerance in large-brained fish. These findings likely relate to species differences in behavior and ecology, and may have implications for conservation efforts as hypoxic and anoxic environments increase globally as a result of human activities.

TAYLOR, CHARLOTTE (Charlotte.Taylor@mobot.org), Research Department, Missouri Botanical Garden, P.O. Box 299, St. Louis, MO 63166 USA & Burgund Bassüner (MBG). Diversity patterns in neotropical plants: The Rubiaceae (quinine) family.

Finding patterns in the natural world is basic to scientific inquiry. Herbarium specimen data detail distribution patterns in Neotropical plants, and these patterns can then be studied in the context of geographic and environmental factors; data quality is very important here to seeing a real pattern. Study of the Rubiaceae family in Central and South America using MBG data shows some apparent patterns that give insight into species differences, ecological factors, and regional diversity for this family. This information allows us to formulate and test some hypotheses about evolutionary and biogeographic history. This information also supports work assessing conservation status for Rubiaceae species.

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ST. LOUIS SLEEC FALL 2014 RETREAT  
POSTER PRESENTATIONS

BALABAN-FELD, JESSE (jbalaban@slu.edu); Dr. Thomas Valone. Department of Biology, Saint Louis University, Repeatability of Male Mate Preferences in *Drosophila melanogaster*.

Male mate choice has been reported across many taxa, but less is known about its consistency. We directly observed the courtship and mating behavior of male *Drosophila melanogaster* who were given the opportunity to simultaneously choose between a pair of females differing in mating status or age. Each male was tested three times in one day. Males exhibited a strong mating preference for virgins. Furthermore, males spent the majority of their courtship time pursuing virgin females. There was no significant repeatability between the first and second trials, however, there was significant repeatability in percent of time courting the virgin between trials 2 and 3. Although males showed a slight preference for young females, males demonstrated no repeatable courtship preference for females of either age group. The analysis of male courtship and mating behaviors has important implications into how male mate preferences can shape sexual selection.

BOGLER, DAVID ([david.bogler@mobot.org](mailto:david.bogler@mobot.org)) Missouri Botanical Garden. Evolution of a Botanical REU Program in Plant Systematics, Conservation Biology, and Ethnobotany at the Missouri Botanical Garden

The NSF-sponsored Research Experiences for Undergraduates (REU) at MBG is currently in its third year. The general themes of the program are Plant Systematics, Conservation Biology, and Ethnobotany. A diverse group of 10 students are recruited to spend 10 weeks at MBG working full-time on mentored research projects. Past projects include: economics medicinal plant production in urban areas; ethno-veterinary practices on the Sioux Reservation; DNA barcoding plants of Shaw Nature Reserve; morphometrics of native grape species; description of new species of Aroids and ferns; conservation genetics and seed germination studies of rare species; pollen imaging with SEM; and ecology of invasive plants. About half the students were recruited from Historically Black Colleges and Universities, Hispanic universities, and Native American colleges. Valuable lessons have been learned about recruitment, matching students with mentors, developing enrichment components, assessment, and student tracking. The program has had positive impacts the academic future of the students.

CHURCH, JUSTIN ([jchurch1991@aol.com](mailto:jchurch1991@aol.com)); David Jennings. Southern Illinois University Edwardsville. Sequence analysis of Growth Hormone and its receptor in closely related *Anolis* lizards that vary in body size.

Body size influences many aspects of organismal morphology, physiology, and ecology. In vertebrates, body size is regulated through the actions of pituitary growth hormone (GH) and its downstream effects on the production of Insulin-like growth factors (IGFs). The current work examines sequence divergence in the coding regions of GH and GH-receptors in three species of *Anolis* lizards that vary in body size. Previous work has demonstrated that plasma levels of GH differ among these species, suggesting that GH gene regulation may differ among them. Total RNA was isolated from the livers of *Anolis carolinensis*, *A. sagrei*, and *A. equestris*, reverse transcribed to cDNA and then subjected to PCR using primers sequences available for other reptiles. If the larger body size of *A. equestris* is due to alterations in the endocrine regulation of growth, GH and GH-receptor sequences may differ between this species and the smaller *A. carolinensis* and *A. sagrei*.

COLLIS, CHUCK ([charlescollis@claytonschools.net](mailto:charlescollis@claytonschools.net)) Clayton High Schools. Oscar Fernandes; Daniel Greenblatt; Zoe Marquis-Kelly; Carly Osherow. Female Choice in sagebrush crickets: are risks rewarded?

During their breeding season, male sagebrush crickets (*Cyphoderris strepitans*) climb into sagebrush to secure a singing perch at dusk. Sexually receptive females use auditory cues from the males to find prospective mates. Previous studies have shown that acoustic signaling by males is energetically expensive and increases the risk of predation. Presumably female choice in mating has balanced these expenses by rewarding males who recover quickly from interruptions and expend more energy calling than their rivals. We gathered baseline data on male calling behavior and then ran female choice trials. It was hypothesized that females would choose males who exhibited aggressive calling behavior more often than males who called more timidly. During female choice trials, timid males called significantly more often than baseline data but bold males showed no significant differences. Females mated with bold males more often than timid males, but this difference was not statistically significant.

COONEY, EVE. C ([Cooney@stlzoo.org](mailto:Cooney@stlzoo.org)) Youth Programs Coordinator, Saint Louis Zoo. Laura Seger; Bob Merz; Lindsey Wendler; Andrew White; Sydney Barnason. Zoo ALIVE: Raising, Releasing and Regarding the Endangered American Burying Beetle.

The Saint Louis Zoo is involved in a five year project to raise and release the endangered American burying beetle back into the wild, the first reintroduction of a federally endangered species in Missouri. 2014 marked the third year of this project. For the first time, Zoo ALIVE teen volunteers and Zoo Education Department staff assisted the project, providing daily care of beetles and helping with the release. In June 2014, the teens joined Zoo staff and other volunteers to release 344 adult American burying beetles in Wah'Kon-Tah Prairie, near El Dorado Springs. Larvae counts indicated that 2,862 beetle larvae may have been produced by the released pairs, and the teen volunteers gained a better understanding of conservation science, field work, ecosystem functioning, and their ability to contribute in conservation efforts.

CRADIC, ALYSSA ([acradic1@live.maryville.edu](mailto:acradic1@live.maryville.edu)); Dr. Kyra Krakos; Adam Rork (presenting author) ([arork@live.maryville.edu](mailto:arork@live.maryville.edu)). Maryville University, Missouri Botanical Garden. A comparative study of the reproductive biology of *Veronicastrum virginicum* and *Penstemon digitalis*

This research examines how plant phenology and plant-pollination systems have over the past fifteen for two species. This study was conducted at Shaw Nature Reserve and focused on the flowering species *Veronicastrum virginicum* and *Penstemon digitalis*. 1. How has the phenology changed for these two plant species in the last 15 years? 2. Who were the primary pollinators 15 years ago? 3. Who are the current primary pollinators? 4. Is *P. digitalis* currently experiencing pollen limitation? Current pollinator observations were compared to pollinator observations taken from 15 years ago. Hand pollination treatments were used to determine if *P. digitalis* was experiencing pollen limitation. The primary pollinator of both species is *Bombus* spp. Both *P. digitalis* and *V. virginicum* have shifted in bloom time, their pollination systems have not changed. *Penstemon digitalis* is self-compatible and not experiencing pollen limitation ( $p = 0.928$ ).

DEMARIANO, AUDRA ([audrademariano@gmail.com](mailto:audrademariano@gmail.com)) Maryville University. Dr. Kyra Krakos; Dr. Peter Hoch; Dr. Nichole Miller-Struttman. Historical Pollen Data as a Comparative Tool in Climate Change Studies.

Analysis of comparative historical data can help predict future plant-pollinator associations as the climate continues to change community dynamics of an ecosystem. In general, detailed records on past pollination interactions to evaluate these potential problems are rare and incomplete. Pollen loads from historical insect collections potentially provide comparative data. This project assesses the use of historical pollen data as an informative comparative tool in understanding the impact of climate change on pollination. We used historical plant and pollinator data to answer the following questions: Is there a correlation between age of specimen and the size of the pollen load? Is there a difference in the diversity of the pollen load that correlates to age of the insect? Are all insect groups not affected by time? Which body parts of the insect is most impacted by time? Results indicated no correlation between specimen age and pollen load size.

DIMICK, EMILY ([dimickemily@gmail.com](mailto:dimickemily@gmail.com)) Southern Illinois University Edwardsville; Karen Martin; Timothy James; Thomas Fowler. Mushroom Mating Pheromones and Receptors Share Recognition Specificities Between Species.

The widespread mushroom fungus *Schizophyllum commune* has thousands of different mating types and is an obligate outcrosser for sexual reproduction. Its *matB* genetic complex has genes that encode mating receptors and pheromones. In contrast, the Caribbean regional species *Schizophyllum umbrinum* requires no mate to produce mushrooms and basidiospores, however it does have a *matB* gene complex with genes predicted to encode mating receptors and pheromones. *S. umbrinum* pheromones and *S. commune* receptors were expressed in the yeast *Saccharomyces cerevisiae* to determine the functionality of the predicted *S. umbrinum* pheromones. Assays for pheromone activity were positive for two of four *S. umbrinum* pheromones tested. Expression of *S. umbrinum* pheromone genes in *S. commune* supported the finding that *S. umbrinum* mating genes are functional. To date, no evidence of self-activation of pheromone signaling within *S. umbrinum* has been discovered to explain the role of the pheromones in this homothallic species.

DUNHAM, LOREN N ([ldunham@siue.edu](mailto:ldunham@siue.edu)); Richard L. Essner; Peter R. Minchin. Southern Illinois University Edwardsville, Edwardsville, IL 62026. Demography, Habitat Use, and Home Range in the Southern Flying Squirrel (*Glaucomys volans*) in Bluff Forests of Southwestern Illinois.

Agriculture and urbanization in southwestern Illinois have fragmented the once predominant oak-hickory forests. The effects of habitat fragmentation on suburban wildlife are poorly understood, especially for small mammals such as the Southern Flying Squirrel (*Glaucomys volans*). Flying squirrels are arboreal rodents whose presence is indicative of habitat quality, as they prefer mature, relatively open forest stands. Previous research indicates that flying squirrels in Illinois may be declining. Southern flying squirrels are found on the SIUE campus and adjacent Bohm Woods State Nature Preserve, however the characteristics of this population are unknown. Our study will utilize artificial nest boxes to examine demographics, movement patterns, and home range sizes of the population. Capture data will be combined with vegetation data to create a predictive model relating habitat characteristics to presence or absence using logistic regression. Study sites consist of 145 plots in three forest patches, which will be monitored through autumn 2014.

ENGELKE, AARON ([aengelk@siue.edu](mailto:aengelk@siue.edu)); Kelly Barry. Southern Illinois University Edwardsville. The Use of Tissue Culture as a method of In vitro propagation of *Polygonatum canaliculatum*.

*P. canaliculatum*, or Solomon's seal, is a perennial plant found throughout the North American woodlands and it is admired for its attractive fern-like foliage and flowers. Although established plants are hardy, plant growth is slow. Additionally, Solomon's seal seeds exhibit morphophysiological dormancy and germination requires 60 to 90 days of cold, moist stratification. Consequently, Solomon's seal is often harvested from natural areas by collectors and reestablishment is poor. Tissue culture can increase plant material available for nursery use and reduce the time requirements for nursery stock development. Rhizomes from germinated seeds were used to develop a shoot multiplication protocol. Tissue culture derived plantlets were acclimated and planted in The Gardens at SIUE. The research indicates that tissue culture can be a suitable method of propagating Solomon's seal.

GIRRESCH, REBECCA ([rgirresch1@live.maryville.edu](mailto:rgirresch1@live.maryville.edu)) Maryville University; Kyra Krakos. An Assessment of Communication Strategies in Engaging the Public in Undergraduate Research and Issues in Sustainability.

This research focused on identifying the most effective method of communication in educating and engaging undergraduate students and the public on issues in sustainability, specifically in developing long-term solutions to the Bush honeysuckle plant. Three methods of communication were investigated in this research study: media outlets, community organizations, and local schools. The effectiveness of each method was measured by its success in achieving two objectives: drawing undergraduate students and community members to an educational event; and informing participants about the threats invasive species pose to native ecosystems. Each method's effectiveness was measured quantitatively through surveys administered before and after the event.

The outreach event served to both research the potential of grazing goats as a management solution to the juvenile Bush honeysuckle as well as to inform the public about this neighborhood issue. The outcomes of this research data will guide preparation for future communication with and engagement of the public not only in the honeysuckle project in the future, but also in other areas of undergraduate research at Maryville University. Furthermore these results are intended to be extended to the investigation into long-term solutions of invasive plant species at other institutions around the country.

HERNÁNDEZ-YÁÑEZ, HAYDÉE ([hhernandezyanez@mail.umsl.edu](mailto:hhernandezyanez@mail.umsl.edu)); Robert Marquis. University of Missouri St. Louis. The role of herbivores and soils as limiting factors in *Piper* distribution in a tropical rain forest.

Plant distribution and restriction to certain habitats could be due to either biotic or abiotic factors; mainly these are thought to be: 1) competition, 2) dispersal, 3) edaphic specialization, 4) natural enemies or 5) soil-herbivore interaction. Few consider that herbivores and soil effects can limit plant distribution; plant ecologists often ignore the role of herbivores, while plant-herbivore ecologists often omit the mitigating role of abiotic factors, such as soil type. In order to elucidate this interaction, we conducted a survey of plant distributions at La Selva Biological Station, Costa Rica, with plants of the genus *Piper* (Piperaceae). We recorded plant species, abundance, light levels, and herbivory along transects in two soil types. Preliminary analyses have found a lack of interaction between soil or light with plant abundance, however, some piper species are distributed significantly different; this could be due to herbivory, which remains to be analyzed.

HORACK, PATRICIA ([phgx6@umsl.edu](mailto:phgx6@umsl.edu)); Gyanpriya Maharaj; Aimee S. Dunlap. University of Missouri St. Louis. Tracking and sampling in bumblebees— effects of experience and unlearned preference.

It is common when making choices about resources for animals to have pre-existing preferences which may then be modified by experience. However, a strong bias may interfere with the acquisition of new information when sampling and tracking changes in resource quality. We asked how an unlearned preference is modified by experience, and specifically, how this might bias individuals towards or against sampling resources, and tracking those sampled changes. We applied a classic foraging theory framework of two resource types: one steady and one varying. Bumblebees sampled more frequently when they lacked an initial preference, while reducing sampling when an initial preference existed for an unvarying resource. This bias was also present in how quickly and accurately bees used their experiences to track sampled changes. We discuss how initial bias in preference may influence how well bees can track modified floral environments in an ever changing world.

HUFF, CHRISTOPHER J. ([chuff@siue.edu](mailto:chuff@siue.edu)), Environmental Science Graduate Student Southern Illinois University Edwardsville, The Effect and Use of Hunter Derived Offal by Local Scavengers.

During the 2013 hunting season, Missouri and Illinois hunters harvested a total of 252,574 and 146,614 Whitetail Deer (*Odocoileus virginians*) respectively. With each harvested deer, an influx of nutrient rich offal was introduced into the local ecosystem as hunters field dressed their animals. The primary research goal of this study is to better understand the dynamic that these offal sites have with the area's scavengers and the surrounding ecosystem. I am conducting a survey of wildlife interactions through the examination of trail camera images. The specific goals of this study are to: 1) assess the importance of offal piles for each individual species; 2) examine the temporal patterns of scavenging; 3) determine how Whitetail Deer interact with offal. The data for this study was collected over the course of three seasons. Preliminary results show that there was 311 events recorded that included 16 species interacting within the offal sites.

HULSEY, RYAN C. ([rhulseyl@live.maryville.edu](mailto:rhulseyl@live.maryville.edu)) Maryville University; Kyra N. Krakos; Adam Hoeft; Adam Rork. The Reproductive Ecology Of A Rare Western Prairie Species – *Oenothera coloradensis*.

This study is focused on the reproductive ecology of a rare prairie species of *Oenothera* found in high altitude prairies in Colorado and Wyoming. Exclusion experiments and determinations of pollination success using fluorescent microscopy revealed the system to be self-compatible. Pollinator observations where visitors were collected, pollen load was determined, and visitation rate calculated showed that noctuid moths were the only functional group responsible for pollen flow. No significant difference ( $p=0.68$ ) was found between natural versus supplemental hand pollination tests, indicating pollen limitation is not being experienced by this species. Reproductive traits indicate convergent evolution between another species of *Oenothera* sect. *Gaura* in functional groups of pollinators, floral measurements, and habitat.

KAJBAF, KIMIA ([kkajbaf@siue.edu](mailto:kkajbaf@siue.edu)) Elizabeth Esselman. Southern Illinois University Edwardsville, Edwardsville, IL. Identification of an Unknown Missouri Glade Aster Species.

The genus *Symphyotrichum* (Asteraceae) contains species that are found throughout North America. Over forty-seven species occur in Missouri (Yatskievych 2006). *Symphyotrichum pilosum* is among the most widespread and weediest of our native asters while *S. parviceps* is less common and mainly occurs as scattered populations in the eastern half of the state. The purpose of this study is to identify an unknown *Symphyotrichum* species found in a glade near Steelville, MO. It has been argued that the aster is a hexaploid variant of *S. parviceps*, another cytotype of *S. pilosum* or a new unknown species. Chromosome counts have revealed the aster is a hexaploid ( $n=48$ ). This number is larger than the all known numbers for *S. pilosum* ( $n=16,20,24$ ) and *S. parviceps* ( $n=16,24,32$ ) in the state of Missouri. ITS sequence data was not able to resolve relationships among these taxa. Microsatellite markers are currently being developed to determine the relationships among these taxa.

KHEZRI, MARIYA ([mkhezri1@live.maryville.edu](mailto:mkhezri1@live.maryville.edu)), Maryville University; Kyra Krakos. Experimentation of Honeysuckle Biomass in Development of Products and Works of Art.

The invasive species of honeysuckle has been a large contributor to the lack of plant biodiversity on the Maryville University campus. For the past three years, a group of students and faculty

members have worked hard to remove the trees and experiment with various management methods. The resulting biomass from the removal is potentially a useful resource, rather than just a waste. **The main goal of this project was to experiment with the physical properties of honeysuckle biomass to develop it into a material that can be used as an expressive medium for artists.** Various methods such as stripping, slicing, grinding, and twining were used to make products and artwork from the honeysuckle plant. This interdisciplinary project has allowed students from various backgrounds such as design, biology, business, and communications to work together to create a greater outcome and educate a wider audience.

KITCHEN, CASSANDRA (Department of Biology Saint Louis University); Laura Klein (lklein10@slu.edu); Dan Chitwood; David Bogler; and Allison J. Miller. Digital morphometric analysis of North American *Vitis* growing in a common garden

Phenotypic plasticity offers the opportunity for plants to adjust to changing environments. This dynamic observation has been made in many taxa across their geographic ranges. Common gardens allow researchers to examine effects of environment on phenotypes among various taxa and genotypes from across the species' geographic range. Here, we use two, economically important North American grapevines (*Vitis riparia* and *V. rupestris*) to study leaf morphology in a common environment. By applying elliptical fourier descriptors (EFD) and generalized procrustes analysis (GPA) to digital images of leaves growing on vines in a common garden, we compare variation in shape, lobing, and sinus features among genotypes and between species. These results will be used in future work that integrates ion concentration and water use efficiency data for the common garden plot.

LEDFORD, ROBIN ([Robinledford77@gmail.com](mailto:Robinledford77@gmail.com)); Peter Minchin; Elizabeth Esselman. Southern Illinois University Edwardsville, Edwardsville, IL. Levee Lake: A 2012 Floristic and Natural Community Survey and Analysis.

Levee Lake is a forested wetland system that developed in a Mississippi River oxbow in the floodplain known as the American Bottom. With the exception of perimeter levees and attempts to drain the wetland, Levee Lake remains in a relatively undisturbed, natural state. During a 1976 survey of Levee Lake, Nyboer and Reeves identified it as the last remaining relatively undisturbed wetland complex in the American Bottom. The purpose of this study was to obtain a recent inventory of the existing plant species of the Levee Lake wetland system, to evaluate the quality of the existing vegetation, and to document and evaluate changes in vegetative composition as compared to the 1976 INAI survey. Our results indicate that the Levee Lake wetland system has suffered a reduction in conservative plant composition, a reduction in natural quality grading, and a shift in natural communities.

LIU, SHIH-HUI ([slu25@slu.edu](mailto:slu25@slu.edu)) Saint Louis University Biology, 3507 Laclede Avenue, St. Louis, MO 63103; Peter C. Hoch; Peter H. Raven; Janet C. Barber. Preliminary phylogeny and ploidy-associated distribution patterns in *Ludwigia* (Onagraceae).

Polyploidy has been important throughout the history of angiosperms and may contribute to the success of invasive plants. The primary goal of our study is to improve the understanding of polyploid evolution by using the cosmopolitan wetland genus *Ludwigia* (Onagraceae), which comprises 82 species placed in 23 sections. By using both chloroplast and nuclear sequencing data, we extended our earlier phylogenetic study. We also assessed the strength of association among distributions and ploidy. Even though our preliminary phylogeny, which includes 28

species in 10 sections, shows low resolution along the backbone of the tree, our results indicate that two large sections (*Oligospermum* and *Macrocarpon*) and one monotypic section (*Caryophylloidea*) are monophyletic groups. Three other large sections (*Pterocaulon*, *Myrtocarpus*, and *Africana*) do not appear to be monophyletic. Our results also suggest that diploids and multi-ploids have wider variations and larger distributions than tetra-, hexa- and octoploid taxa.

LOZA, ISABEL M. ([isarivera23@yahoo.com](mailto:isarivera23@yahoo.com)) Department of Biology, University of Missouri, St. Louis, MO, 63121, USA and Herbario Nacional de Bolivia, Campus Universitario Cota-Cota, calle 27, Correo Central Cajón Postal 10077, La Paz, Bolivia; Ivan Jimenez; Peter Stevens; Peter M Jørgensen; Robert E. Ricklefs. Rarity shows phylogenetic signal in a regional species pool of tropical woody plants.

Local abundance, geographic range size and habitat breadth are three axes of rarity thought to have distinct effects on extinction risk. Understanding phylogenetic patterns of these rarity axes provides insights into the extent to which rarity is phylogenetically conserved and, how extinction risk may be distributed across phylogenies. We describe phylogenetic patterns in the three axis of rarity using data from an extensive network of forest plots located in the Madidi Region of Bolivia. Hierarchical variance partitioning across taxonomic levels indicated phylogenetic signal in the three axes of rarity: species belonging to the same genus tended to be more similar in the three axes of rarity than expected by a null model randomly assigning to species values of local abundance, geographic range size and habitat breadth. However, at deeper phylogenetic levels the axes of rarity exhibited little or no phylogenetic signal.

MARTY, ALICIA ([anmn87@mail.umsl.edu](mailto:anmn87@mail.umsl.edu)) Department of Biology, University of Missouri – St. Louis, St. Louis, MO 63121; PG Parker. Aggression Dynamics and Hormone Fluctuations in Black and White Ruffed Lemurs (*Varecia variegata*)

Black and White Ruffed Lemurs (*Varecia variegata*) are critically endangered primates that can present a captive management challenge. Females are dominant over males and the most dominant female often shows increased aggression towards other females during the breeding season. Animal managers may prematurely separate females at the first sight of aggression, which can lead to prolonged separation or group reconfiguration - a problematic solution for a primate in which social interaction is crucial for development. Maintaining stable social groups is ideal for this species as reintroduction to the wild may be necessary in the future due to sustained population decline. This study aims to improve animal welfare by understanding the dynamics of female aggression, identifying ways to minimize aggression using enrichment devices, and analyzing fecal glucocorticoids for correlations with aggression behaviors. This study tests the following hypotheses: (1) the dominant individual aggressively pursues subordinate individuals most frequently when subordinate animals are foraging; (2) aggression rates will be lower when food is presented inside enrichment devices that require prolonged manipulation by the animal to retrieve food; (3) the subordinate animals will have overall higher glucocorticoid levels and more frequent glucocorticoid spikes following high aggression periods by dominant individuals. Preliminary results show a strong similarity in mean glucocorticoids between a dominant individual and a subordinate ( $p=0.98$ ), but each had differing hormone trends throughout the breeding season. The subordinate individual had several small rises in glucocorticoids, while the dominant individual remained relatively stable, but had a substantial rise in glucocorticoids correlating with a parturition-specific tail manipulation behavior, despite

not being pregnant. This behavior, in addition to aggression, will be examined further in the upcoming breeding season.

MERCHANT, LAUREN ([lmmerchant@slu.edu](mailto:lmmerchant@slu.edu)) Department of Biology, St. Louis University, St. Louis University, 3507 Laclede Ave. Macelwane Hall, St. Louis, MO 63103. Morality, Intrinsic Value and Human Obligation: Neither we, nor the environment, ever got the memo...

### Background/Question/Methods

As soon as the human species appeared on this earth it has sought an understanding of itself in relationship to the rest of the world. Some have seen humans as superior, others as simply a small part of a greater system, as well as countless variations in-between. Never the less, the goal has been always to assign human morality based in purpose and value to the whole of a purposeless universe. Past approaches only further confounded the problem and reared inconclusive results. Ethics has yet to construct a theory that is weighted and scalable while at the same time accounting for interactions between scales. Peter Singer's "expanding circles" is not truly hierarchical, but utilitarian and leaves much up to the discretion of the person applying it. Many disciplines have a hierarchical approach that which philosophy lacks. Consequentially, ecological ethics has been based almost entirely on case studies and has no overarching ethical theory. In a world where reality is complex, imperfect and heavily at risk from anthropogenic activity, can a true hierarchy, independent of culture, be constructed to prioritize ethical concerns and stakeholders? This integrative and interdisciplinary analysis sought to use current biological and philosophical understandings in order to (1) identify why past ethical approaches have failed, (2) approach the solution within an evolutionary context and (3) propose a new ecological ethic that is applicable in both theory and practice.

### Results/Conclusions

This analysis found that past attempts to address environmental ethics concerns contain numerous inconsistencies (e.g., sentientism would value a panda above the bamboo it eats), arbitrary assignments of value (e.g., anthropocentrism would state that humans have an adaptive trait of greater value than any other evolved trait) and ignore moral evolution in a larger context. An ethical hierarchy is indeed obtainable and intrinsic value is not necessary to obligate humans to earth's natural systems. I propose a culturally independent, nested hierarchy in which decision making can be fluidly assessed to promote the greater "good" for all (human and nonhuman alike). Its underlying premise states that the ability to conceptualize is a driving force behind such obligation. This presentation will highlight areas of importance in building such a model and present the fundamental results and conclusions to this newly emerging perspective. In a modern era of climate change and social unrest, having this kind of framework is essential for the individual, policy making, management, and even directing research.

WILLIAM GRANT MORTON ([morton.william@mail.ic.edu](mailto:morton.william@mail.ic.edu)) Southern Illinois University Edwardsville, Edwardsville, IL. Lawrence W. Zettler; Elizabeth J. Essleman. Isolating Orchid Mycorrhizal Fungi from *Spiranthes vernalis* (Orchidaceae) for Subsequent Seed Germination and Reintroduction.

The Spring Ladies' Tresses orchid (*Spiranthes vernalis*) is considered threatened or endangered throughout its middle North American range. One goal for any conservation program is to successfully increase population numbers, possibly by re-introduction of plants into existing populations. It is commonly known that orchids form unique relationships with mycorrhizal

fungi and the association is often essential for orchid seed germination and enhanced seedling survival. The intent of this study is to isolate and identify mycorrhizal fungi associated with an established adult *Spiranthes vernalis*. To date (September 2014), fungi assignable to the ubiquitous genus *Ceratobasidium* have been isolated from pelotons in a mature plant, and efforts are now underway to further identify these strains using ITS amplification and sequencing. Identification and isolation of the fungus will allow *in vitro* germination experiments and possibly the subsequent reintroduction of seedlings to aid in the conservation of the species.

MUCHHALA, NATHAN ([n\\_muchhala@yahoo.com](mailto:n_muchhala@yahoo.com)) University of Missouri-St. Louis; Nicolas Correa; Monica Carlsen. Fruit types and geographic range size in the genus *Burmeistera* (Campanulaceae).

In this study we used information from herbarium specimens to evaluate the influence of fruit traits on range size among species of the genus *Burmeistera* (Campanulaceae). This genus presents one of two types of berries: brightly-colored, fleshy cylinders adapted to bird dispersal, or dull-green, inflated ‘balloons’ apparently dispersed by insects or rodents. Here we test the prediction that dispersal by flying animals leads to larger species distributions. Range sizes were evaluated by two means; area of the minimum convex polygon, and the area of predicted suitability using Maxent. Results show no correlation between fruit type and range size in *Burmeistera*, thus dispersal mode might not be the most important parameter shaping distribution patterns.

MUÑIZ, PAIGE ([paigemuniz@gmail.com](mailto:paigemuniz@gmail.com)) Department of Conservation, St. Louis, Missouri, St. Charles, MO; Alex Vavra (Saint Louis University); Lauren Merchant (Saint Louis University); Gerardo Camilo (Saint Louis University). Bee diversity across socio-economic range of urban gardens in St. Louis city.

#### Background/Question/Methods

Pollinators are an important component of ecosystems, providing an essential service for plant reproduction, including food production. Among pollinators, bees are some of the most efficient and diverse members. This diversity allows for a range of species to go from generalists, like honey bees, to highly specialized, like squash bees (*Peponapis* spp.). Unfortunately, little is known about how pollinators respond to inner-city environments. This is important given the renewed interest in sustainability advocates to develop local food and produce sources within inner city locations. We sampled a range of community garden in St. Louis city. These gardens occurred in a range of socio-economic (from low to middle high), and ethnic (mostly black to mostly white) neighborhoods. Plantings were almost exclusively vegetables (tomatoes, peppers, pumpkins), fruits (apples, peaches, and berries) and herbs (sage, basil, and various mints). Sampling was done in a systematic fashion and took place bi-weekly from mid May to late September 2013, and again in 2014. Each session lasted for 50 minutes and included 2-3 individuals sampling for all pollinators using aerial nets. All collected individuals were mounted, labeled and identified to species.

#### Results/Conclusions

Over 70 bee species representing five families and thirty genera were collected. Early-mid July to late August was the peak of abundance and diversity. Some notable species include *Bombus pensylvanicus*, which is uncommon and believed to be in decline in parts of its range, and *Bombus auricomus*, which is uncommon. *Megachile addenda* and *Megachile frugalis* represent

new records for St. Louis city. The total bee diversity observed in the garden (alpha diversity) represents over 80% of the total bee diversity for the area (gamma diversity). Our results have significance for managing ecosystem services across the urban environment of cities.

NORDELL, SHAWN E. ([Nordell@slu.edu](mailto:Nordell@slu.edu)) Thomas J. Valone, Courtney Harrington, Andrew M. Hayden, Neja Mahajan, & Tina Mozelewski. Department of Biology, Saint Louis University, 3507 Laclede Ave. Macelwane Hall, St. Louis, MO 63103. Effect of Heterospecific Eavesdropping on Gray Squirrel Caching Behavior.

Many animals store food in temporary caches and have evolved several behavioral strategies to minimize loss of caches to conspecific or heterospecific cache pilferers. Gray Squirrels (*Sciurus carolinensis*) face the threat of cache loss to heterospecific blue jays (*Cyanocitta cristata*). Here we tested the hypothesis that squirrel caching behavior would be affected by nearby vocalizations of blue jays. We provided a single type of cacheable food item and recorded the proportion of nuts cached in treatments with vocalizations of a potential cache pilferer (blue jays) or a non-cache pilferer (American robins, *Turdus migratorius*). Squirrels cached fewer nuts and traveled farther before caching items when blue jay vocalizations were played. To investigate whether such behavioral modifications occur in response to a generalized “jay call” (Family Corvidae), we conducted a second experiment in which we examined squirrel caching behavior in response to two novel (allopatric) vocalizations, one from cache pilfering Stellar’s jays (*Cyanocitta stelleri*) and the other from non-cache pilfering Elegant trogons (*Trogon elegans*). Squirrel caching behavior did not differ in response to these novel vocalizations. Our work suggests that squirrels can obtain important social information about their environment using auditory cues.

PRETZ, CHELSEA ([chelz.pretz@gmail.com](mailto:chelz.pretz@gmail.com)); Danelle Haake. Harris-Stowe State University, Missouri Botanical Gardens, Litzsinger Road Ecology Center. Preliminary Investigation of Edge Effects on Prairie Plant Species.

Small prairies provide refuge for many native species of prairie-dependent plants and animals. However, the smaller the prairie, the greater the proportion of prairie that shares an edge with neighboring habitats. This study is a preliminary investigation of how proximity to woodlands and other edges would affect microclimates and plant species diversity within a prairie. Data was collected from Litzsinger Road Ecology Center (LREC), in Ladue, Missouri about 10 miles from downtown St. Louis. About 120 permanent 0.5 m x 0.5 m plots in two prairies were used to measure (1) distance from the plot to the nearest edge and (2) number of plant species within the plot. All plants within each plot were identified to species and assigned a value for percent coverage. At a subset of plots, temperature was captured by Thermocron® iButtons® every 20 minutes. A significant correlation was found between minimum temperature and distance to edge and between number of species and distance to edge. The closer to the edge, the warmer the temperature and the greater the number of plant species. There were also significant correlations between different species within the prairies; some species were more abundant on the edges and others with more abundant in the middle. For further research, it would be worthwhile to investigate how big the prairies have to be before the edge effect disappears.

PYNE, LEAH ([Leah.pyne@principia.edu](mailto:Leah.pyne@principia.edu)) Principia College; Chrissy McAllister (Principia College); Karl Olson (University of Alaska, Fairbanks); Roger Ruess (University of Alaska, Fairbanks). Changes in abundance of nitrogen fixing shrub *Shepherdia canadensis* in two successional stages.

Fire is an important part of the boreal forest ecosystem. Studies have shown that nitrogen fixers are more abundant after fires and are important contributors of nitrogen to the soil. Much is known about the contribution of alder; *Alnus tenuiflora*, but not much is known about Soap berries, *Shepherdia Canadensis*, a nitrogen fixing shrub common in early successional stages. Here, we examine nodule biomass, aboveground biomass, and stem age in *S. canadensis*, as well as soil temperature, and moisture in two different successional stands of the Bonanza Creek Experimental Forest in Fairbanks Alaska. Results show that *S. canadensis* in younger successional stands have more aboveground and nodule biomass. The older successional site had lower soil moisture and temperature. This, along with increased shading and competition, could be impacting production of *S. canadensis* in later successional stands.

QIAN NIU, SOPHIA ([sophiaqniu@gmail.com](mailto:sophiaqniu@gmail.com)), Department of Biology Saint Louis University; Jason H. Knouft (Center for Environmental Sciences Saint Louis University). Hydrological characteristics, food resource abundance, and food web architecture.

Variation in biodiversity and assemblage structure have been widely used to reflect ecological responses to hydrological characteristics, yet biotic interactions are less studied in the context of local hydrology. We examine the relationships between food web structures, i.e. linkage density (LD) and connectance (LC), and distribution skewness in biomass flux (SK), and allocation of autochthonous energy (%AU), with hydrological variability as well as food resource abundance. Spring and summer food webs are quantified with diet and isotope measures for thirteen streams in the Meramec River (eastern Missouri). We found that LD and LC are positively correlated with discharge and food resource in summer ( $R^2 = 0.486 - 0.870$ ), and %AU tends to be positively correlated with current velocity in spring. SK are positively correlated with flow variability during both seasons ( $R^2 = 0.472 - 0.943$ ). The observed patterns are likely due to greater opportunistic feeding and habitat connectivity under high flow conditions.

RANARIVELO, HERITIANA ([hsrq98@umsl.edu](mailto:hsrq98@umsl.edu)), University of Missouri - St. Louis (UMSL). Investigating species hypotheses for the Malagasy clade of the genus *Psorospermum* (Hypericaceae) by integrating morphology and molecular phylogeny.

I investigated species hypotheses for Malagasy *Psorospermum* species by integrating morphological species hypotheses and clustering of sequences in molecular phylogenetic data. The chloroplast gene phylogeny shows the Malagasy *Psorospermum* as monophyletic with two well-supported clades. Using multivariate analysis based on Gaussian mixture models implemented in mclust R packages, I compared the morphogroups defined by the multivariate analysis with the molecular clusters within each of the two clades; individuals for each taxon tip of the clades were measured for their leaf characters and fruit characters. Preliminary results do not provide sufficient information to resolve species boundaries in Malagasy *Psorospermum*. Most morphospecies are not or only partly in agreement with DNA clusters. Additional samples will be added to both molecular and morphological analyses, and other morphological characters such as flower characters and embryo and leaf anatomy need to be investigated.

SAGE, LAUREN ([Lasr44@mail.umsl.edu](mailto:Lasr44@mail.umsl.edu)) and Lisa Rois; Dr. Patricia Parker. University of Missouri-St. Louis; National Park of the Galápagos, the Saint Louis Zoo Wildcare Institute. Inter-Island Dispersal Dynamics of the Galápagos Hawk, *Buteo Galapagoensis*.

Our study assesses whether Galápagos hawks fly in between islands to investigate open territories. We have extracted DNA from 62 hawk blood samples sent to our lab by the National Park of the Galápagos as a result of a rat eradication on the island of Pinzón. 62 hawks were captured on Pinzón, which seemed unusually high considering the prior population estimate was 30. 150 other hawk samples from previous studies were added as a genetic reference set. PCR amplification and fragment analysis at 22 microsatellite loci were conducted for all 212 samples. Genotypes were scored manually with Genemapper software, and analyzed with STRUCTURE, CLUMPP and Distruct in order to determine which hawks belong to the same genetic groups. These groups generally correlate to island of birth due to high levels of philopatry. Though the results are still preliminary, they seem to indicate unexpected dispersal dynamics between Pinzón and Santiago.

STOLTZ, KATHLEEN ([kstoltz@siue.edu](mailto:kstoltz@siue.edu)), David Jennings. Southern Illinois University Edwardsville. Behavioral responses of *Lithobates blairi* tadpoles to cues from predators and conspecifics.

Behavioral changes induced by predators are a selective force for tadpoles as altering behavior or morphology improves tadpole survival. Tadpoles either singly or in groups of five were exposed to two types of predator (crawfish) cues. Tadpoles were exposed to cues from crawfish that had consumed tadpoles or crawfish that had consumed catfish. A third tadpole group was exposed to conspecific alarm cues (ground tadpole), while a fourth group acted as the control. Tadpole movements were quantified by placing tadpoles in clear containers with an 'X' drawn on the bottom and counting the number of lines crossed during 30 minute periods before and after the introduction of chemical cues. In a second experiment, tadpoles exposed to treatments for long periods were compared to tadpoles naive to predator and conspecific cues. We predict decreased movement within groups exposed to conspecific cues or cues from crawfish that had previously consumed tadpoles.

TAYLOR, CHARLOTTE M ([charlotte.taylor@mobot.org](mailto:charlotte.taylor@mobot.org)); BASSÜNER, BURGUND ([burgund.bassuner@mobot.org](mailto:burgund.bassuner@mobot.org)) Science and Conservation Division, Missouri Botanical Garden, St. Louis, MO. Distribution patterns of Neotropical Rubiaceae. (Three posters with same title)

Patterns of distribution give a clue to biodiversity and lineage diversity among the native Neotropical Rubiaceae. The distribution of a species, genus, or tribe depends on a variety of factors including its biogeographic history, habitat preference, and genetic factors. Here we present maps of selected taxa showing some distribution patterns that are informative for Neotropical Rubiaceae biogeography. Distributions are mapped, based on individual Rubiaceae specimen localities from the TROPICOS® database, a curated data collection. Many Rubiaceae are specific with regard to niche or habitat, so distribution information can be lost when only a general range is outlined. These maps represent a step toward documenting detailed distributions for Neotropical Rubiaceae. Such knowledge of species and genus distributions depends on good taxonomic work and adequate exploration.

WALKER, ELIZABETH A.; Blythe E. Janowiak (presenter) ([bjanowia@slu.edu](mailto:bjanowia@slu.edu)) Saint Louis University Department of Biology. Effects of antibiotics on the murine vagina microbiome with GBS colonization and the role of glutathione.

In about 25% of healthy women, GBS is a member of the genital tract flora. These women have risk of passing on GBS to their infants either through infected amniotic fluid or at delivery as the infant emerges from the birth canal. Infected infants are at high risk for developing neonatal meningitis and/or sepsis. As such, prophylactic antibiotics are given to pregnant women who are colonized with GBS to clear GBS prior to delivery. The focus of the current study is to study the effects of antibiotics and the presence of glutathione on the vagina microbiome with and without GBS colonization. Mice will be colonized in the vagina with wild type or glutathione-deficient GBS, and the vagina microbiome will be monitored over time. Results will show how the vaginal microbiome is changing in response to antibiotic treatment and how glutathione helps GBS colonize the mammalian vagina.

WERNER, LAWRENCE ([lawrencewerner2@gmail.com](mailto:lawrencewerner2@gmail.com)) Southern Illinois University Edwardsville; Richard Essner; Jason Williams. Exploring the Overwintering Strategies of a Cold Water Anuran, *Ascaphus montanus*.

The Mountain Tailed Frog, *Ascaphus montanus* is a cryophile that is associated with permanent mountain streams in the Northwestern United States. Although unknown, adults likely overwinter in the fast moving streams, but to do so they would need to survive extended bouts of subzero temperatures. The purpose of this study was to determine if these frogs can tolerate conditions found in mountain streams by either surviving freezing or avoiding freezing by resisting ice inoculation and supercooling. No frogs survived the supercooling point trials or after being frozen by ice inoculation. However, two of the four frogs survived freezing 4 days after an exotherm was recorded. Based on the known literature it seems that this species can survive in high sub-zero temperatures found in its aquatic environment. These data suggest that the frogs are freeze tolerant under certain conditions and may use a combination of supercooling and freeze tolerance to survive.

WESTHAFER, ERIC ([ewestha@siue.edu](mailto:ewestha@siue.edu)); Jake Schaefer ([jake.schaefer@usm.edu](mailto:jake.schaefer@usm.edu)); David Duvernell ([dduvern@siue.edu](mailto:dduvern@siue.edu)). Southern Illinois University Edwardsville, University of Southern Mississippi. Geometric Morphometrics of the Black Spotted Topminnow across the river continuum

The main aspect for ecomorphological studies is to understand what drives changes in shape and size of organisms in varying habitats. We sampled 8 sites in the Gasconade and Meramec River drainages ranging from headwater to large river habitats. Using geometric morphometric techniques we compared size and shape independent of one another across habitat types. We hypothesized that headwater populations will exhibit larger size and a deeper, more streamline body form and large river populations will exhibit a smaller, shallower body form. Using relative warp scores, a principle components analysis (PCA) was used on the first four principle components which accounted for ~65% of the variation. We found statistically significant results describing sexual dimorphism (37%), body depth (12%), tail length (8%), and pelvic fin placement (7%) across the first four principle components respectively. Principle components 2 & 3 showed significant differences between drainages. Size was found to be significant between headwater and large river habitats.

ZWECK, JUSTIN ([jzweck@slu.edu](mailto:jzweck@slu.edu)) Department of Biology, St. Louis University, 3507 Laclede Ave. Macelwane Hall, St. Louis, MO 63103. Mike Arduser (Missouri Department of Conservation); Peter Bernhardt (St. Louis University). No Evidence for Plant-Pollinator Mismatch in White Prairie Clover (*Dalea candida* (Fabaceae)): Implications for Climate Change.

Climate change is known to disrupt ecological interactions. Specifically, it alters life histories, decoupling interactions between two or more species. For example, when insect and flowering periods fail to overlap, plants may lose valuable pollinators. This leads to pollen limitation and reduced reproductive success in wildflowers. We compared the pollination biology of *Dalea candida* (Fabaceae) between 2012 and 2013 at the Shaw Nature Reserve, MO, where the flowering period occurred nearly one month earlier in 2012 (peak ~ mid-June) than in 2013 (peak ~ mid-July). We found a 50% overlap among all pollinating insects. In both years *Dalea candida* was pollinated primarily by bumblebees (*Bombus griseocollis*), sweat bees (*Augochlorella* spp., *Lasiglossum* spp.) and wasps (*Myzinum* sp., *Tachytes* sp.). We did not find evidence for pollen limitation in either year as flowers averaged 14.4 and 12.8 grains deposited on their receptive pistil tips (stigmas) in 2012 and 2013 respectively. There were no significant differences in pollen deposition or pollen tube growth between years ( $p > 0.05$ ). While pollination in *Dalea candida* did not appear to be strongly affected by the change in flowering time during our study, other components of fitness (such as seed set and herbivory) will require further examination.