FINAL REPORT
Professional Development Grant Spring (February) 2018

In February 2018, I received a Professional Development Grant to cover expenses for an ATU undergraduate student (Edgar Sanchez) and I to attend the Arkansas Academy of Science (AAS) conference April 6-7, 2018, in Jonesboro, AR. This funding allowed us to attend the conference where Edgar presented research funded by the Arkansas Tech University Undergraduate Research Grant. Specifically, he developed novel genetic microsatellite markers that will allow us to determine paternity of nestling songbirds. This research was conducted under my supervision and that of a collaborator at The Field Museum in Chicago, IL, between January 2-10, 2018. This is part of a larger research project that involves numerous undergraduate students and aims to understand the ecological effects of bird feeders. This opportunity was ideal for Edgar to participate in the scientific process and to contribute toward a scholarly product. The AAS conference proved an ideal venue at which to disseminate our findings. We received positive and constructive feedback that will prove beneficial as we prepare these results for publication in a peer-reviewed ecology or genetics journal. Attached are the details of Edgar's presentation as provided in the conference booklet.

Since I am an Associate Editor for the organization's peer-reviewed journal, The Journal of the Arkansas Academy of Science, my attendance was expected and will help me to fulfill my editorial duties. Additionally, this conference provided an excellent opportunity to familiarize myself with current research of Arkansas scientists. This conference attracts researchers from most Arkansas universities, many of whom do research closely related to my own work. Through formal and informal interactions across the week, I strengthened existing relationships and forged new collaborations. I ultimately expect this experience will facilitate the continued integration of cutting-edge science into the courses I teach at ATU.

P: 17 –Amanda Trusty
Arkansas State University, Undergraduate Student
Judge: Yes

Does frequently visiting a Bluebird nest increase predation risk?
(Co-Author: Virginie Rolland)

A review showed that frequently monitoring nests may impact predation risk, but manmade nest cavities were not considered. Thus, our objective was to determine the effect of visit frequency on nest predation of birds nesting in artificial cavities. Between March and September 2017, we monitored 115 nest boxes occupied by Eastern Bluebirds (Sialia sialis), about 10 km north of Jonesboro, Arkansas. We recorded the nest status every 1-6 days from the first egg to fledging or nest failure. Fifteen days after hatching, chicks may fledge prematurely if disturbed. We randomly divided nests with 15-day-old chicks in two groups: checked daily or at the estimated fledging date. We excluded nests of unknown fate, and of the remaining 195 nesting attempts, 44 were depredated. Specifically, we found that frequent visits did not impact risk of predation but increased risk of abandonment. However, all chicks successfully fledged from nests checked daily after day 15, indicating that nests may be most vulnerable at a younger stage. We recommend that bluebird monitors record nest status at a 3-day or longer interval during early nest stages. With caution, monitors may visit nests daily after day 15 to accurately determine nest fate without jeopardizing nest success.

P: 18 – Michael Trusty
Arkansas State University, Undergraduate Student
Judge: Yes

Does axle grease effectively protect bluebird nests from predators?
(Co-Author: Virginie Rolland)

Bird conservation organizations have long promoted the use of predator guards, such as the Kingston stovepipe baffle, to protect nest boxes and increase nest success of birds nesting in cavities. A recent large-scale study showed that predator guards effectively reduce nest predation. However, the effectiveness of axle grease as a common predator deterrent was not tested. Therefore, our objective was to determine the effectiveness of axle grease at increasing nest success. From March to September 2017, we monitored 148 nest boxes at a site 10 km north of Jonesboro, Arkansas, but we focused our study on the 115 nest boxes used by Eastern Bluebirds (Sialia sialis). We divided these nest boxes evenly among three groups: baffle, grease, and no guard. Bluebirds made 238 nesting attempts, 44 of which were depredated, primarily by snakes (48%) followed by raccoons/cats (28%), squirrels (13%), and unidentified predators (11%). Our models indicate that grease and baffles equally improved bluebird nest success by about 40%. Though not significantly, grease tended to yield a higher nest success than baffles. To conclude, axle grease is a cheap and effective alternative to baffles that owners of bluebird boxes in Arkansas and elsewhere can use to further bluebird conservation.

P: 19 – Edgar Sanchez
Arkansas Tech University, Undergraduate Student
Judge: Yes

Developing Microsatellite Markers for Genetic Identification of Songbirds
(Co-Author: Douglas Barron)

Microsatellites are short tandem repeats (e.g. AGAGAGAG) of base pairs in a species' genome. High mutation rates in these regions produce variation in the number of repeats across individuals that can be utilized to determine parentage genetically. In our present research, we are interested in determining traits of individual birds that influence their reproductive success. Because females regularly mate outside of their social pair bond, however, we cannot assume all offspring belong to the female's mate but instead must utilize genetic paternity analyses to determine a male's reproductive success. In this project our objective was to develop useful microsatellites for our two main focal species, the House Finch (Haemorhous mexicanus) and House Sparrow (Passer domesticus). We used mist nets to capture birds on the Arkansas Tech University campus and collected blood samples for use in developing microsatellite markers at The Field Museum's Pritzker DNA Laboratory in Chicago, IL. In short, we fragmented genomic DNA and isolated only those fragments that contained microsatellites using specially designed probes. DNA fragments were then transformed into competent E. coli cells, PCR-amplified, and Sanger sequenced. The resulting DNA sequences were then used to design primers to amplify specific microsatellite loci from genomic DNA. After sequencing approximately 500 E. coli colonies, we successfully designed 15 primer pairs for each species that are suitable to determine parentage genetically. This finalized set of microsatellites will be used to genotype all captured individuals in our study so we may evaluate the relationship between adult characteristics and reproductive success.

P: 20 – Gary Graves
Smithsonian Institution, Faculty Researcher
Judge: No

Winter surveys of Cotinus obovatus (American smoketree) in the Ozark Mountains

Cotinus obovatus (American smoketree) is a rare deciduous tree with a relictual distribution in southeastern North America. Efforts to map its fine-scale geographic distribution in the Ozark Mountains have been limited to the growing season when the distinctive blooming panicles and foliage facilitate detection in hardwood-cedar woodlands. Here I describe the physiognomic traits of leafless C. obovatus that permit effective population mapping in winter landscapes. Clumped growth and diagonally leaning stems facilitate detection at a distance and bark texture, twig morphology, and sap odor confirm the identity of the tree at close range.

P: 21 – Zac Campbell
Arkansas State University, Faculty Researcher
Judge: No

High-throughput Plant Phenotyping at the A-State Phenomics Facility *(Co-Author: Nirmal Nepal)*

The A-State Phenomics Facility offers a variety of high-throughput plant phenotyping assay capabilities, including multi-well plates for seed phenotyping; petri dishes to assess in vitro cultures, seed germination, and seedling growth and vigor; tray configurations for small plants such as Arabidopsis and tobacco; and pot configurations for larger, faster growing plants, such as rice, maize, soybean, and tomato. We routinely test plants growing in both soil and hydroponics, and a number of stress tolerance protocols have been optimized, including those to assess water limitation, heat, nutrients, light, and salinity. We continue to update our technology and protocols in order to achieve the highest level of excellence during each experiment. Utilizing visible, fluorescence, near and far infrared sensors, and proprietary and open source algorithms, we can obtain a wealth of readouts to quantify plant size, color, architecture, and overall health to empower plant biology research.

P: 22 – Leila Henning
University of Arkansas at Monticello, Undergraduate Student
Judge: No

Novel nuclear and plastid loci and their utility for inferring relationships among species of the genus Streptanthus (Brassicaceae) found in Arkansas and adjoining states.
(Co-Authors: Freddie Rivera, Brent Baker, Karen Fawley, Marvin Fawley)

One of the main challenges of species level taxonomy in vascular plants is finding regions of DNA that are variable enough to provide adequate characters for phylogenetic inference. Often, plant species that are easily distinguished by morphological features have few or no differences in the DNA sequences of traditionally used loci such as the ribosomal DNA ITS regions, rbcL, matK, or COI. We have been interested in the taxonomic status of the Arkansas twistflower, Streptanthus maculatus subsp. obtusifolius, which is an Arkansas endemic plant. We are trying to determine if this subspecies should be maintained, merged with Streptanthus maculatus subsp. maculatus (found in Oklahoma and Texas), or elevated to species status. Preliminary studies using nuclear ribosomal ITS sequence data provided some indication of relationships, but with very few character differences. Here we describe preliminary results with the novel nuclear loci, G34 and G56, as well as the plastid trnH-psbA spacer and a plastid region that comprises the trnL-ccsA spacer and most of the ccsA gene. Together these nuclear and plastid regions provide variability that should be useful for approaching our research question.

P: 23 –Jennifer Bryant
Arkansas State University, Undergraduate Student
Judge: Yes

The Hunt for Bigleaf
(Co-Author: Travis Marsico)

Rare trees are invaluable for the ecological niches they fill, supporting ecosystems and having potential economic and medicinal values. The bigleaf magnolia is no exception. This aptly named magnolia is a spectacular understory tree that has leaves up to 1 m long and .5 m wide, unlike anything else found Arkansas! With only one wild population documented west of the Mississippi River, this population is in danger of being lost. Although vouchered specimens exist, the location of this tree remains a mystery. The specimen labels contain errors in counties and coordinates that make it unclear if all known Arkansas specimens have come from a single population or multiple populations in Northeast Arkansas. The mission of this research project is to identify these locations, conduct a thorough search of last-known possible locations to determine if there are living trees in these populations, and to categorize habitat metrics to aid in searching for unknown populations. Located trees will be documented and records shared with the Arkansas Natural Heritage Commission for further study and preservation of the native genotypes. Failure to locate any trees of this species in Arkansas could result in an ecological restoration project for this species.