Midwest Bat Working Group
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Presentation Abstracts

Thursday

EVOLUTIONARY GENETICS AND ECOLOGY OF THE EMERGING PATHOGEN WHITE-NOSE SYNDROME. Hannah T. Reynolds and Jason Slot. *Department of Plant Pathology, The Ohio State University, 2021 Coffey Rd., Columbus, OH 43210.*
The emerging pathogen white-nose syndrome is caused by the fungus (*Pseudogymnoascus destructans*), which has diverse relatives already present in bat hibernacula. To understand the genetic and ecological factors underpinning this disease, we use a combination of genomics, phylogenetics, *in vitro* assays, and virology. Our major questions are: 1) how has the white-nose syndrome fungus evolved from related, non-pathogenic fungi, 2) how might such evolutionary events have impacted its ecology, and 3) what role do fungal viruses play in virulence? We sequenced four novel *Pseudogymnoascus spp.* genomes, and using a large comparative genome set, found widespread variation in *Pseudogymnoascus* gene copy numbers. Here, we highlight two genes essential to fungal ecology: a subtilisin protease gene known to be associated with host invasion and tissue degradation, and a nitrate transporter gene, which could potentially facilitate environmental growth and/or contribute to pathogenesis. We analyzed the evolution of these genes and found evidence of repeated duplication and gene loss, with both genes having recent duplications found only in the white-nose syndrome fungus. Gene duplications are known to permit the emergence of novel metabolic functions, and may be an important factor in the evolution of this bat pathogen. Gene expression and virulence of some fungi can be affected by viruses that infect them. We sequenced a combined transcriptome of 21 non-pathogenic *Pseudogymnoascus* cave isolates, and discovered two novel Partitiviruses infecting these fungi. We used rt-PCR to probe fungal RNA extracts for the presence of these novel viruses, and determined a low level of infection (~5%) in our fungal samples. This corresponds to other fungal systems, which also show low infection rates. We are currently working to infect the white-nose syndrome fungus with these viruses to test how they might alter fungal gene expression and whether they might mitigate virulence on bats.

SANDSTONE CAVES ARE SIGNIFICANT HIBERNACULA FOR THE FEDERALLY THREATENED NORTHERN LONG-EARED BAT (*MYOTIS SEPTENTRIONALIS*). Marlo M. Perdicas, Daniel R. Garrett and Ryan J. Trimbath. *Department of Natural Resources, Summit Metro Parks, Akron, OH 44313; Department of Natural Resources, Cuyahoga Valley National Park, Brecksville, OH 44141.*
Northern long-eared bats (*Myotis septentrionalis*) were recently listed as federally threatened due to the effects of white-nose syndrome (caused by *Pseudogymnoascus destructans*). Their

population and hibernation preferences are poorly understood. Sandstone caves in Liberty Park, Twinsburg, Ohio were surveyed during spring and fall 2004, and again during fall 2015 after the establishment of white-nose syndrome in 2011. Mist nets and harp traps were used to collect bats entering and exiting the cave openings. 2004 population estimates of nearly 10,000 bats were generated using recapture data for two caves. Over 50% of those captured were northern long-eared bats, suggesting that caves produced by cracks and fissures in sandstone geology are significant hibernacula for this species, and that more caves of this type should be evaluated and conserved. 2015 survey results show that nearly all bats previously utilizing the caves are now absent. Conservation of these cave types will ensure their protection for future recolonization by northern long-eared bats and others.

***MYOTIS SEPTENTRIONALIS* and *M. LUCIFUGUS* POPULATIONS POST-WNS IN NORTHERN OHIO.** Tim Krynak. *Natural Resources, Cleveland Metroparks, 2277 West Ridgewood Dr., Parma, OH 44134.*

White-nose syndrome (WNS) is now considered widespread throughout Ohio and documenting the decline while locating remnant populations of both northern long-eared bat (*Myotis septentrionalis)* and little brown bats (*M. lucifugus*) is imperative for protection and potential recovery. To assist in accomplishing this task we turned to a past bat inventory (2002-2003 & 2005) of the of Cuyahoga Valley National Park and Cleveland Metroparks that surveyed 45 locations randomly distributed over the landscape located within Cuyahoga, Summit, and Medina counties. Results from this work described species composition, habitat selection, and roost tree selection of northern long-eared bats. To evaluate decline we focused on 12 of the 45 sites previously surveyed that exhibited the greatest historic capture rates of northern long-eared bats. These sites were revisited in 2015 and mist netting occurred from June 17- July 22, following a similar protocol from previous surveys. As expected the mean capture rate (bat/night) decreased significantly for both northern long-eared bats and little brown bats ($p < 0.001$), while other species encountered did not demonstrate a significant change from pre- to post-WNS, and with big brown bats (*Eptesicus fuscus*) demonstrating an unexpected slight increase. While capture rates were extremely low, one lactating female northern long-eared bat was captured on July 9th and radio tracked to an uncharacteristic roost tree. An emergence survey revealed 4 bats exiting at sunset, but it is unclear if any juveniles were present. Our results confirm that both the northern long-eared bat and the little brown bat populations have dramatically declined on the northern Ohio landscape with only small remnant populations remaining.

PREDICTING BAT ACTIVITY IN THE ROTOR SWEPT AREA BY MODELING BAT ACTIVITY AT DIFFERENT ELEVATIONS IN OPEN HABITATS. I. Paulsen*, K. Chapman, P. Daniels, G. Mickel and K. Clark. *Applied Ecological Services, Inc. 21938 Mushtown Road, Prior Lake, MN 55372.*

Past studies investigating the spatial activity pattern of bat species have largely focused on woodland areas and riparian zones and concluded that the bat activity detected at ground level is insufficient to accurately represent bat species activity at high elevations in the area swept by wind turbine rotors (Menzel et al. 2005, Collins & Jones 2009). Most wind farms in the Midwestern United States are located in open habitats, typically cultivated, where the spatial activity patterns of bats, such as hoary and big brown bats, may differ from that in woodland habitats. We investigated whether bat call detectors installed at low elevations (4 m) in open habitats, primarily cropland, accurately reflected the bat activity detected at high elevations (55 m) at 13 towers in Michigan and Ohio. Our results show that total bat activity, as measured in calls/detector-night during the migratory period (July 15-October 15), as well as activity of big brown bat and eastern red bats, is significantly greater at low elevations compared to high elevations (t [n=8-13] <0.01), while hoary bat activity did not significantly differ across elevations (t [n=19] >0.05). Hoary bat activity at low elevations, however, was positively correlated in a regression model with activity at high elevations, indicating that low elevation detectors reflected high elevation hoary bat activity sufficiently in open habitats (adjusted R^2=0.59, F<0.01). Total bat calls/detector-night at low elevations also correlated with high elevation activity (adjusted R^2=0.39, F=0.02). No such relationship was detected for other bat species. We conclude that bat activity detected at low elevations in open habitats may be sufficient to partially model hoary bat activity and total bat activity in the rotor-swept area, but does not fully represent the spatial activity pattern of other bat species.

TURBINE-INTEGRATED MORTALITY REDUCTION USING REAL-TIME BAT ACTIVITY. Stephen Lindsay, John Goodrich Mahoney, Sue Schumacher and Crissy Sutter. *Normandeau Assoc., Gainesville, FL 32609 (SL, CS); WE Energies, Milwaukee, WI 53215 (SS), Electric Power and Research Institute, Washington, D.C. 20036 (JGM).*
Bat species have been experiencing high levels of wind turbine-related fatalities for many years. Given the continued increase in wind energy facilities (WEFs), particularly in the United States, combined with other emergent threats such as white-nose syndrome (WNS), it is increasingly important to significantly reduce the number of bat fatalities at WEFs. To help curb these fatalities, Normandeau Associates, in association with the Electric Power and Research Institute (EPRI) and WE Energies monitored bat activity on the nacelles of turbines at the Blue Sky-Green Field (BSGF) WEF in Wisconsin during the 2012 fall migration season. These data were compared with weather data to develop a predictive bat activity model that could help inform real-time turbine curtailment options. Normandeau used this model to develop a complete Turbine-Integrated Mortality Reduction (TIMR) system. TIMR incorporates the predictive bat activity model with the real-time acquisition of weather and bat activity data to provide instantaneous information on when turbines should be curtailed. The TIMR system is SCADA-integrated to allow automatic shutdown of turbines when bat mortality is predicted to be high. Normandeau tested the TIMR system at BSGF from July 15 – October 31, 2015. Bat mortality at these turbines was compared to mortality at ten control turbines operating under normal conditions. Bat mortality was 82 % lower for all species and 87% lower for *Myotis lucifugus* (little brown bats) at TIMR turbines compared to control turbines over the entire survey period. The results of the survey also showed a strong correlation between bat activity and mortality, validating the use of activity data to inform mitigation. The successful implementation of TIMR allows companies to maximize bat conservation while minimizing loss of energy and revenue, and has broad implications for bat mortality reduction at WEFs throughout North America.

GENETIC DIVERSITY IN THREE SPECIES OF TREE-BATS. Bryan Carstens, Michael Sovic and H. Lisle Gibbs. *Department of Evolution, Ecology, & Organismal Biology, The Ohio State University, 318 W. 12th Avenue, Columbus, OH 43210.*
Genetic analyses can identify the scale at which wildlife species are impacted by human activities and provide demographic information useful for management. Here, we use thousands of nuclear DNA genetic loci to assess whether genetic structure occurs within *Lasiurus cinereus*

(hoary bat), *L. borealis* (red bat), and *Lasionycteris noctivagans* (silver-haired bat) found at a wind turbine site in Ohio, and to also estimate demographic parameters in each of these three groups. Our specific goals are to: 1) demonstrate the feasibility of isolating RADseq loci from these tree bat species, 2) assess genetic structure within each species, including structure that may be associated with time (migration period), and 3) use coalescent-based modeling approaches to estimate genetically-effective population sizes and patterns of population size changes over evolutionary timescales. Thousands of loci were successfully genotyped for each species, demonstrating the value of RADseq for generating polymorphic loci for population genetic analyses in these bats. There was no evidence for genetic differentiation between groups of samples collected at different times throughout spring and fall migration, suggesting that individuals from each species found at the wind facility are from single panmictic populations. Estimates of present-day effective population sizes were large, but varied substantially across the three species, from a low of $\sim 2\times10^5$ for *L. noctivagans* to a high of $\sim 1.6\times10^6$ for *L. borealis*. All populations show evidence of expansions that date to the Pleistocene. These results, along with recent work also suggesting limited genetic structure in bats across North America, argue that additional biomarker systems such as stable-isotopes or trace elements should be investigated as alternative and/or complementary approaches to genetics for sourcing individuals collected at single wind farm sites.

MIDWEST WIND ENERGY MULTI-SPECIES HABITAT CONSERVATION PLAN.
Megan Seymour. *US Fish and Wildlife Service, 4625 Morse Rd., Suite 104, Columbus, OH 43230.*
The American Midwest is experiencing rapid growth in the development of wind energy for electric power generation. While wind turbines are a clean and renewable means to generate power, they are known to cause mortality of bats and birds. Many wind energy projects in the Midwest must address potential risks posed to species listed as threatened and endangered under the Endangered Species Act (ESA), particularly the Indiana bat. Where development may take listed species, an "incidental take permit" may be issued by USFWS. To obtain a permit, a habitat conservation plan must be prepared and the U.S. Fish and Wildlife Service (USFWS) must conduct a National Environment Policy Act analysis. To provide a regional approach, the Midwest Wind Energy Multi-Species Habitat Conservation Plan (MWE MSHCP) is being developed as a collaborative effort among the USFWS's Midwest Region; natural resources agencies of the States; the American Wind Energy Association; a consortium of wind energy companies; and The Conservation Fund. The purpose of the MWE MSHCP is to provide conservation benefits to the Covered Species, as well as other non-listed species, while accommodating wind energy development across the Midwest. The MWE MSHCP will provide a clearly defined regulatory process for wind energy project operators to take actions that avoid, minimize, monitor, and mitigate adverse effects on Covered Species and streamline the permitting process. The proposed term of MWE MSHCP is 45 years and covers 18,004 megawatts of existing wind facilities and 33,000 megawatts of new wind development. The proposed Covered Species include the Indiana bat, northern long-eared bat, little brown bat, Kirtland's warbler, Great Lakes and Great Plains populations of the piping plover, interior least tern, and bald eagle. The Covered Lands include a subset of areas within the 8 Midwest states (Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin).

Friday

INFLUENCE OF ROADSIDE CHARACTERISTICS ON BAT SPECIES' PRESENCE AND RELATIVE ACTIVITY IN NORTHWEST OHIO. Christian E. Nordal* and Dr. Karen V. Root. *Department of Biology, Bowling Green State University, Bowling Green, OH 43403.*
Northwestern Ohio provides foraging habitat to eight bat species in remnant natural areas within a mixed disturbance matrix. These species face numerous threats such as habitat loss and white-nose syndrome, and continuous monitoring efforts are needed for effective management of declining populations. Driving transects offer a quick and efficient way to survey species in areas that are fragmented by roads, yet no studies have demonstrated the effects of common roadside features associated with this type of habitat fragmentation on presence and activity of bat species. We surveyed 15 roads each within and outside of protected areas, successfully detecting all eight species found in the region. We developed models for all species except the northern long-eared bat (*Myotis septentrionalis*) because of low detection rates. Univariate logistic regression models highlighted the significant effects many roadside features, e.g., canopy cover, roadside slope, and telephone poles, have on bat activity and presence. Responses varied among species, indicating a differential species response to characteristics associated with fragmentation. We developed statistically significant multivariate models for all species' presence and activity except for the hoary bat (*Lasiurus cinereus*). Low explanatory power for all models indicated these local features have modest influence on presence and activity, and other factors may also be important. Driving transects in this region may, thereby, offer an effective monitoring strategy for managers in charge of a variety of taxa, but monitoring of core habitat for forest interior specialists, such as the newly-listed northern long-eared bat, should be included to successfully detect the full species assemblage. These results should aid our efforts to improve the management of bats, so they may persist in the face of many threats and a changing environment.

A PRELIMINARY EVALUATION OF AUTOMATED BAT CALL CLASSIFIERS USING ACOUSTIC TRANSECT DATA FROM SUPERIOR, CHIPPEWA AND CHEQUAMEGON-NICOLET NATIONAL FORESTS. Kevin L. Murray, Tara Hohoff, Timothy J. Catton, Brian Heeringa and Kari Kirschbaum. *Western Ecosystems Technology, Inc., Bloomington, IN 47404 (KLM), University of Illinois, Champaign, IL 61801 (TH), Superior National Forest, USDA – Forest Service, Ely, MN 55731 (TJC), Chequamegon-Nicolet National Forest, USDA – Forest Service, Ashland, WI 54541 (BH), Chippewa National Forest, USDA – Forest Service, Cass Lake, MN 56633 (KK).*
Identification of bat echolocation calls to species is becoming increasingly important in bat research, particularly in monitoring the spread and long-term effects of white-nose syndrome and in assessing the risk to sensitive bat species posed by various types of development. To meet this growing need, automated identification software packages (i.e., autoclassifiers) have proliferated in recent years. While autoclassifiers provide objective and repeatable quantitative call identification, they have several shortcomings due to the limitations of statistical analyses involved, our imperfect knowledge of bat echolocation call variation, and the nature of bat

echolocation calls. We used acoustic transect data from three National Forests in Minnesota and Wisconsin to evaluate the effectiveness of autoclassifiers. The goals of the analysis will be to: 1) examine congruence among autoclassifiers in estimating general bat activity, relative species activity levels, species presence/absence, and individual species classifications; 2) determine if certain species or species groups cause consistent problems; 3) determine if call quality and identification confidence level impact performance; and 4) determine how autoclassifiers deal with rare and absent species.

BRANDENBARK™: MITIGATION/MANAGEMENT TOOL FOR PROJECTS INVOLVING BARK ROOSTING BATS. Mark Gumbert, Joshua Adams, Piper Roby, Price Sewell, Mike Brandenburg and Zachary Baer. *Copperhead Environmental Consulting, Inc., 11641 Richmond Rd., Paint Lick, KY 40461 (MG, JA, PR, PS, ZB)*; *Fort Knox, DPW, Natural Resource Branch, 6th Avenue, Suite 320, Fort Knox, KY 40121 (MB).*

ARCHIVING BAT SKIN BIOPSIES: STORAGE METHOD MATTERS FOR PROSPECTIVE STABLE ISOTOPE ANALYSIS. T. J. Divoll*, J. M. O'Keefe and R. H. Michener. *Center for Bat Research, Outreach, and Conservation, Department of Biology, Indiana State University, Terre Haute, IN 47809 (TJD and JMO); Boston University Stable Isotope Laboratory, Department of Biology, Boston University, Boston, MA 02215 (RHM).*
Many bat researchers opportunistically collect 3 mm wing biopsies during field surveys and store them in ethanol (EtOH) for future genetic analyses. Samples for non-genetic studies, such as those using stable isotopes, are typically frozen dry without a preservative. Could stable isotope analysis of archived skin samples stored in EtOH be used to infer changes in diet or niche over time? To compare isotopic results from EtOH or frozen dry storage, we collected one skin sample biopsy from both wings of 30 bats, randomly storing one per bat in EtOH and one frozen dry. Samples were collected at a managed forest (20 *Myotis septentrionalis* and 4 *M. sodalis*) and a riparian-agricultural site (5 *M. sodalis*) in central Indiana. Carbon ($d^{13}C$) and nitrogen ($d^{15}N$) isotope ratios were measured in all samples and statistical parameters were estimated by Markov chain Monte Carlo with 10^5 repetitions to determine the probability that paired samples were different. We calculated four additional metrics by group (species and site): range of carbon and nitrogen, bivariate total area and standard ellipse area in isotopic space. Overall, there was a >99% probability that the mean difference (MD) between EtOH and dry samples was significant for carbon (MD = 0.948, CrI = 0.224, 0.465) as well as nitrogen (MD = 0.583, CrI = 0.364, 0.807). All groups visually occupied different areas of isospace, and dry samples had greater standard ellipse area than EtOH samples (*M. septentrionalis*, Pr >98%; *M. sodalis*, Pr = 73.9%). For all groupings, we observed a greater range of carbon values in dry samples than in EtOH. It is, therefore, likely that carbon molecules in EtOH increased uniformity of values. Although skin samples stored in EtOH may be useful for genetic analyses, we do not recommend using archived wet samples for stable isotopes.

USFWS REGION 3 STANDARDIZED SPREADSHEET FOR SUBMITTING BAT DATA. Keith Lott, Kristen Lundh, Erik Olson, Andy King, Shauna Marquardt, Barb Holsler and Tam Smith. *United States Fish and Wildlife Service (USFWS), 4625 Morse Road, Suite 104, Columbus, OH 43230.*
Annual reporting is a requirement of all section 10(a)(1)(A) Recovery permits. Although Field Offices and the Regional Office receive these reports, the data is not provided in a standard

format. Consequently it is left to the individual Field Offices to retrieve data from written reports and assemble it into a usable format. The resulting databases are designed and maintained by the individual Field Offices which makes regional or species-range data difficult to query and cross-reference. In 2015, a group of U.S. Fish & Wildlife Service (USFWS) biologists was assembled to create a data reporting system that would be standardized across Region 3 of the USFWS. A standard data format allows for the development of analysis methods or tools at the Field Office level to easily be shared with other Field Offices or reused for other bat species. In addition, the use of this database will hopefully reduce redundancy, increase ease of data entry, and minimize errors. Ultimately this database should increase the efficiency of the Service when assessing potential impacts and evaluating species trends.

BAT SURVEYS AT EFFIGY MOUNDS NATIONAL MONUMENT IN NORTHEASTERN IOWA. Francis Tillman, Kayla McLaughlin and Gerald L. Zuercher. *Department of Natural & Applied Sciences, University of Dubuque, Dubuque, IA 52001.*
We were asked to survey bats at Effigy Mounds National Monument in northeastern Iowa with special emphasis on detections of federally threatened northern long-eared bats (*Myotis septentrionalis*) and federally endangered Indiana bats (*M. sodalis*). We sampled bats with acoustic detectors (Wildlife Acoustics SM3) and with mist-nets. Acoustic detectors were randomly deployed throughout the park and provided guidance on where to set mist-nets to enhance our capture success. Through Kaleidoscope Pro 3.0, acoustic files were initially identified to species. For myotine bat species, each file was examined to determine the correct bat species. Seven bat species were confirmed, including northern long-eared bats which were recorded at each sampling location. Analysis of acoustic files has not presented compelling evidence to suggest the occurrence of *M. sodalis* at the park. All captured bats were processed and DNA samples were obtained from the facial region using Isohelix® DNA swabs; these samples were used to test for the presence of *Pseudogymnoascus destructans*, the fungus that causes white-nose syndrome. In total, seven bat species were captured with northern long-eared bats being most common, followed by little brown bats and big brown bats (*Eptesicus fuscus*). Some spatial patterns have emerged with northern long-eared bat captures occurring throughout the park and little brown bat captures only occurring in the northern sample sites. Silver-haired (*Lasionycteris noctivagans*) captures have occurred only in upland prairie-forest interface locations while captures for all other bat species were concentrated in lowland floodplain locations. At present, Effigy Mounds National Monument appears to be an important site for bats, especially northern long-eared bats.

ROOSTING HABITS OF THE NORTHERN LONG-EARED BAT (*MYOTIS SEPTENTRIONALIS*) IN A MANAGED FOREST. Timothy Carter, Jocelyn Karsk, Kristi Confortin and Scott Haulton. *Department of Biology Ball State University Muncie, IN 47306 (TC, JK, KC); Division of Forestry, Indiana Department of Natural Resources, Division of Forestry, 402 W Washington St., Ridgeville, IN 47380 (SH).*

HABITAT SUITABILITY MODELING OF THE NORTHERN LONG-EARED BAT (*MYOTIS SEPTENTRIONALIS*) IN SOUTHERN INDIANA. Jocelyn R. Karsk*, Timothy C. Carter and G. Scott Haulton. *Department of Biology, Ball State University, Cooper Life Science Building, CL 121, Muncie, IN 47306 (JRK, TCC)*; *Indiana Department of Natural Resources, Division of Forestry, 402 W Washington St., Ridgeville, IN 47380 (GSH).*

Silviculture treatments have long been implemented on state forest lands in Indiana. There is a need to better understanding these influences on bat species in order to understand which forest management practices might best promote bat conservation, especially for threatened and endangered species. The northern long-eared bat (*Myotis septentrionalis*) was federally listed in 2015 and this listing is having major implications for land managers since the northern long-eared bat uses forested landscapes for summer roosting habitat. Our goal was to create a habitat suitability model that included both landscape variables and harvest history. Our study site was at the Hardwood Ecosystem Experiment (HEE) located in the Morgan-Monroe State Forest and Yellowwood State Forest in southern Indiana. We generated presence-only models of roost selection using the program MaxENT using 105 known roost locations to identify areas important to summer roosting habitat within our study area and to identify important stand-scale factors in habitat selection. The landscape variables that we used were elevation, aspect, slope, distance to major roads, and forest type, and time since harvest. With decreasing populations and likelihood of captures, models may become an important alternative for informing future management actions.

PREDATION AND OTHER FACTORS INFLUENCING EMERGENCE TIMES OF INDIANA BATS (*MYOTIS SODALIS*). Robert Arndt, Joy O'Keefe, William Mitchell, Jordan Holmes and Steven Lima. *Center for Bat Research, Outreach, and Conservation, Indiana State University, Terre Haute, IN 47809.*
Variation in emergence times in bats could be explained by a range of factors, including predation risk, food competition, reproductive state, or changes in weather. The aim of this analysis was to determine the set of factors that best explains the variation relative to sunset in emergence times in a population of Indiana bats from summer maternity roosts. Emergence time data were collected from March to October, 2003 to 2014, at a site in central Indiana that has long hosted maternity roosts of Indiana bats. Roosts were observed from 30 minutes before sundown until 10 minutes had passed without an exiting bat. Bats showed a strong tendency to leave a roost earlier as (i) the reproductive season progressed through pregnancy and lactation, and (ii) cloud cover at dusk increased. Emergence times were also earlier at roosts farther from forest edge, in larger colonies, and in relatively humid conditions. Moon phase and temperature had little impact on emergence times. Many of the variables with strong effects may be associated with either predation risk or food competition. The effect of reproductive period suggests that bats were taking greater risks by emerging earlier (often before sunset) when their energetic demands were highest. The tendency to leave earlier from larger colonies suggests a role for competition in emergence times. Emergence times are less correlated with cloud cover during times of high energetic demand, suggesting riskier behavior. A relatively strong effect of relative humidity may indicate an underlying unmeasured factor, perhaps related to food availability.

GLOBAL INFLUENCE OF LAND COVER ON DIETARY SPECIALIZATION OF INSECTIVOROUS BATS. Josiah J. Maine and Justin G. Boyles. *Cooperative Wildlife Research Lab, Southern Illinois University, Carbondale, IL 62901.*
Anthropogenic land-use change is a leading cause of biodiversity loss globally, but species vary in their response to environmental change. Assessing the variables influencing resistance of species to environmental change is important to guide biodiversity conservation. Generalists, for example, may be more resistant to environmental change than specialists due to their ability to

exploit changing resources. Insectivorous bats are voracious predators, but exhibit wide variation in dietary specialization. Here, we assess the effect of land cover and wing morphology on dietary diversity and the two most common prey items on which bats specialize (moths and beetles). We selected independent variables using phylogenetic generalized least squares and model selection. Moth and beetle specialization were highly correlated with phylogenetic relationships, while dietary diversity exhibited only slight phylogenetic signal. Dietary variables were not significantly related to morphological variables. Dietary diversity increased with increasing amount of cropland near the study area, specialization on moths decreased with increasing habitat diversity, and specialization on beetles decreased with increasing distance from the equator. Prey diversity was expected to decrease with increasing cropland, but our results show a positive relationship. We suggest that dietary specialists may avoid agricultural habitats due to lack of preferred prey. Dietary specialists may thus be increasingly at risk as agricultural intensity increases around the world.