Hosted by: Wisconsin Department of Natural Resources

At Pyle Center University of Wisconsin

Madison, Wisconsin

Poster and Oral Abstracts

*Student Competition Presenter

Poster Abstracts

POSTER #1

BAT COMMUNITY AND FEMALE *MYOTIS SEPTENTRIONALIS* ROOST-SITE HABITAT ASSESSMENT AT EFFIGY MOUNDS NATIONAL MONUMENT

Meagan J. Albon*, Madeleine E. Zuercher, Francis E. Tillman, Jr., and Gerald L. Zuercher, *Department of Natural and Applied Sciences, University of Dubuque, Dubuque, IA 52001 (MJA, FET, GLZ); Department of Integrative Biology, University of California – Berkeley, Berkeley, CA 94720 (MEZ)*

Effigy Mounds National Monument (EFMO) is a national park along the Mississippi River in northeastern Iowa that contains diverse topography with lowland and upland forests interspersed with upland prairie. *Myotis septentrionalis* (Northern Long-eared Bat) were listed as a Federally Threatened species in April, 2015. The park has been the focus of bat monitoring since 2014 and appears important for *Myotis septentrionalis* as they have been acoustically detected throughout the park. One goal was to assess bats within the park with emphasis on *Myotis septentrionalis*. Spatial and temporal patterns of bat communities were evaluated by mist-netting multiple locations within the park during 2015 and 2016. Seven species were captured during 2015 and five species were captured in 2016. *Myotis septentrionalis* was the second most common species captured in both years behind *Myotis lucifugus* (Little Brown Bat). Interestingly, in both years, *Myotis septentrionalis* were captured in lowland and upland sites as predicted by net-night effort. *Myotis septentrionalis* are thought to use habitat similar to availability. A second goal was to evaluate whether female *Myotis septentrionalis* roost-site habitat fits a generalist model or whether any habitat patterns exist that might guide the National Park Service with future management. We placed VHF radio-transmitters on eleven female *Myotis septentrionalis* during 2015 and 2016 and successfully tracked seven bats to their daytime roost-trees at least once. We located a total of 14 roost-sites. At each roost-site we assessed surrounding habitat for comparison against available habitat. We detected no patterns for habitat variables such as slope, canopy cover, tree density, and average diameter-at-breast-height. However, average tree height at roost-sites was significantly shorter compared to general available habitat at the park. Our data suggest that female *Myotis septentrionalis* use roost-sites during summer that generally resemble the available habitat.

POSTER #2

A COMPARISON OF NORTHERN LONG-EARED BAT (*MYOTIS SEPTENTRIONALIS*) HABITAT SUITABILITY IN FOREST-DOMINATED AND AGRICULTURAL-DOMINATED LANDSCAPES

Cheyenne Gerdes, Laura D'Acunto and Patrick Zollner. *Department of Forestry and Natural Resources, Purdue University, West Lafayette, IN 30602*

Persistent population declines and the continuing spread of White-nose Syndrome have led to the listing of the once common Northern long-eared bat (*Myotis septentrionalis*) as federally threatened. Addressing the resource needs of these bats during the summer when gestation, parturition, and lactation occur is an important part of species preservation. The majority of studies on summer roosting needs of this species focus on site and roost tree characteristics. However, because Northern long-eared bats are highly plastic in maternity roost selection, using landscape level characteristics to define critical habitat may be a more feasible approach for generating management tools. While landscape-level habitat suitability data exists for the highly forested areas in southern Indiana, less work has been done to determine habitat suitability for the more agriculturally fragmented areas of the Midwest. This study compares habitat suitability of forest dominated and agricultural dominated landscapes for northern long-eared bat roosts. We delineated forest-dominated and agricultural-dominated landscapes using a 25km moving window analysis on a raster dataset of forested and non-forested cells derived by the National Land Cover Database. We considered each cell with a window containing at least 22% forest as forest-dominated, while the rest of the study area we considered agriculture-dominated. We used

MaxEnt to create a habitat suitability maps of northern long-eared bat based upon historical roost records. Landscape-level environmental features such as local and nearby forest habitat, water resources, the presence of developed areas, and the presence of nearby roads to inform habitat suitability were used as predictor variables in this modeling. We generated unique models for forest dominated areas and agriculturally dominated areas and compared these models to determine whether variables informing suitability differed for forest-dominated and agriculture-dominated landscapes.

POSTER #3

NORTHERN BAT ROOSTING HABITAT IN THE UPPER OHIO VALLEY

Jesse L. De La Cruz[1†], Ryan L. Ward[1] [1]*AllStar Ecology LLC, 1582 Meadowdale Road, Fairmont, WV 26554, USA. 304-816-3490*. †Corresponding author jesse@allstarecology.com

Limited research has been conducted in regard to suitable roosting-habitat of Northern Bats (*Myotis septentrionalis*) in the Upper Ohio Valley. As Northern Bats continue to decline due to the fungal pathogen *Pseudogymnoascus destructans,* it will be necessary to understand habitat interactions of a remaining population stronghold in hopes of preventing regional species extirpation. Our research objectives were to determine average roost tree use and home range size, and to assess roosting-habitat suitability and availability across the landscape. We used a maximum entropy (MAXENT) approach to determine if the distribution of various ecological factors influenced roosting-habitat suitability of Northern Bats. We conducted mist-netting capture and radio-telemetry tracking across Monroe and Noble Counties in eastern Ohio, and Doddridge, Harrison, Marshall, Ritchie, and Tyler Counties in western West Virginia. Tracking efforts found 44 Northern Bat roosts comprised of 10 tree species and 1 man-made structure (i.e., telephone pole), with cavities (78.6%) of Sassafras (*Sassafras albidum*; *n* = 13) and Red Maples (*Acer rubrum*; *n* = 13) used equally and most often (59.1%). Furthermore, roosting home range size, based on 6 minimum convex polygons (MCP), was $\bar{x}$ = 7.4 ± 5.8 ha. Based on roost tree locations, MAXENT (AUC = 89.3 ± 2.9) characterized highly suitable roosting-habitat as being forest tracts of 100–200 ha that were non-forest $\geq$ 53 years ago. Additionally, suitable roosting areas were associated with elevations of 300–365 m and aspects of 200–300°. Slope and area solar radiation contributed little to the model and may not be limiting ecological factors. High (81–100%) and medium-high (61–80%) roosting-habitat suitability classes were uncommon across the landscape (0.9% and 3.1%, respectively), with the broad medium-to-high classes (41–100%) collectively comprising 13.8% of the study area. These results add to current knowledge of roosting-habitat of the Northern Bat and provide land and wildlife managers localized guidance on conservation priorities.

POSTER #4

CITIZEN-BASED BAT MONITORING IN WISCONSIN

Heather M. Kaarakka and J. Paul White. *Bureau Natural Heritage Conservation, Wisconsin Department of Natural Resources, 101 S Webster St, Madison, WI.*

In Wisconsin, five of the seven species of bats found in the state are listed as Species of Greatest Conservation Need, and the remaining two are Species with Information Needs. Wisconsin's Wildlife Action Plan identified inventory and monitoring efforts at that time (2008) as not adequate to address bat population trends and status, distribution and range, and habitat requirements. To increase monitoring efforts for bats, the Wisconsin Bat Program turned to the state's established citizen-based monitoring network to create a volunteer based bat monitoring program. For almost a decade, the Wisconsin Bat Program has partnered with citizen-scientists in Wisconsin to conduct acoustic and summer roost surveys. Surveyors use AnaBat SD ultrasound detectors to record bats on walking, water and driving routes. To monitor summer roost sites, surveyors conduct evening emergence counts several times over the season. Statewide bat surveys conducted by volunteers have allowed the WBP to collect baseline data about distribution and relative abundance of bats prior to the arrival of white-nose

syndrome. To date, over 3,000 acoustic surveys have been conducted in every county in the state and WBP has over 150 monitored roosts in its summer roost database. Since the occurrence of WNS in Wisconsin in 2014 and subsequent declines in winter bat populations, population declines have also been observed on the summer landscape through acoustic and roost surveys. Records of these declines would not be known were it not for the survey efforts of citizen-scientists. The WBP will continue to expand both acoustic and summer roost surveys in the future as citizen-based monitoring has proven an effective method of gathering long-term data about bat ranges and population trends across the state.

POSTER #5

RESEARCH, MONITORING, AND OUTREACH IN THE ILLINOIS BAT CONSERVATION PROGRAM'S FIRST YEAR

TARA C. HOHOFF**,** Matthew M. Safford, Ashleigh B. Cable, Joseph A. Kath, Ann M. Holtrop, Jill L. Deppe, and Steven J. Taylor. *Illinois Natural History Survey, Champaign, IL 61820 (TCH, SJT, MMS); Eastern Illinois University, Charleston, IL 61920 (JLD, ABC); Illinois Department of Natural Resources, One Natural Resources Way, Springfield IL 62702 (JAK, AMH).*

The Illinois Bat Conservation Program (IBCP), established in July 2016, is a statewide research, monitoring and outreach program focused on conservation and management of Illinois bats. This program collects data via numerous survey methods including: mist netting, acoustic surveys, emergence counts and eDNA fecal sampling in order to better understand how bat species are utilizing resources in Illinois. This data helps inform conservation and management efforts for Illinois' thirteen bat species. For several species, Illinois bat populations are still declining due to white-nose syndrome, and other types of mortality remain a concern as wind energy continues to expand within the state. In the last half of the summer of 2016, we completed mist netting at 5 sites, emergence counts at 4 sites, completed 6 NABat Monitoring GRTS grids, and collected 5 eDNA fecal samples. Acoustic data collection follows the guidelines outlined by the USGS in the North American Bat (NABat) Monitoring Program, utilizing both stationary deployments and driving transects. Outreach efforts thus far include development of a website (www.illinoisbats.org), handing out fliers to landowners, a training workshop for agency personnel, and several radio interviews, including one with the Illinois Farm Bureau. The NABat surveys have provided approximately 45,000 sound files that we are in the process of classifying using both software identification and manual vetting. In 2017, the IBCP will expand mist netting efforts, as well as begin radio-tracking to locate additional roost sites. In 2017, we hope to strengthen collaborations and cooperation with researchers, resource managers, and agencies working in Illinois. Finally, we hope to increase the number of known Illinois roost locations by reaching out to fellow biologists, resource managers, and the general public using a roost reporting form available online (www.illinoisbats.org).

POSTER #6

FIRST STATE-WIDE ACOUSTIC SURVEY FOR BATS IN MICHIGAN

Giorgia Auteri, Rob Mies, John DePue, and Bill Scullon. *Organization for Bat Conservation, Bloomfield Hills, MI (GA, RM); University of Michigan, Ann Arbor, MI (GA); MI Department of Natural Resources, Norway, MI (BS); MI Department of Natural Resources, Baraga, MI (JD)*

Populations of bats in Michigan are facing novel threats, such as white-nose syndrome and climate change, as well as long-standing risks from direct habitat loss. Yet, prior to these efforts there has been no programmatic, state-wide monitoring of these animals during the summer and fall to establish a baseline of data against which to measure future distribution trends. We initiated an annual, citizen-science based, bioacoustic monitoring program for bats in the state. Volunteers attached acoustic monitoring equipment (EchoMeter Touch) to vehicle roofs and performed either a linear or loop driving transects (~30 miles long) at 20 mph or slower. All calls were identified quantitatively (Kaleidoscope

V.4.0.0 and EchoClass V.3.1) and qualitatively. We used a conservative approach, designed to reduce false-positives, in which a call was only assigned a final identification if at least two of the three methods agreed. Eight survey routes were conducted between 21 July and 30 August 2016, with 15 total survey nights and 1–3 surveys performed per route and 22.6 total survey hours. A final identification to species group was assigned to 68% (661) of recorded calls: Big brown/silver-haired bats (n = 534), eastern red bats (108), hoary bats (14), evening bats (3), and little brown bats (2). Calls of evening bats were restricted to the southwestern portion of the state, while calls of little brown bats occurred at one site in the eastern Lower Peninsula, near a known hibernation site. We are expanding future efforts to paint a broader picture of bat populations, and establish a summer bat monitoring program in Michigan.

POSTER #7

YEAR-ROUND AND SEASONAL ACOUSTICAL MONITORING OF BATS IN THE DRIFTLESS REGION OF NORTHEASTERN IOWA: IS YEAR ROUND MONITORING WORTHWHILE?

Tyler K Self and Gerald Zuercher. *National Park Service, Effigy Mounds National Monument, Harpers Ferry, IA 52146(TKS); Department of Natural and Applied Sciences, University of Dubuque, 52001(GZ)*

Acoustic monitoring of bat echolocation calls is a remote monitoring technique recently implemented as part of a larger long-term bat study at Effigy Mounds National Monument (EFMO) in northeastern Iowa. The purpose of the study is to establish baseline data against which future comparisons can be made as White-Nose Syndrome (WNS) begins to affect local bat populations. Long term monitoring of multiple sites allows comparison of activity across both temporal and spatial scales. Bats exhibited different activity patterns based on species and site. *Myotis lucifugus* (little brown bat) and *Myotis septentrionalis* (northern long-eared bat) appear more active at upland sites while *Eptesicus fuscus* (big brown bat) appear more active at lowland sites. Determining where bat activity is concentrated could be especially important for WNS sensitive species and affects landscape management decisions within the park. Multiple locations were monitored from April through October to compare between lowland and upland sites. Some sites also were continually monitored over the winter season. The long term monitoring has recorded bat activity during every month of the year, suggesting some minor bat presence within EFMO during the winter months. Additionally, six of seven species confirmed in the park have shown activity outside of the April through October period. This represents the first documentation of overwinter bat activity at EFMO, and hibernacula are not thoroughly documented in northeastern Iowa. Because winter activity has been associated with WNS, year-round monitoring at additional locations may yield further evidence of winter activity, and could potentially detect WNS related changes in bat activity.

POSTER #8

MORE REFERENCE RECORDINGS DECREASES, RATHER THAN INCREASES, ACOUSTIC CLASSIFICATION PERFORMANCE OF *MYOTIS SODALIS* AND *M. LUCIFUGUS*

Joseph M. Szewczak[1], John D. Chenger[2] and Janet D. Tyburec[3] ***1*** *Humboldt State University, Arcata, USA;* ***2*** *Bat Conservation and Management, Inc., Carlisle, USA;* ***3*** *Bat Survey Solutions, LLC, Tucson, USA*

Initial attempts to use recordings from species-known tracked bats to identify *Myotis sodalis* and distinguish it from the acoustically similar congener *M. lucifugus* indicated some acoustically distinct parts of their respective call repertoires. This encouraged continued tracking and recording of these species in hope that a larger data set would strengthen the statistical difference between their echolocation calls and provide more robust classification. Instead, additional data filled in parts of the data space previously reserved to the other species and vice versa. This implied that apparent classification success between these species might result from the stochasticity of the data used to base a classifier. To investigate this, we used a set of 10,955 species-known call samples recorded from tracked individuals in twelve states across its range. We randomly selected sets from 614 to 10,005 call

samples to build and test classification performance using both the full SonoBat version 4 time-frequency and time-amplitude parameters and Analook-equivalent time-frequency parameters. Classification performance ranged from 95.0–69.9% correct using the full SonoBat parameter sets and from 88.6–56.9% correct for the Analook-equivalent parameter sets. Both approaches revealed greater range of performance for smaller data sets, a downward trend in classification performance with larger data sets, and both extrapolated to a meaningless 50% correct performance near 21,000 calls. This indicates that these species may make similar flight and foraging maneuvers requiring calls having similar solutions to the task at hand, and that any single call or sequence cannot identify these species definitively.

POSTER #9

IMPROVING BAT SURVEY EFFICIENCY AND OCCUPANCY RESULTS BY USING SIMULTANEOUS CAPTURE AND ACOUSTIC METHODS

Janet D. Tyburec[1], John D. Chenger[2], and Joseph M. Szewczak[3], ***1*** *Bat Survey Solutions, LLC, Tucson, USA;* ***2*** *Bat Conservation and Management, Inc., Carlisle, USA;* ***3*** *Humboldt State University, Arcata, USA*

All survey methods for bats are biased. Physical capture surveys, using mist nets will over-represent species that: (1) fly close to the ground, (2) have fast, un-maneuverable flight styles, and (3) are common. Passive acoustic surveys, using high-frequency microphones on bat detectors, will over-represent species that have echolocation calls that are: (1) high-amplitude, (2) low-frequency, and (3) unique (i.e., include repertoires that have little overlap with other species in the area). We illustrate the occupancy results of single-survey method efforts using either mist-nets or bat detectors and then compare occupancy results when acoustic and capture efforts are combined simultaneously. Surveys were conducted during the summer of 2016 at survey sites in three distinct geographic locations of the United States: the Southwest (southeastern Arizona), Northwest (extreme northern California), and Midwest (western Kentucky). Total bat species diversity known from each area is based upon decades of work by the authors at these three locations and ranged from 13-21 species. At each location, the completeness of bat surveys using single vs. combined methods was documented using species accumulation models. By combining both acoustic and capture survey methods, simultaneously, time spent in the field to determine the most accurate estimate of species occupancy was reduced by up to 60%. Researchers performing bat surveys will be more efficient and produce more reliable results when capture and acoustic methods are deployed simultaneously.

POSTER #10

FACTORS INFLUENCING VOLUNTARY BAT CONSERVATION MANAGEMENT BY PROFESSIONAL FORESTERS

Laura E. D'Acunto* and Patrick A. Zollner. *Department of Forestry and Natural Resources, Purdue University, West Lafayette, IN 47907 (LED, PAZ).*

Integration of conservation efforts that benefit endangered species in forested lands of the U.S. are highly dependent on the decisions made by professional foresters. Federal regulations do not require private landowners to search for endangered species before conducting forest management activities. Because private lands make up 85% of Indiana's forests, recommendations by consultant professional foresters influence the majority of the management decisions made on Indiana bat (*Myotis sodalis*) habitat in the state. Thus, we wanted to determine what factors lead professional foresters in Indiana to adopt management strategies that benefit bat conservation. We conducted an online survey of Indiana consultant, state, non-profit, and industry foresters to address two main objectives: 1) to assess forester awareness of regulations for adequate bat habitat and their level of exposure to extension education on this subject; 2) to identify the factors that influence professional foresters in Indiana to manage forests to improve bat habitat quality. We hypothesized that forester awareness of regulations and increased

exposure to extension education should correlate with willingness to engage in voluntary management activities that benefit bats. To address whether intention to manage forests in congruence with conservation recommendations translates into on-the-ground decisions, we will conduct vegetation surveys on stands marked for harvest by a subsample of our survey respondents. Through the results of this study, we will have a greater understanding of how management decisions are made on private forests in Indiana, as well as where education intervention could be used to further benefit bat conservation.

POSTER #11

LANDSCAPE FEATURES AFFECTING BAT PHONIC GROUP ACTIVITY IN GREAT SMOKY MOUNTAINS NATIONAL PARK

Elizabeth A. Beilke and Joy M. O'Keefe. *Center for Bat Research, Outreach, and Conservation, Indiana State University, Terre Haute, IN 47807*

Great Smoky Mountains National Park (GRSM) is a spatially heterogeneous and biologically significant area. Twelve bat species occupy GRSM, with 6 of those confirmed susceptible to WNS. The relationship between nocturnal habitat use by bats and landscape features is poorly understood; however, understanding these relationships may allow us to use landscape features to predict where bats are. We conducted an acoustic survey at 48 random (2–8 nights/point) from May to August 2015–2016 in GRSM to relate bat activity to landscape features such as dominant habitat type, proximity to water, distance to early successional edge, distance to human infrastructure, elevation, and measures of landscape heterogeneity. We deployed Pettersson D500X detectors on trails in spruce fir, northern hardwood, and conifer-mixed forests and in early successional openings, merging recorded calls into major phonic groups (identifications made in EchoClass v3.1). We then used stepwise generalized linear models to identify landscape features that best predicted bat activity in GRSM. Preliminary analyses of 2016 data showed that linear models were most significant for low frequency bats, which were more likely to be detected in early successional openings near water. These results suggest that landscape-scale features may not be strong predictors of activity for mid frequency or *Myotis* bats in GRSM. These results may have been confounded by pooling bat species into phonic groups, and different call ID programs may have yielded separate results. Our results may change given the addition of our 2015 data.

POSTER #12

THE LITTLE BROWN BAT PRIORITY SPECIES CAMPAIGN: A REGIONAL CONSERVATION EFFORT

Elizabeth Watson Lehrer and Juanita Armstrong-Ullberg

Urban Wildlife Institute, Lincoln Park Zoo, Chicago, IL (EWL); Will County Forest Preserve District, Joliet, IL (JAU)

Chicago Wilderness, an alliance of environmentally-focused organizations in the Chicago metropolitan area, recently launched a Priority Species Campaign to concentrate regional conservation efforts around wildlife species of concern. After a rigorous selection process, the little brown bat (*Myotis lucifugus*) was selected as one of the 12 priority species. Recognizing the challenges that little brown bats are facing due to White-nose syndrome (WNS), biologists and educators from several county and state agencies as well as the Lincoln Park Zoo have joined forces to identify conservation goals and metrics for the five-year work plan. We will present our goals and strategies to broaden monitoring efforts, protect roosting locations, and launch a regional citizen science program using recent advances in acoustic monitoring equipment.

POSTER #13

NEW GEOGRAPHIC AND SEASONAL RECORDS OF BATS IN IOWA.

Stephanie Griffith, Evelyn Kammeyer, Alex Mandi, Ashley Oblander, Jessica Riebkes, and Russ Benedict. *Biology Department, Central College, Pella, Iowa 50219 (SG, EK, AM, JR, RB); Department of Biology, University of Nebraska Omaha, Omaha, NE 68182 (AO)*

From 2002 to 2016, we conducted roughly 450 events to capture or survey bats (nights of mist-netting, visits to bridges, mines, caves) and captured or observed 5686 bats including individuals of all nine species that regularly reside in Iowa. Our captures include a total of 115 new county records, with at least seven records for each of the nine species in the state. Since the geographic distributions of most species span the entire state, most of these county records simply fill in gaps within the hypothesized distributions. Records for *Lasionycteris noctivagans*, *Lasiurus borealis*, *Myotis lucifugus*, *Myotis septentrionalis*, *Myotis sodalis*, and *Perimyotis subflavus*, however, extend the known range for these species or fill in large gaps in their suspected distributions. Additionally, our captures provide evidence of reproduction occurring across the state for most species; previously, little information has been published on the geographic extent of reproduction for bats in Iowa. Lastly, the captures we report here substantially increase our knowledge of the timing of seasonal activities for bats in Iowa. We present new early and/or late records for lactation, post-lactation, appearance of flying young, and flight activity outside of hibernation for most species.

POSTER #14

SUMMER SEX RATIOS OF BATS IN SOUTHWEST WISCONSIN

Scout Harrison[1] and Katya Frank[2], *Department of Biology, University of Wisconsin-Platteville, Platteville, WI 53818; [1]900 Siemers St., Platteville, WI 53818; [2]137 N. Winsted St., Spring Green, WI 53588*

We summarize sex-ratio data for 5 bat species sampled via mist-net surveys in Grant County, Wisconsin annually since 2004. Sex ratios based on cumulative data across all years and sites are as follows: *Eptesicus fuscus*, 52% M : 48% F (n = 167); *Lasiurus borealis*, 38% M : 62% F (n = 80); *Perimyotis subflavus*, 56% M : 44% F (n = 50); *Myotis lucifugus*, 73% M : 27% F (n = 647); *M. septentrionalis*, 34% M : 66% F (n = 38). Sex-ratios among young-of-the-year (YOY) bats differed significantly ($p < 0.05$) from adult sex-ratios for *L*. *borealis* and *M*. *lucifugus* only. Annual variation in adult sex-ratio was examined for *M*. *lucifugus*, the most frequently encountered species. From 2006-2015 (years where at least 10 total *M*. *lucifugus* were captured), the proportion of adult females captured declined, but not significantly ($R^2 = 0.37$, $p = 0.06$). Skewed sex-ratios may be particularly deleterious for species impacted by white-nose syndrome, such as *M*. *lucifugus*.

POSTER # 15

ASSESSMENT OF *PSEUDOGYMNOASCUS DESTRUCTANS* EXPOSURE AND ECTOPARASITE IMPACT IN A NORTHEASTERN IOWA BAT COMMUNITY

Francis E. Tillman, Jr*., Gerald L. Zuercher, and Rasika G. Mudalige-Jayawickrama. *Department of Natural & Applied Sciences, University of Dubuque, Dubuque, IA 52001 (FET, GLZ, RGM)*

White-Nose Syndrome (WNS), caused by the fungus *Pseudogymnoascus destructans* (*Pd*), continues to expand and impact bat populations across the country. Effigy Mounds National Monument (EFMO), in northeastern Iowa, is at the forefront of the WNS spread. EFMO is home to at least seven bat species. In addition to the impacts of WNS, there may be other factors impacting bat health to be considered. One particularly understudied factor is ectoparasitism. Little is known about bat ectoparasites in general or their role in possible *Pd* transmission. Studies on parasite-host interactions have linked ectoparasites to poor physical health, decreased reproduction rate, and death. In addition, ectoparasites have been linked to *Pd* spread. Our first goal was to assess exposure to *Pd* by all bat species via Isohelix swabs of the muzzle of captured bats followed BY analysis of isolated DNA. Only two captured bats have exhibited

physical signs associated with WNS; wing damage in both cases. Currently, the exposure rate is ~5%. Our second goal was to evaluate the ectoparasites found on bats at EFMO. Only *Eptesicus fuscus* (big brown bats), *Myotis lucifugus* (little brown bats), and *Myotis septentrionalis* (northern long-eared bats) yielded ectoparasite samples. The most prominent ectoparasites were bat ticks, bat fleas, and mites which were found on all three species. In addition, a single bat bug was observed on a female *Eptesicus fuscus*. *Eptesicus fuscus* with ectoparasites had significantly greater body mass than those without. Additional trends are suggestive but not statistically significant. They include smaller *Myotis lucifugus* body mass with ectoparasites compared to those without and the opposite trend for *Myotis septentrionalis*. Also, female *Myotis lucifugus* were more than twice as likely to have ectoparasites. More data should be gathered to properly evaluate the impact of ectoparasites on the physical health of host bats.

POSTER #16

A REGIONAL COMPARISON OF HEAVY METAL CONTAMINANTS IN BATS

Vanessa G. Rojas*, Jennifer C. Latimer, and Joy M. O'Keefe. *Center for Bat Research, Outreach, and Conservation, Department of Biology, Indiana State University, Terre Haute, IN 47809 (VGR, JMO); Department of Earth and Environmental Science, Indiana State University, Terre Haute, IN 47809 (JCL).*

Due to being high trophic level consumers that live relatively long lives, bats are excellent bioindicators and can tell us about heavy metal contaminants (e.g., lead, copper) in the environment. Bats are experiencing significant declines from white-nose syndrome and wind energy; heavy metal contamination might further stress bat populations. We assessed heavy metals in bat fur from areas with a history of mining and varying degrees of urban development. We hypothesize that there will be differences between Indiana and southern Appalachian bats due to different environmental and geographic conditions. From May to August 2009–2016, we collected fur from bats captured in the Cherokee and Nantahala national forests and the Great Smoky Mountains National Park (Southern Appalachian sites), and Yellowwood and Morgan-Monroe State Forests, and Indianapolis Airport Authority property (Indiana sites). We trimmed dorsal fur from the bats, storing uniquely labeled samples in 1.5 mL centrifuge tubes at room temperature. Preliminary analysis included 68 *Eptesicus fuscus* samples from across study areas and sexes. In the lab, we washed, rinsed, and dried fur samples at 60°C, and then digested samples with nitric acid. We analyzed metal concentrations within samples using an Inductively Coupled Plasma–Optical Emission Spectrometer. We expect elevated levels of iron, aluminum, and copper, all of which were detected at high levels in earlier water assessments in our study regions. In future analyses, we aim to identify and quantify heavy metals in different bat species (*E. fuscus*, *Lasiurus borealis, Myotis* species) and sexes across our study regions. We expect to find differences between forest-dependent bats (e.g., *Myotis* spp.) and bats more adapted to developed areas (e.g., *E. fuscus*) or long distant migrants (e.g., *L. borealis*). This study can inform remediation efforts that could lead to healthier bat populations and environments.

POSTER # 17

BAT FATALITY AND ACTIVITY AT A SINGLE-TURBINE WIND FACILITY IN NORTHEASTERN IOWA

Lillian Brondyke, Jane Busch, Nathan Hemming, Cassandra Peterson, and Dawn Reding. *Department of Biology, Luther College, Decorah, IA 52101 (LB, NH, CP, DR); Northeast Iowa Montessori School (JB)*

Accumulating evidence indicates that bats are particularly susceptible to wind turbine associated fatalities. Many studies have recently examined bat collisions at wind facilities, and some common patterns are emerging. However, virtually all of the studies have been conducted at large-scale wind farms. It is unclear whether the patterns observed will also apply to single-turbine sites. Our goal was to investigate bat activity and fatality at the Luther College wind turbine, Decorah, Iowa. We conducted daily carcass searches and nightly acoustic monitoring from 15 April – 15 October 2016. We used

molecular techniques to verify species and sex of carcasses found. We also deployed Anabat SD1 and Pettersson D500X acoustic detectors and analyzed the recorded bat calls to identify species present using EchoClass and Sonobat software, respectively. We found a total of 52 bat carcasses representing 6 species (Little Brown, Silver-haired, Eastern Red, Big Brown, Tricolored, and Hoary). In contrast to most previous studies, we found the resident cave-dwelling species represented a high proportion (57%) of the total fatalities. The Little Brown bat was the most common species recovered as well as acoustically identified. Total number of bat calls approached or exceeded 1000 per night in late July. The relatively high activity and fatality level may be attributed to a general attractiveness of single turbines or to the specific location of this wind turbine. To tease these apart, future efforts should focus on examining patterns at other single-turbine sites.

POSTER # 18

RABIES IN BATS OF ILLINOIS

Jean Mengelkoch, Joyce Hofmann, Connie Austin, and Steve Amundsen. *Illinois Natural History Survey, University of Illinois Urbana Champaign (JM, JH, SA); Illinois Department of Public Health, Springfield (CA)*

Every year thousands of bats in the United States are submitted for rabies testing. We have identified most of the bats submitted in Illinois since 2002. Although the number of bats submitted for testing in Illinois has varied widely, the percentage of submitted bats that test positive for rabies has remained relatively constant. The vast majority of the submitted bats are big brown bats (*Eptesicus fuscus*), which frequently use buildings for roosting in the summer and hibernating in the winter. However, the bats with the highest prevalence of rabies are bats that are not typically associated with humans (hoary bat [*Lasiurus cinereus*], eastern pipistrelle [*Perimyotis subflavus*], and eastern red bat [*Lasiurus borealis*]). We will continue to monitor and examine long term trends of bats submitted for rabies testing in Illinois.

POSTER #19

DESIGN OF A MOLECULAR SEX IDENTIFICATION TEST FOR THREE BAT SPECIES

Cassandra Peterson and Dawn Reding; *Department of Biology, Luther College, Decorah, IA 52101*

Bats are ecologically important species that are experiencing threats from wind energy development. It is important know whether males and females are equally at risk for turbine-associated fatalities. Although researchers are often able to identify the sex of bats based on morphology, damage and decay of the carcasses can make this challenging. DNA-based tests provide an unbiased approach for identifying sex for even the most challenging carcasses. However, published tests currently work for only a few species. The goal of our research is to design a working molecular sex test for three important bat species: Big Brown (*Eptesicus fuscus*), Little Brown (*Myotis lucifugus*), and Silver-haired (*Lasionycteris noctivagans*) bats. We used PCR to amplify an intron region of the zinc-finger-X (zfx) and zinc-finger-Y (zfy) gene on known males using general mammalian primers. We then used molecular cloning techniques to isolate these fragments. For each species, we picked 10 clones to culture, isolate plasmid DNA, and sequence. These DNA sequences are being used to design internal, species-specific primers that will allow for a quick and easy method of separating zfx/zfy bands via gel electrophoresis. These primers will be tested on individuals of known sex to ensure accuracy of the test, which will provide a useful tool for studying bats.

POSTER # 20

PRE-WNS BAT ACTIVITY AND INSECT ABUNDANCE IN SOUTHERN WISCONSIN

Amy K. Wray[1], Jade M. Kochanski[2], Emma Pelton[2], Heather Kaarakka[3], J. Paul White[3], M. Zachariah Peery[1], and Claudio Gratton[2]

1. Department of Forest and Wildlife Ecology, University of Wisconsin-Madison; 2. Department of Entomology, University of Wisconsin-Madison; 3. Wisconsin Department of Natural Resources

The role of predators as top-down regulators of prey communities has been extensively studied among large carnivores, however, the community interactions between insectivores and their prey remain largely uncharacterized. In North America, bats are currently threatened on a continent-wide scale by the emergence and spread of White-nose Syndrome (WNS), a devastating disease resulting from infection with the fungus *Pseudogymnoascus destructans*. WNS was detected in Wisconsin in March 2014, and is predicted to cause precipitous declines among Wisconsin bats – all of which are insectivores – within the next four to five years. The decline in bat populations could have significant effects on our agricultural sector, yet data relating bat activity with insect community composition – including region-specific quantification of pest control services – have not yet been widely collected in Wisconsin. In 2015 and 2016, we performed bat acoustic monitoring and insect blacklight trapping surveys at paired locations both near and far from little brown (*Myotis lucifugus*) and big brown bat (*Eptesicus fuscus*) maternity roosts. We identified insects by microscope and compared abundance, diversity, and richness with factors such as time, levels of bat activity, and landscape composition. These insect community data will serve as an important baseline for comparing future insect community changes in Wisconsin that may be related to WNS-associated bat declines.

POSTER #21

IMPACT OF BAT PREDATION AND HABITAT STRUCTURE ON MOTH COMMUNITY COMPOSITION

Matthew M. Safford*, Steven J. Taylor. *Illinois Natural History Survey, University of Illinois, Champaign, IL 61820 (MMS, SJT)*

Moth diversity and abundance are heavily influenced by localized habitat features, including vegetation species composition, and shelter from wind and predators. As moths are an important food source for bats, their physiology, life history traits, and habitat have been shaped in part by predation pressure. Some moths have evolved in response to bat predation through an enhanced capacity to detect ultrasonic bat calls, while others may have adapted to residing in dense forested areas where bat foraging is more limited. A better understanding of how bat activity (a surrogate for predation) and habitat structure influence moth community composition will inform conservation and management actions to maintain moth diversity and abundance - protecting both moths and the ecosystems and chiropteran predators that depend on them. This study is being conducted in a mosaic of 535 acres of forest fragments, restoration prairie, and sinkhole ponds in Monroe County, Illinois. Almost half of Illinois' bat species are know from the site, including the Indiana bat, *Myotis sodalis*, and the northern long eared bat, *Myotis septentrionalis*. Data collection during monthly site visits began in September, 2016, totaling 8 nights at each of 8 prairie and 8 forest sampling sites. Sites are distributed between forest and prairie habitat, 25m from habitat edge and water features. Moths are collected using black light bucket traps, and 66 macrolepidoptera species have been identified so far. Bat acoustic data are recorded in association with each bucket trap using Anabat Express detectors. Through manual vetting of 7343 sound files, 303 bat passes (195 high frequency calls, F_{min} >30khz, and 108 low frequency calls F_{min}<30khz) have been identified. Research in 2017 will continue in monthly site visits to collect moth specimens and bat acoustic data. Additional data will be collected in 2017 to analyze habitat structure, using various parameters including tree density, tree dbh, canopy cover, ground cover, and prairie vegetation height.

Oral Abstracts

EXPLORING THE DECISION-MAKING BEHIND FLUCTUATING EMERGENCE TIMES OF INDIANA BATS (MYOTIS SODALIS)

Arndt, R.J.*, J.B. Holmes, J.M. O'Keefe , W. Mitchell, and S.L. Lima. *Department of Biology, Indiana State University, Terre Haute, IN 47809*

Timing of emergence is often recorded at bat roosts, but the factors causing shifts in emergence times remain relatively unexplored. We analyzed 12 years of emergence data for maternity roosts in an Indiana bat (*Myotis sodalis*) population in central Indiana. On average, emergence from roosts began shortly after sunset, but sometimes occurred before or well after sunset. Using an information theoretic approach, we built several statistical models representing hypotheses based on three broad environmental influences on emergence times: predators, competition, and physical variables (meteorological and astronomical). The best performing model included most of the variables associated with anti-predator trade-offs, assuming that bats emerging before or near sunset experienced a foraging benefit and a substantial risk of predation by diurnal raptors. One such variable was reproductive period. Emergence events began earlier relative to sunset as the reproductive period progressed into lactation, the most energetically demanding portion of the reproductive cycle. During lactation, about 20% of emergence events began before sunset, compared to only 5% prior to pregnancy. Earlier emergence was also associated with high cloud cover events (darker conditions), larger roost populations, and greater distances to open habitat (roosts were located in forested habitat). Moonlight at sunset, however, was notably absent from the top model and had little or no apparent influence on emergence times. The emergence behavior of Indiana bats is consistent with a trade-off between energetic needs and predation risk, most likely due to the temporal overlap of early emergences with the activity period of diurnal raptors.

NEW GEOGRAPHIC AND SEASONAL RECORDS OF BATS IN IOWA.

Stephanie Griffith, Evelyn Kammeyer, Alex Mandi, Ashley Oblander, Jessica Riebkes, and Russ Benedict. *Biology Department, Central College, Pella, Iowa 50219 (SG, EK, AM, JR, RB); Department of Biology, University of Nebraska Omaha, Omaha, NE 68182 (AO)*

From 2002 to 2016, we conducted roughly 450 events to capture or survey bats (nights of mist-netting, visits to bridges, mines, caves) and captured or observed 5686 bats including individuals of all nine species that regularly reside in Iowa. Our captures include a total of 115 new county records, with at least seven records for each of the nine species in the state. Since the geographic distributions of most species span the entire state, most of these county records simply fill in gaps within the hypothesized distributions. Records for *Lasionycteris noctivagans*, *Lasiurus borealis*, *Myotis lucifugus*, *Myotis septentrionalis*, *Myotis sodalis*, and *Perimyotis subflavus*, however, extend the known range for these species or fill in large gaps in their suspected distributions. Additionally, our captures provide evidence of reproduction occurring across the state for most species; previously, little information has been published on the geographic extent of reproduction for bats in Iowa. Lastly, the captures we report here substantially increase our knowledge of the timing of seasonal activities for bats in Iowa. We present new early and/or late records for lactation, post-lactation, appearance of flying young, and flight activity outside of hibernation for most species.

ROOSTING HABITS OF THE EASTERN SMALL-FOOTED BAT IN THE SHAWNEE NATIONAL FOREST, ILLINOIS

Kristi A. Confortin* and Timothy C. Carter, Ball State University, Muncie, IN 47306

Abstract: The Eastern small-footed bat (*Myotis leibii*) primarily uses upland habitats. Within this habitat the bats use rocky outcrops with loose rocks as roosts. The spread of the bat disease White-Nose Syndrome has made it more crucial to understand the species distribution across the landscape. In 2005 a population of this species was discovered in in Illinois on the Shawnee National Forest. Over the last few years limited research has been done to document the presence and basic roosting habits for this population. Because of its limited distribution and perceived low numbers, the Eastern small-footed bat was added to the Illinois Threatened Species List in spring 2015. To guide future management decisions, the US Forest Service needs a better understanding of the summer roosting ecology and how it might be impacted by those decisions. During the summer of 2015 and 2016 we examined the roosting habits, 21 females and 21 males were fitted with radio transmitters and tracked to their day roosts. Seventy of the 96 roosts were located under loose rocks. Characteristics were recorded for all of these roost rocks. Our research shows bat occupancy will increase with the width of rock, a larger area of dryness under the rock and higher percentage of vegetation around the roost rock. Bat occupancy will decrease when percent area under the rock is covered with debris. Results also show that Eastern small-footed bats use a diversity of roosts beyond loose rocks. This species also made use of rock cervices, cliff bluffs, and man-made structures as their day roosts. The proportion of time each roost was used differed by roost type. We were also able to document the differences in daily travel distances between roost types and genders.

THE IMPACT OF ARTIFICIAL LIGHT ON PREY SELECTION BY INSECTIVOROUS BATS*

Zachary M. Cravens*[1], Veronica A. Brown[2], and Justin G. Boyles[1] *1 Cooperative Wildlife Research Laboratory, Southern Illinois University, Carbondale, IL 62901, 2 University of Tennessee Genomics Core Facility, Knoxville, TN 37996*

Artificial light impacts bat species in numerous ways, often leading to roost abandonment, spatial avoidance, and delayed emergence. The effect of artificial light on foraging opportunities, however, may be detrimental or beneficial depending on taxon-specific traits and environmental conditions. Some species of bats seem to avoid artificially lit conditions while others have been observed feeding near lights. Further, artificial light concentrates insects and may interfere with predator avoidance mechanisms of tympanate moths. To evaluate the effects of artificial light on prey selection by bats, we manipulated naturally dark areas with artificial light. Temporary lights were erected along naturally dark forest roads or streams on public lands in southwestern Missouri, resulting in two experimental conditions: unlit (control) and lit (treatment). We captured bats via mist nets in both experimental conditions and held them in cloth bags for 30-45 minutes, after which we collected all deposited fecal pellets. Next-generation sequencing of DNA amplicons on the Illumina MiSeq platform identified sixteen insect orders in 188 fecal samples from six bat species. For all bat species, roughly 75% of the identified insects were comprised of Lepidoptera, Coleoptera, and Diptera. Of relative proportion of insects identified, moths in general, and eared moths specifically, increased in lit treatments for little brown and gray bats, while the relative proportion of beetles increased in lit treatments for big brown bats. Light treatment had little effect on relative prey concentrations of red, evening, and tri-colored bats. Thus, our results suggest that not all bat species respond to artificial lights with the expected increase in moth consumption.

LANDSCAPE CHARACTERISTICS RELATED TO THE USE OF ARTIFICIAL ROOSTS BY BATS IN NORTHCENTRAL WEST VIRGINIA

Jesse L. De La Cruz[1†], Ryan L. Ward[1], Eric S. Schroder[1 1]AllStar Ecology LLC, 1582 Meadowdale Road, Fairmont, WV 26554, USA. 304-816-3490. †Corresponding author jesse@allstarecology.com

Abstract – Recent population declines of numerous bat species caused by the fungal pathogen *Pseudogymnoascus destructans*, including the threatened Northern Bat (*Myotis septentrionalis*), has heightened the need to conserve remaining populations and to promote reproduction. Research regarding the establishment and evaluation of effective conservation measures for *Myotis* bats is lacking, particularly summer roosting habitat on the Appalachian Plateau of northcentral West Virginia. Our research objectives were to evaluate the overall use of 3 artificial roost structures (i.e., rocket box, nursery box, and artificial bark) by bats, and to relate this use to local landscape characteristics. Monitoring of 306 structures detected use of 132 (43.1%) artificial roosts of which 54 (41.6%) were confirmed to house Northern Bats. Overall roost use was associated with southwestern aspects, higher elevation, and steeper slopes when contrasted with unused structures. Additionally, used structures were closer to forest edge, small core (<100 ha), and medium core (100-200 ha) forests. Nursery boxes were used more than expected based on availability, but rocket boxes accounted for 40 (74.1%) of the roosts used by Northern Bats and 77.7% of the structures to house maternity colonies. Furthermore, rocket boxes were the only structure to house maternity colonies at multiple life stages (i.e., pregnant females, non-volant pups, volant pups). Roost locations of maternity colonies and non-reproductive Northern Bats only varied in terms of distance to streams, with maternity colonies being significantly further away from the resource. The results of this study provide land and wildlife managers localized guidance on implementing effective conservation management techniques within the region.

IS DIETARY OVERLAP BETWEEN INDIANA BATS AND NORTHERN LONG-EARED BATS HABITAT DEPENDENT*?*

Timothy J. Divoll, Veronica A. Brown, Gary F. McCracken, Joy M. O'Keefe
Center for Bat Research, Outreach, and Conservation, Indiana State University, Terre Haute, USA (TJD, JMO); Department of Ecology and Evolutionary Biology, University of Tennessee, Knoxville, USA (VAB, GFM)

The northern long-eared bat (*Myotis septentrionalis*) and the Indiana bat (*M. sodalis*) are considered generalist predators and occur together in various landscape contexts. These two *Myotis* differ in roost preferences and foraging space use, but we do not know if dietary differences also facilitate their coexistence. Furthermore, differences between the two species may be habitat dependent. We used next-generation sequencing to identify prey consumed during the 2014-16 maternity seasons at two central Indiana sites—the heavily forested Hardwood Ecosystem Experiment and the highly fragmented Indianapolis Airport mitigation area. Unique representative DNA sequences were matched to reference sequences in BOLD and GenBank at 98.5% and the lowest taxonomic level. We confirmed matches (i.e., presumed prey items) with local moth, beetle and spider specialists. Northern long-eared bats (n=82) consumed ≥474 prey items from 14 different orders and Indiana bats (n=51) consumed ≥459 different prey items from the same 14 orders. Of the 697 prey species detected, 38% were consumed by both bat species. Microlepidoptera, including many deciduous leaf pests, small beetles, crane flies, gnats and midges were common prey. Next we will compare niche breadth and overlap across the two landscapes in the context of shared habitat and potential competition. Combining information on prey consumed with other aspects of each species' foraging ecology (e.g., ecomorphology, habitat preferences, and foraging space use) should inform conservation strategies to promote optimal foraging habitat for these two endangered *Myotis*.

BAT ACTIVITY SURROUNDING THE SILVER MOUNTAIN HIBERNACULUM DURING SPRING EMERGENCE AND FALL SWARM

Joel A. Flory, Deahn M. Donner, Brian L. Heeringa, Jacqueline L. Frair. *USDA Forest Service, Northern Research Station, Rhinelander, WI 54501 (JAF,DMD); USDA Forest Service, Chequamegon-Nicolet NF, Washburn, WI 54891 (BLH); SUNY College of Environmental Science and Forestry, Syracuse, NY 13210 (JLF)*

To determine bat activity patterns and habitat use during spring emergence and fall swarm, 13 acoustic detectors were deployed in a 4 km^2 landscape centered on Silver Mountain Mine hibernaculum, Houghton County, MI. during 2016. This hibernaculum was presumed free of white-nose syndrome at the time. Within this landscape, twelve 0.5 km cells were surveyed using a Wildlife Acoustics SM3Bat detector centrally located, and one detector was placed at the mine entrance. Detectors were deployed for a 5- and 4-week period during spring and fall, respectively to coincide with expected beginning and end dates of hibernation. Using SonoBat v4.1.0 to auto classify 16,800 .wav files, we observed several activity patterns. Current classification at the coarse high frequency/low frequency level yielded 316 LoF/1,816 Hif and 554 LoF/3,688 HiF call sequences for the spring and fall survey periods, respectively. Bat activity varied across the landscape with no strong relation with distance from the hibernaculum. Frequency of HiF bat activity was greater in cells located at higher elevation portions of the landscape during fall swarm, whereas LoF bat activity was more widely distributed across the landscape. HiF bat activity showed greater spikes around mid- and late-September at which point it virtually ceased, whereas the LoF bat activity continued until later into the fall. Call analysis through manual vetting is ongoing and refinement of species activity distributions may modify those currently observed. These preliminary results will be combined with sampling efforts planned in 2017 within the same landscape. Detector locations will be moved within each cell to determine if the same relative patterns of activity and use of the landscape are observed rather than patterns being driven by local-scale habitat variability associated with detector placement. Results will inform managers on the temporal and spatial use of the forest during critical life-history stages.

WHITE-NOSE SYNDROME IN WASHINGTON: LEAP OR CREEP?

Kyle G. George[1], Abby Tobin[2], Jeffrey M. Lorch[1], Jonathan Palmer[3], Daniel Lindner[3], Jeffrey T. Foster[4], and Anne E. Ballmann[1]

1 *U.S. Geological Survey – National Wildlife Health Center, Madison, USA;* ***2*** *Washington Department of Fish and Wildlife, Olympia, USA;* ***3*** *U.S. Forest Service, Northern Research Station – Center for Forest Mycology Research, Madison, USA;* ***4*** *University of New Hampshire, Department of Molecular, Cellular and Biomedical Sciences, Durham, USA*

Since the emergence of white-nose syndrome in New York in 2006, the causative fungus, *Pseudogymnoascus destructans* (Pd), has spread from its epicenter by approximately 200–900 km per year in a pattern consistent with a point-source introduction. It reached eastern portions of Oklahoma, Nebraska, and Minnesota by spring 2016, approximately 1,900 km from the first documented site. Then, quite unexpectedly last spring, WNS turned up in Washington state over 2,100 km away from the nearest known Pd occurrence. In March 2016, a debilitated little brown bat (*Myotis lucifugus*) was found along a hiking trail in King County, Washington and was later confirmed to have white-nose syndrome. The fungal isolate obtained from this bat grouped with other isolates of Pd from the eastern U.S. based on whole genome sequencing and phylogenetic analyses. Furthermore, the bat was determined to be a western subspecies, *M. lucifugus alascensis,* through sequence analysis, and subsequent surveillance detected Pd on a second bat from King County. These findings indicated that the presence of Pd in Washington did not represent another novel introduction to North America and that these bats became infected in the Pacific Northwest. Limited sampling of bats and hibernaculum environments suggests that Pd is not yet widespread or abundant in western states, but more intensive surveillance efforts are

needed to determine how Pd was introduced into the region. Here, we describe surveillance efforts underway in western states to help answer this question. It remains unclear how Pd will affect western species of bats, but the disease which is responsible for mortality of more than five million cave-hibernating bats in the eastern U.S could have major implications for their conservation and management.

WHY ARE ROCKET BOXES FAVORED BY AN INDIANA BAT MATERNITY COLONY IN THE CORE OF ITS RANGE?

Julia P. S. Hoeh and Joy M. O'Keefe. *Center for Bat Research, Outreach, and Conservation, Indiana State University, Terre Haute, IN 47807*

Installing artificial roosts or bat boxes may aid endangered species, but we need more data to find the optimal bat box design for particular bats, e.g. the Indiana bat (*Myotis sodalis*). To characterize differences inherent in three artificial roost styles (traditional bat box, rocket box, and modified BrandenBark™), we evaluated roosting surface area, entrance area, volume, temperature (12 points/roost), and relative humidity (3 points/roost) while bats were excluded from one cluster containing one of each roost style. We compared emergence counts across 1–2 years at five additional clusters. Rocket boxes provided >2X the entrance and surface area and >5X the volume vs. other roost types. Relative humidity varied less in the rocket box across the season (rocketbox = 67.3±15.3%RH, bat box = 70.8±17.3%RH, and modified BrandenBark™ = 65.8±19.5%RH) and the rocket box provided a wider range of available temperatures at a given time [ANCOVA, $F_{3, 509} = 42.72$, $p<0.001$]. As outside air temperature (T_A) increased, internal temperature range also increased for all roosts, but across T_A the rocket box roost provided a wider availability of internal temperatures (0.7°C over BrandenBark™, 1.3°C over bat box). When T_A ranged greatly, the BrandenBark™ roost was less stable than the bat box and rocket box [ANCOVA, $F_{5, 312} = 127.2$, $p<0.001$]. Across the season, consistently more Indiana bats emerged from the rocket box (2–210 bats/night) than the other roost styles, and 4 of 5 available rocket boxes had >30 Indiana bats. The max emergence count in bat boxes and modified BrandenBark™ (in clusters) was 22 and 2 bats, respectively. Artificial roost structure affects microclimate and bats show a clear preference for rocket box roosts over bat boxes and modified BrandenBark™. Possible explanations for this preference include Indiana bats choosing larger roosts, moderate humidity, or more available temperatures within the roost.

INFLUENCE OF SURVEY METHOD ON DETECTION PROBABILITY OF COMMON BAT SPECIES IN NORTHERN ILLINOIS

Tara C. Hohoff and Jill L. Deppe. *Eastern Illinois University, Charleston, Illinois; Illinois Bat Conservation Program, Illinois Natural History Survey, Champaign, Illinois (present: TCH).*Currently bat biologists employ two main methods for sampling—utilizing passive acoustic recorders and actively capturing individuals using mist nets. The United States Fish and Wildlife Summer Survey Guidelines for Indiana bats (*Myotis sodalis*) currently permits mist netting or acoustic sampling to be used for presence/absence determination. However, the difference in detection probability between these two methods is poorly understood, especially in regards to full-spectrum recorders. In this study, we employed a multi-method approach to survey for bats in northern Illinois and compared results of observed detections of two common species of bats, the little brown bat (*Myotis lucifugus)* and big brown bat (*Eptesicus fuscus)*, using the program Presence 11.5. The results identified that both species had higher detection probability estimates using acoustic recorders compared to mist nets. The little brown bat was more than four times as likely to be detected via the acoustic recorder (p=0.9055) than by mist netting (p=0.1961). And the big brown bat was more than twice as likely to be detected by the

acoustic recorder (p=0.9692) than by mist netting (p=0.4445). These results support previous research that two sampling methods should be employed when possible and mist netting results of rare species should be used with caution, especially with low survey visits (<7).

BAT COMMUNITIES IN SOUTHWEST WISCONSIN DURING THE ERA OF WHITE-NOSE SYNDROME

Jeffrey J. Huebschman, *Department of Biology, University of Wisconsin-Platteville, Platteville, WI 53818*

Since 2004 I have conducted bat mist-net surveys in Grant County, Wisconsin with the objective of collecting baseline data on species richness and relative abundance, reproduction patterns, and other life history data. To date my students and I have caught and examined 1401 individual bats, representing 7 species. Across all years and sites, the relative frequency of capture is as follows: *Myotis lucifugus* (61.1%), *Eptesicus fuscus* (17.9%), *Lasiurus borealis* (11.0%), *Perimyotis subflavus* (5.3%), *M. septentrionalis* (3.7%), *L. cinereus* (0.7%), and *Lasionycteris noctivagans* (0.4%). In 2014, WNS was first documented in Wisconsin (in Grant County) and it has subsequently been documented from many other counties in the state. I will present a summary of our bat survey data, including trends in species capture frequencies over time.

OCCUPANCY AND MATERNITY ROOST SELECTION OF NORTHERN LONG-EARED BATS (*MYOTIS SEPTENTRIONALIS*) IN THE LAKE STATES REGION

Brenna Hyzy. *University of Wisconsin-Stevens Point, Stevens Point, WI.*

White-nose syndrome is an invasive fungal disease that has decimated populations of North American cave-dwelling bat species since its discovery in 2006. Among the species most impacted by WNS is the northern long-eared bat, resulting in the listing of the species as federally threatened under the Endangered Species Act. Almost nothing is known regarding the habitat requirements of northern long-eared bats in the Lake States region. The recent occurrence of WNS in Wisconsin affords an important opportunity to establish baseline data on the northern long-eared bat in this region. Therefore, the objectives of my research are to determine if occupancy of northern long-eared bats is influenced by specific large-scale and site-level habitat characteristics, and to determine if selection of maternal roost sites by northern long-eared bats is influenced by characteristics of roost trees and adjacent habitat conditions. To examine occupancy, I deployed 20 acoustic bat detectors at 8 sampling sites stratified by habitat type and left out for 10 capture nights. To identify roost trees and movement patterns, I actively captured bats via mist netting at three pre-determined maternity sites in south-central Wisconsin, affixed a radio tag to each female bat caught, and subsequently tracked her movements until the radio tag was considered off-air. Results from my research are expected to support or replicate those published from other parts of the country on northern bats. These studies stated that roost selection is less explained by individual tree concepts than it is by forest succession and ecological conditions. As efforts continue to further understand and control WNS, the expected results from my research should provide guidance to land management agencies regarding forest management practices and how to potentially improve conservation efforts to reduce the impacts of stressors on northern long-eared bats that are more immediately controllable such as habitat loss.

AN IMPROVED DIETARY ANALYSIS METHOD TO PREDICT THE ECOSYSTEM SERVICES PROVIDED BY BATS

Michelle A. Jusino[1], Mark T. Banik[1], Amy K. Wray[2], Jonathan M. Palmer[1], Lei Xiao[3], J. Paul White[4], Emma Pelton[5], Heather Kaarakka[4], Akito Y. Kawahara[3], Claudio Gratton[5], M. Zachariah Peery[2], and Daniel L. Lindner[1]

1) United States Forest Service, Northern Research Station, Center for Forest Mycology Research, Madison, WI; 2) Department of Forest and Wildlife Ecology, University of Wisconsin-Madison, Madison, WI; 3) Florida Museum of Natural History, University of Florida, Gainesville, FL; 4) Wisconsin Department of Natural Resources, Madison, WI; 5) Department of Entomology, University of Wisconsin-Madison, Madison, WI

Bats across North America are threatened by the spread of white-nose syndrome (WNS), a disease caused by the fungus *Pseudogymnoascus destructans.* The economic value that bats provide through ecosystem services is difficult to measure, but estimates range from several to many billions of dollars. Bats are specifically valued in agricultural and forested regions as important suppressors of arthropod pests; however, regional values have rarely been quantified and little work has focused on forested regions. Next generation sequencing (NGS) has been used to examine bat diets, but those data may be biased toward certain taxonomic groups due to the methods used. Specifically, the primer pair typically used to amplify and identify the arthropod DNA found in bat guano appears to have a narrow taxonomic range. Here, in an effort to determine the diets of bats in Wisconsin, a hotspot for agriculture and forestry, we developed an improved method to amplify and identify the arthropods found in bat guano using NGS. Using our new method, we found a 4-fold increase in arthropod diversity in bat guano compared to previous methodology. To validate our diversity estimation, we developed a spike-in control community consisting of DNA from a taxonomically diverse set of over 40 known arthropods. We further validated our system with guano samples from bats fed known diets. We then used our new method to examine and compare the dietary components of little brown (*Myotis lucifugus*) and big brown bats (*Eptesicus fuscus*) in southern Wisconsin in 2014, the year that *P. destructans* was first detected in Wisconsin. Arthropod pest communities are predicted to change as white-nose syndrome progresses across the Midwest, and thus these data can serve as a baseline for future studies.

U.S. FISH AND WILDLIFE SERVICE'S 2017 UPDATE ON BAT-RELATED ISSUES

R. Andrew King. *U. S. Fish and Wildlife Service, Indiana Field Office, Bloomington, IN (RAK)*

The U. S. Fish and Wildlife Service (FWS) remains actively engaged in numerous issues pertaining to the conservation of federally threatened and endangered bats and the habitats upon which they depend. I will present an update on several topics of interest to bat researchers, consultants and conservationists in the Midwest including: ongoing status assessments and work plans, federal permits and current permit reporting requirements, ongoing Habitat Conservation Plans, Indiana bat summer survey guidance changes, and a forthcoming acoustic ID training opportunity.

USING PASSIVE ACOUSTICS TO ESTIMATE BAT ROOST POPULATIONS

Laura Kloepper, Yanqing Fu, and Joel Ralston *Department of Biology, 262 Science Hall, Saint Mary's College, Notre Dame, Indiana*

Passive acoustic monitoring is a widely used method to identify bat species and determine spatial and temporal activity patterns. One area where acoustic methods have not yet been successfully applied, however, is in determining population counts, especially from roosts. Typically, most roost counts are obtained with thermal imagery that may be prohibitively expensive for many natural resource managers or require complex computer programming. Here, we introduce a new acoustic technique to estimate

population size of Brazilian free-tailed bats (*Tadarida brasiliensis*) emerging from large cave colonies. Data were acquired across multiple nights and at different cave locations with different roost structures and flight behavior profiles. We used a single microphone to monitor echolocation activity and simultaneously recorded the emerging bats with thermal video. Bat abundance counts were determined from a single video frame analysis (every 10 sec) and were compared to different acoustic energy measures of an acoustic sequence recorded at the time of the analyzed video frame. For most cave locations, linear regression models successfully predicted bat emergence count based on acoustic intensity of the emerging stream, which indicates future population estimates may be collected solely with acoustics. Here, we describe our method and report on its application for counting bats from different roost locations.

BAT SPECIES DIVERSITY AND DISTRIBUTION WITHIN A HIGHLY URBAN ECOSYSTEM

Elizabeth W. Lehrer, Patrick J. Wolff, R. Julia Kilgour, Mason A. Fidino, and Seth B. Magle
Urban Wildlife Institute, Lincoln Park Zoo, Chicago, IL (All); US Army ERDC-CERL, Champaign, IL (PJW); University of Guelph, Guelph, ON Canada (RJK)

The effects of urbanization on bats are likely context-dependent and species-specific, but more information is needed to understand the mechanisms underlying species responses. The arrival of the devastating fungal disease, white-nose syndrome (WNS), in northern Illinois during winter 2012 further underscored the need to monitor bat distributions and activity across the Chicago area. During May-September 2013-2015, we used passive acoustic detectors (SM2BAT+; Wildlife Acoustics) to record echolocation calls at 22 study sites. Study sites included forest preserves, city parks, and golf courses, and were located across an urbanization gradient beginning in downtown Chicago and extending 70 km outside of the city. Landscape variables (i.e., canopy cover, distance to water, percent urban land cover) were recorded within a buffer around the detector. We detected up to 7 species at both urban and rural extremes, including species impacted by WNS (*Myotis* sp., *Perimyotis subflavus, Eptesicus fuscus*); the majority of identifiable recordings were *E. fuscus* (56%). Impervious surface had the strongest negative influence on the colonization and persistence rates of several species. As bats throughout North America face the impacts of increasing urbanization and a rapidly spreading disease, our results will inform future monitoring and conservation efforts for populations in Chicago, and elsewhere.

THREATS TO NORTH AMERICAN BATS PRIORITIZED BY REGION

Rob Mies[1], Charles M. Francis[2], Rodrigo A. Medellin[3], Jeremy Coleman[4], Rita Dixon[5], Brian Carver[6], Vanessa G. Rojas[7], D. Scott Reynolds[8], Jorge Ortega[9], Jordi Segers[10], Angie McIntire[11], Jeff Gruver[12] and Cori Lausen[13]
1 *Organization for Bat Conservation, Bloomfield Hills, MI, USA;* **2** *Environment Canada, Ottawa, Ontario, CAN* **3** *Instituto de Ecologia, UNAM, D.F., MEX;* **4** *U.S. Fish and Wildlife Service, Hadley, MA, USA;* **5** *Western Bat Working Group, Boise, ID, USA;* **6** *Southeastern Bat Diversity Network, Cookeville, TN, USA;* **7** *Midwest Bat Working Group, Terre Haute, IN, USA;* **8** *Northeast Bat Working Group, Concord, NH, USA;* **9** *Institute Politecnico Nacional and Program for the Conservation of Mexican Bats, D.F., MEX;* **10** *Canadian Wildlife Health Cooperative, Charlottetown, Prince Edward Island, CAN;* **11** *Arizona Game and Fish Department, Phoenix, AZ, USA;* **12** *WEST, Laramie, WY, USA;* **13** *Wildlife Conservation Society Canada, Kaslo, BC, CAN*

The North American Bat Conservation Alliance Steering Committee developed a list of 21 threats facing bats in North America, classified by IUCN criteria. Over 200 bat experts from 12 regions of Canada, United States of America (USA) and Mexico participated in an electronic survey and provided their best estimate of proportion of bat species affected by each threat in their region; the scope and severity of the threat to those species; and the trend of that threat. We used the mean value of a Scope-Severity

index to rank threats within regions. The impact of pathogens and microbes on bats ranked as the top threat in most regions in Canada and the USA, but was considered a relatively low threat in Mexico and the Pacific Southwest. The impacts of evicting and/or eradicating bats from roosts ranked as high threats in eastern and western Canada and Mexico. Agricultural crops ranked as a high threat in Mexico and the USA's Midwest, Southeast, and Pacific Southwest regions. Farming and ranching were also a high threat in Mexico. Regionally specific threats such as recreation activities in USA's Mountain region and Alaska, fire suppression and management in the USA's Pacific Northwest and Alaska, and dams and water management in USA's Southwest were of high concern. Other major threats included impacts of renewable energy, climate change, industrial/urban development, forestry practices and mining/quarry activity. The next step is to electronically collect detailed information from bat biologists on ways to mitigate the highest-ranking threats.

BAT RESPONSE TO PRESCRIBED FIRE FREQUENCY IN OAK-DOMINATED FORESTS

Lisa Powers, Chris Hauer, Carolyn Paul, Dave McNaughton, Shannon Henry, Timothy Haydt, and Brent J. Sewall. *Department of Biology, Temple University, Philadelphia, PA 19122 (CH, LP, CP, BJS); Pennsylvania Department of Military and Veterans Affairs, Fort Indiantown Gap – National Guard Training Center, Annville, PA 17003 (DM, SH, TH).*

Prescribed fire has become a popular management tool, providing a means to reduce fuel loads and stimulate oak regeneration within hardwood forests. Previous studies indicate fire may also be beneficial to bats by reducing understory clutter and creating snags for roosting. Our objective was to assess impacts of prescribed fire frequency on bat activity within oak-dominated forest stands at Fort Indiantown Gap (FIG), a military training facility in south-central Pennsylvania. FIG foresters have used prescribed fire extensively since 2004, with burn frequencies that range never-burned to annually-burned, providing the opportunity to test the effects of a wide range burn frequencies. We hypothesized that bat activity would increase with burn frequency. We used Pettersson D500x acoustic detectors to passively record bat echolocation call sequences within stands where annual prescribed fire had been conducted 0-12 times over a 12-year period. Bat activity was recorded at 110 sites from 23 May – 13 September 2016, a period following heavy local impacts of white-nose syndrome on many hibernating bat species. Bat call sequences were identified to species using SonoBat 4.0.7 automated identification software and hand-vetting. Big brown bats (*Eptesicus fuscus*) and eastern red bats (*Lasiurus borealis*) comprised 97.1% (N = 5,362 of 5,523) of identified call sequences. We used Akaike Information Criterion to evaluate models of bat call data using the following predictors of nightly bat activity: burn frequency, time since last burn, date, canopy cover, understory clutter, distance to nearest water, and distance to nearest road. The results of our analyses contribute to our understanding of the relationship between bats and prescribed fire by determining whether bat activity continues to increase with fire frequency, or reaches an upper limit where habitat suitability declines.

THE BURDEN OF DATA IN ACOUSTIC MONITORING SMART DETECTORS: SALVATION FOR OUR SANITY?

Julie L. Remp and John D. Chenger, *Bat Conservation and Management, Carlisle, PA 17015*

The non-invasive nature of acoustic sampling provides an attractive option for monitoring bats, and advancements in devices and methodologies have enabled more extensive monitoring initiatives, but this has resulted in a burden of vast quantities of data to process and manage. These huge data burdens can take hours or days to process even with the support of software designed to organize, filter, and automatically classify bat echolocation calls. In this test study we compared a new smart detector with built-in full spectrum analysis to an existing traditional full spectrum detector platform with it's files run through currently available desktop bat call analysis software programs. We deployed both detectors at

the same location with the same setup and to record from sunset to sunrise for the study period. We processed the traditional detectors recorded files using SonoBat 4 that performed full spectrum analysis, and Kaleidoscope Pro with converted zero-cross files as an USFWS approved classifier to compare against the new smart detector analysis. We tracked and compared data processing times and auto classification results. This test comparison demonstrated the new smart detector significantly reduces the amount of data processing time required to reach auto classification results compared to existing software analysis programs. Reduction of the data processing burden can allow bat biologists to more easily conduct data heavy studies, projects, and protocols and devote more time for manually vetting to reduce discrepancies in auto classification results.

EXAMINING THE EFFECTS AND IMPORTANCE OF LOCAL- AND LANDSCAPE-LEVEL VARIABLES BEFORE AND AFTER WHITE-NOSE SYNDROME

Laura E. D'Acunto, Karly A. Rushmore*, and Patrick A. Zollner, *Purdue University, Department of Forestry and Natural Resources, West Lafayette, IN 47907*

Accurate approaches of species occupancy predictions are useful in targeting conservation efforts for North American bats under increasing pressure from white-nose syndrome (WNS). We assessed the importance of local- versus landscape-level variables in estimating bat occupancy in Indiana. We predicted that local measurements would strongly impact detection probability of *Myotis* bats because previous studies have shown a correlation between the genus and local variables. We collected data from May 15, 2014 to August 15, 2014 across 3 properties: Feldun Purdue Agricultural Center, Southeast Purdue Agricultural Center, and Southern Indiana Purdue Agricultural Center. We identified acoustic files to species using the automated software EchoClass (v 3.1). We ran single-species occupancy models using landscape-level and local-level variables as covariates to analyze occupancy of Indiana (*Myotis sodalis*), northern long-eared (*Myotis septentrionalis*), and little brown bats (*Myotis lucifugus*). We calculated the probability of detecting a bat on any given sampling night, then compared our post-WNS probabilities to pre-WNS detection probabilities calculated in Pauli et al. (2015). Pre-WNS *M. sodalis* detection probability =0.309, while post-WNS probability =0.089. *M. septentrionalis* pre-WNS detection probability =0.209, and post-WNS detection probability =0.035. These values indicate that detection probabilities have declined following the WNS outbreak, emphasizing the need for more precise occupancy modelling approaches. Furthermore, our results suggested that local vegetation variables were more useful than landscape-level variables for predicting *Myotis* bat occupancy. Overall, our findings suggest that as WNS continues to diminish North American bat populations, a multi-scale approach may provide the most accurate occupancy predictions.

THE INFLUENCE OF MINING ACTIVITY ON A HIBERNATING BAT POPULATION IN WISCONSIN

Jennifer Summers*, Dr. Chris Yahnke, Dr. Timothy Van Deelen, J. Paul White and Heather Kaarakka. *College of Natural Resources, University of Wisconsin-Stevens Point, Stevens Point, WI 54481; Department of Biology, University of Wisconsin-Stevens Point, Stevens Point, WI 54481; Department of Forest and Wildlife Ecology, University of Wisconsin-Madison, Madison WI 53707; Wisconsin Department of Natural Resources, Madison WI 53707.*

Bats are known to arouse from hibernation due to disturbances. Frequent arousal from hibernation can cause mortality in bats due to increasing energetic costs, especially to bats infected with the deadly fungal disease, White-Nose Syndrome (WNS). An operational mine in northwest Wisconsin, uncontaminated with the WNS causing fungus at the time of this study, hosts over 52,000 hibernating bats of four species in an inactive portion of the mine. It is unknown if mining activity (i.e. blasting) causes a disturbance and arouses hibernating bats. Environmental data loggers and Anabat Roost

Loggers were placed inside the hibernaculum to monitor bats for two hibernation seasons between 2013 to 2015. These data were analyzed to determine the relationship between blasting activity, environmental conditions, and bat arousals. Using echolocation calls as a measure of arousal, we determined the relationship between amount of explosives used per blasting event and the difference in bat activity before and after blasting. We also investigated the influence of environmental conditions including temperature, relative humidity, and pressure, within the mine on bat activity. Preliminary results indicate blasting activity influences the difference in bat activity, with bat activity increasing after blasting as the amount of explosives used increases. Temperature and barometric pressure do not significantly influence the difference in bat activity before and after blasting.

HABITAT USE BY NORTHERN LONG-EARED BATS (*MYOTIS SEPTENTRIONALIS*) IN THE FORESTED REGION OF MINNESOTA

Morgan B. Swingen, Ron A. Moen, Richard J. Baker, Timothy J. Catton, Kari B. Kirschbaum, Gerda E. Nordquist, Christi A. Spak, Brian J. Dirks, Nancy J. Dietz. *Natural Resources Research Institute, University of Minnesota Duluth, Duluth, MN (MBS, RAM). Division of Ecological and Water Resources, Minnesota Department of Natural Resources, St. Paul, MN (RJB). USDA Forest Service, Superior National Forest, Duluth, MN (TJC). USDA Forest Service, Chippewa National Forest, Cass Lake, MN (KBK). Minnesota Department of Natural Resources, Minnesota Biological Survey, St. Paul, MN (GEN, CAS). Minnesota Department of Natural Resources, Nongame Wildlife Program, Minnesota Army National Guard, Camp Ripley Training Center, MN (BJD, NJD).*

The northern long-eared bat (*Myotis septentrionalis,* MYSE) was recently listed as threatened under the Endangered Species Act. An additional 4(d) rule restricts forest harvest near known, occupied roost trees during the reproductive season. Our goals were to estimate the summer distribution of MYSE in the state of Minnesota, and identify and characterize their summer habitat, particularly maternity roost trees. We deployed acoustic detectors across the forested region of the state, and captured and tracked female MYSE during the reproductive period (June-July). From 2015-2016, acoustic data were collected at 203 locations, and MYSE were confirmed at 51 of those sites. We will add a habitat component to the acoustic analysis by comparing MYSE presence to % cover of various habitat types. We placed 66 transmitters on female MYSE, which were tracked to 184 roosts. Three roosts were in buildings and the remaining 181 were in trees. MYSE roosted in at least 22 species of trees, with an average DBH of 38.5 cm (range: 10.7 – 107.1), and average height of 14.9 m (range: 2.4 – 30.0). Roosts were located in both live and dead trees of varying decay stage, but most were dead or declining trees. There were no differences in DBH, height, species, or decay stage of roost trees used between pregnant, lactating, and non-reproductive female MYSE. It appears that MYSE are fairly common across the forested region of the state, and are using several tree species as roosts. Our data suggest that female MYSE do not have strong preferences for species or size of roost tree, but that decay stage is a more important factor for roost suitability.

ADDRESSING VARIATION IN TIMBER HARVEST TECHNIQUES AND THE EFFECT ON BAT OCCUPANCY AND DETECTION

Keifer L. Titus, Timothy C. Carter, and Scott Haulton *Department of Biology, Ball State University, Muncie, IN 47306 (KLT, TCC); Indiana DNR Division of Forestry, Indianapolis, IN (SH).*

Timber harvest in southern Indiana is an essential tool in habitat management for the Indiana DNR-Division of Forestry. The primary method of timber harvesting conducted on Indiana state forest land is individual tree selection, yet there are a variety of other timber harvesting techniques taking place on the landscape. However, the long term effects of these harvesting techniques on the ecological

community, especially with regard to the bat community, is poorly understood. Since the onset of White-Nose Syndrome (WNS) in Indiana in 2011 bat conservation efforts continue to be a priority. Identifying the effects of each harvest is of great interest to all parties. In order to understand how each timber harvesting techniques effect the bat community we are examining how relative bat occupancy changes across a continuum of timber harvest intensity. This continuum includes unharvested "control" forest, single tree selection harvests, shelter-wood harvests, and clear cut harvests. This work is being conducted as part of the Hardwood Ecosystem Experiment (HEE) in south-central Indiana. This is a long-term (100 year) ecological study that provides a unique opportunity to research how bats are responding to the different harvesting techniques. In the summer of 2016 from May to August, we sampled 108 sites using SM2+ acoustic echolocation detectors; each detector recorded simultaneously for three nights. Over 33,800 call files were recorded during our first field season and analyzed using Bat Call ID (BCID) an automated call identification software. With over 9,400 call files identified to species, preliminary results suggest *Myotis spp*. occupy moderate to low intensity harvest types while low and mid frequency calling bats prefer to occupy more intensely harvested sites. We plan to continue this study through the summer of 2017 to strengthen our findings.

ALTERNATIVE SNACKS: INFLUENCES OF LANDSCAPE & INSECT COMMUNITIES ON BAT DIETS IN SOUTHERN WISCONSIN

Amy K. Wray[1], Claudio Gratton[2], Michelle A. Jusino[3], Jonathan M. Palmer[3], Heather Kaarakka[4], J. Paul White[4], Emma Pelton[2], Jade M. Kochanski[2], Daniel L. Lindner[3], and M. Zachariah Peery[1]
1. Department of Forest and Wildlife Ecology, University of Wisconsin-Madison; 2. Department of Entomology, University of Wisconsin-Madison; 3. USFS Northern Research Station, Center for Forest Mycology Research; 4. Wisconsin Department of Natural Resources

Nearly 70% of bat species are insectivorous – a trait considered ancestral to bats – and many provide important ecosystem services such as biocontrol of agricultural and forest pest insects. Among the two most common North American bat species, Big Brown bats (*Eptesicus fuscus*) are generally thought of as beetle specialists, while Little Brown bats (*Myotis lucifugus*) seem to prefer Dipteran and Lepidopteran prey. Recent advances in sequencing technology and bioinformatics, however, have shed light on more nuanced patterns of inter- and intra-specific dietary variation in bats. In particular, the effects of landscape and temporal insect abundance patterns may influence the dietary preferences of bats and lead to spatial and temporal differences in bat foraging strategies. To investigate the relationships between bat activity and insect community composition – including region-specific quantification of pest control services – we performed bat acoustic monitoring, insect surveys, and next-generation sequencing analysis of bat guano at paired locations both near and far from bat roosts in Wisconsin. We identified insects by microscope and compared abundance, diversity, and richness with factors such as time, levels of bat activity, and landscape composition. These insect community data will serve as an important baseline for comparing future insect community changes in Wisconsin that may be related to WNS-associated bat declines.