Poster Presentation Abstracts
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ACTIVITY OF BATS AT MINNETONKA CAVE, IDAHO

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Minnetonka Cave is Idaho's largest limestone cave, and Idaho's only show cave, with 33,000 tourists visiting each summer. Idaho Department of Fish and Game in cooperation with federal agencies, has initiated increased monitoring at important hibernacula in response to the threat of possible westward spread of White-nose Syndrome (WNS). Semi-annual hibernacula surveys have shown increasing trends in use by bats at Minnetonka Cave since the 1990's, and species include those that are potentially the most vulnerable to WNS. Beginning in 2011, we installed a long-term acoustic monitoring system outside the entrance of the cave to monitor activity of bats across seasons and verify species present at the site. We used Wildlife Acoustics SM2BAT bat detector, secured in weatherproof housing, to record ultrasonic vocalizations bats produce while in flight. We obtained 583,026 acoustic files over 21 months. Of those files, 358,187 (61%) were recordings of bats. We used Sonobat 3.1.1 software to automatically classify bat call files to species or genus groups. In addition to automatic classifications, we manually checked a random sample of bat call files and Sonobat-generated classifications of species whose presence at the site was unexpected. We documented acoustic activity of bats throughout the year. Activity levels were the highest during July and August, lowest from December through February. We documented calls indicating the presence of Townsend's big-eared bat, big brown bat, western red bat, hoary bat, silver-haired bat, Mexican free-tailed bat and long-eared myotis, little brown myotis, long-legged myotis and western small-footed myotis at the site. To reinforce our classifications of *Myotis* species, we captured bats with a harp trap inside the entrance of the cave in October 2014. We verified all acoustically detected *Myotis* species. Minnetonka Cave is a significant hibernaculum and will remain a high priority for bat conservation in Idaho.

DEMOGRAPHICS AND ACTIVITY OF THE MEXICAN LONG-NOSED BAT, *LEPTONYCTERIS NIVALIS* (PHYLLOSTOMIDAE) IN BIG BEND NATIONAL PARK, TX, USA.

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We initiated a pilot study using PIT tagging at a maternity colony of Mexican long-nosed bats (*Leptonycteris nivalis*) at Mount Emory Cave in Big Bend National Park, TX in 2014. This species is endangered throughout their range in the U.S. and Mexico. This colony is known to be largest

in size during the peak of Agave flowering in the summer months but there is no information on the arrival and departure dates each year. Further, the frequency and duration of foraging bouts are unknown. Our objective was to detect seasonal occurrence, nightly activity, and demographic information about this species at their northernmost roost. We implanted 38 bats with PIT tags and used a Biomark IS1001 and cable antenna in a novel serpentine configuration to monitor the medium-sized cave entrance. We detected 61% of tagged individuals at least once from May-September (Adults=8, Juveniles=15). We hypothesize that the early season detection rate was low because some bats avoided the antenna. We calculated the maximum nightly activity for 13 bats over periods of one to eight nights in July and August. On average adults and juveniles were active for 7.85 hours. Pregnant females were captured at the cave much earlier than expected (26 April) and we detected a tagged juvenile male much later than expected (1 September). PIT tagging additional bats in this colony to increase our sample size and initiating PIT tag monitoring earlier in the upcoming season will continue to provide a more comprehensive understanding of the activity of this species.

ROOST AND FORAGING RESOURCE SELECTION BY EASTERN RED BAT, (*Lasiurus borealis*)

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Bat populations in North America are being impacted by various threats including human induced changes in habitat at multiple scales, climate, disease and wind power development. Migratory bat species are being particularly impacted by wind turbines. These declines emphasize the urgent need for understanding associations between bat populations and their habitats at critical periods. We examined the effects of site and landscape structure on the distribution and activity patterns of eastern red bats (*Lasiurus borealis*). Historically, the importance of foraging resource selection to conservation of forest bats has been viewed as secondary to importance of roost selection. We used resource utilization functions (RUF) and discrete choice modeling to test the hypotheses that a) site, landform and landscape factors affect both foraging and roosting resource selection by eastern red bats and b) selection varies by reproductive stage. We radio-tracked 53 females in early, mid and late lactation (n=18, 15, and 20). Individual home range size (99%) ranged from 202 – 3727 hectares (ha) (mean=1357; SE=122); smoothing (h) values used to compute the UD ranged from 30 – 591. Most bats had an area of high use near their roosts and multiple areas of lower use. Highest use was associated with open deciduous forest on ridges and upland drainages in areas close to non-forest edge and relatively high road density. Inter-individual variation in resource selection was high, even among demographically similar bats. The variability in individual responses to resource attributes suggests that factors at multiple landscape scales affect this species; therefore, management strategies that provide a range of composition and structural diversity are important to meet both roosting and foraging needs for *L. borealis*.

BATS AND PUBLIC SHELTERS: BIG BROWN BATS OF HAMMEL WOODS GET THEIR OWN CONDO

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Abstract: What would you do if a colony of big brown bats was hanging around one of your most popular picnic shelters? Offer the bats a condo building of their own, of course. That's what the Forest Preserve District did in September of 2014 when the Pennsylvania-based company, Bat Conservation and Management Inc. was hired to install a midsize bat condo about 75 feet north of the Shorewood Grove Shelter in Hammel Woods. The bat issue at Shorewood Grove Shelter has been on the District's radar for years because of complaints. Sometimes bats would uncharacteristically emerge during the day after becoming irritated by noise from picnickers and smoke from the shelter's fireplaces. Others times, picnickers were annoyed by the bats and the guano they left behind. So the condo was installed as an incentive for the bats to relocate.

THE EFFECT OF STREAM DEGRADATION ON RIPARIAN BAT DIVERSITY

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Stream ecosystems have been degraded throughout the Southern Rockies due to multiple perturbations. Kimball Creek, a 3rd order stream located on the High Lonesome Ranch near De Beque, Colorado, has experienced in-stream channel and riparian habitat degradation due to cattle, irrigation, extirpation of beaver, and high spring flows, resulting in deeply incised channel morphology and increased sedimentation. Plans are being implemented by the High Lonesome Ranch to restore Kimball Creek to a more natural hydrological pattern. The conservation and restoration of stream and riparian ecosystems depends upon an understanding of the ecological interactions between them. Bats, and the emerging aquatic insects upon which they feed, are important components of these inter-ecosystem interactions, which may have reciprocal cascading effects. As part of a larger study of Kimball Creek's pre-restoration ecology, we collected data to evaluate bat species richness and activity. During Summer 2013 and 2014 two Wildlife Acoustics SM2Bat+ bat detectors were placed at two sites on Kimball Creek that varied in altitude, vegetative structure, and degree of degradation for a total of over 60 acoustic sampling nights. During that time, over 40,000 bat passes were recorded, with approximately 20,000 bat passes per study site. We used SonoBat version 3.1 for full spectrum species identification, followed by post-identification review of bat calls and subsequent visual verification of species assignment. Bat activity and bat species richness at both sites was high. Both sites varied in the activity of each species, with greater evenness in species activity at the more degraded, open, lower-altitude site. Our continuing study of bat species richness and activity will help to elucidate the role of these terrestrial insect predators

on the potential for inter-ecosystem trophic cascades in Kimball Creek and will add to the knowledge of bat conservation on the Western Slope of the Rocky Mountains.

BAT USE OF TIMBER HARVESTS AND ADJACENT FORESTS: A COMPARISON OF CALL ABUNDANCE ACROSS THE HARVEST-FOREST GRADIENT

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Increased bat use of timber harvests has been documented in multiple studies, yet questions remain regarding differences in species' use of areas within and surrounding timber harvests. Our objective was to compare echolocation call abundances for six species across a gradient relative to timber harvest treatments in a managed central Indiana forest. We recorded bat echolocation calls at clear cuts (n=6), shelterwood cuts (n=6), and patch cuts (n=12) during May-July, 2013 and 2014 and sampled 120 locations per season. Detectors were placed at five locations relative to each harvest: harvest center, harvest edge, 15 m into forest, 50 m into forest, and 100 m into forest. We classified bat calls into six species: *Eptesicus fuscus*, *Lasiurus borealis*, *Lasiurus cinereus*, *Perimyotis subflavus*, *Myotis septentrionalis*, and *Myotis sodalis/lucifugus*. We used a generalized linear model with year, harvest, and detector location as fixed effects to compare bat call abundances by species and used Akaike's Information Criterion to select the best models. We found greater call abundances at harvest center and harvest edge than all forest locations for *E. fuscus*, *L. borealis*, *L. cinereus*, *P. subflavus,* and *M. septentrionalis*. No differences were found in call abundance between forest locations, with the exception of *L. borealis*, which had lower call abundance at the 50 m forest location than the 100 m forest location. *Myotis sodalis/lucifugus* call abundance was greater at harvest edge than all other locations. *Eptesicus fuscus*, *M. sodalis*/*lucifugus*, and *M*. *septentrionalis* showed a trend for greater call abundance at harvest edge than harvest center. Despite morphological variance of the species sampled, greater use of locations within timber harvests than in forests adjacent to harvests was found. Identifying patterns in bat species' use of timber harvests and their surrounding forests is important for understanding the effects of silvicultural treatments on bat assemblages.

ATYPICAL AMERICAN BEECH TREE USED BY INDIANA BAT MATERNITY COLONY

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Two juvenile male Indiana bats (*Myotis sodalis*) were radio tracked to an American beech (*Fagus grandifolia*) during the summer of 2013 in Clermont County, Ohio. The American beech resulted in the most bats seen emerging across the five known roost trees discovered during the study and indicates that it may have been a primary maternity roost. There are few records in the literature of Indiana bats using American beech trees as roosts and could influence how habitat assessments are conducted for potential Indiana bat roosts.

ASSESSING CLASSIFIER ACCURACY, KaPRO vs. SonoBat, SOUTH FLORIDA EDITION

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Bat-workers rely upon auto-classifiers to quickly summarize acoustic surveys. This process does not provide an error-free picture of bat occurrence. Instead it merely indicates maximum likelihood for bat presence. How much error is involved in the results depends upon the ability of the researcher to obtain high-quality recordings, and the ability of the classifier to accurately interpret the metrics available in the recordings. Little information has been published about current classifier accuracy rates, so there is very little guidance for applying different classifiers to acoustic surveys. This presentation illustrates how two classifiers are assessed for bat populations in Southwestern Florida, USA.
Calls that are used to evaluate a classifier must be from *known* species, that is, either voucher calls collected from *free flying* bats, or passive recordings that were manually vetted to species by experts with 20+ years of call analysis experience. Using a formula to arrive at the accuracy and precision of automated classifications based on the true positives, false positives, false negatives and true negatives, we can quantitatively compare the performance of programs. Between December 2014 and February 2015, we expertly reviewed a collection of 5000+ quality full-spectrum recordings from 16 Pettersson D500x detectors that were distributed across the 80,000 acre Babcock-Webb Wildlife Management Area. These high-quality recordings were then evaluated by the most currently available versions of SonoBat and KaleidoscopePRO. Results from the auto-classification outputs were compared with the expert manual vetting to determine the relative accuracy and precision of the two programs, and hence their reliability for reporting on passive acoustic surveys. More information about this analysis is archived at: http://www.batmanagement.com/acoustichelp/acoustichelp.html

ASSESSING BATS AT EFFIGY MOUNDS NATIONAL MONUMENT IN EASTERN IOWA FOR EXPOSURE TO *PSEUDOGYMNOASCUS DESTRUCTANS*

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We were asked to evaluate the bats at Effigy Mounds National Monument (EMNM) for signs of White-Nose Syndrome (WNS). We sampled bats at eight locations within EMNM by using mist nets. All captured bats were weighed, measured, and examined. In addition, DNA samples were taken from the oral cavity and facial region using Isohelix® DNA swabs and sterilized cotton swabs; these samples were used to test for the presence of *Pseudogymnoascus destructans*, the fungus that causes WNS. Five bat species were captured in mist nets between mid-July and late September 2014 with Northern long-eared bats (*Myotis septentrionalis*) and little brown bats (*Myotis lucifugus*) being the most common. Big brown bat (*Eptesicus fuscus*),

silver-haired bat (*Lasionycteris noctivagans*), and eastern red bat (*Lasiurus borealis*) all were represented by single captures; all three are species that have historically yielded positive detections of the WNS fungus at different locations. All captured bats appeared healthy after physical examination and wing scores provide no evidence for prior exposure to the WNS fungus. We will present the results from a molecular analysis of the swabs.

MISSOURI BAT CAVE SURVEYS: THE PAST 30 YEARS AND WHAT THE FUTURE MAY HOLD

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The Missouri Department of Conservation began conducting winter bat hibernacula surveys as early as the late 1950s at a few sites, such as Pilot Knob Mine, but the majority of the surveys began in the mid-1970s when both the Indiana bat (*Myotis sodalis*) and the gray bat (*Myotis grisescens*) were listed under the Endangered Species Act. While other species were noted, the focus of the surveys was on Indiana and gray bats before White-nose Syndrome (WNS) began to appear in the northeastern United States. Surveys post 2006 involved an increased effort to count all bat species present and WNS monitoring including: surveillance, collections for research or diagnostics, and various efforts to detect the causative agent. Because of the long-term Indiana bat monitoring protocol, we have survey data pre- and post-WNS on at least 25 caves. Continued cooperation with private landowners, caving organizations, NGOS, other agencies, and the general public, has assisted MDC in documenting several new major bat hibernacula and maternity caves of various species including what is currently the largest Indiana bat hibernaculum in its entire range.

CHANGES IN BAT COMMUNITY COMPOSITION DURING SEASONAL FALL MIGRATION IN NORTHWEST TENNESSEE

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Temperate bat populations fluctuate with changing temperatures resulting in a decrease in populations from early fall to early winter and an increase in late spring to mid-summer. In the fall, many bats either migrate to another area or hibernate in caves, leaf litter, or inside tree bark to survive the cold temperatures of winter. Since normal thermoregulation in insectivorous bats becomes inefficient as temperatures drop, we predicted that species richness in northwest Tennessee would decrease during the fall as the temperatures decreased. We recorded bat calls at a rural pond in Weakley County, Tennessee, late August – early November 2014, using a Pettersson D500X. The full spectrum calls were analyzed with SonoBat version 3.1, followed by visual verification of species identification by N. Buschhaus. Bat species using this area varied during the study, with bat species richness first increasing then decreasing in the latter portion of the study.

KOOTENAY COMMUNITY BAT PROJECT: A COMMUNITY-BASED APPROACH TO BAT CONSERVATION

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The Kootenay Community Bat Project (KCBP) was established in south-eastern British Columbia in 2004 as a community-based approach to bat conservation in buildings. The goals of the KCBP are to: 1) promote the conservation of bats in the Kootenay region, including species at risk and those at risk from White Nose Syndrome; 2) engage citizens in community-based bat stewardship; 3) conserve and enhance critical bat roost habitat; and, 4) monitor bat populations. This project incorporates outreach, inventory, and stewardship activities. KCBP is highly publicized, and encourages local participation in identifying and conserving bat roosts. KCBP also includes roost surveys of bats in buildings on private lands. Over 600 site visits have been conducted in the past 10 years and a total of 514 roost sites have been identified. Seven bat species were detected including Townsend's Long-eared Bat (*Corynorhinus townsendii*), Californian Myotis (*M. californicus*), Western Long-eared Myotis (*Myotis evotis*), Little Brown Bat (*Myotis lucifugus*), Yuma Myotis (*M. yumanensis*), Big Brown Bat (*Eptesicus fuscus*), Silver-haired Bat (*Lasiurus noctivigans*) and Long-legged Myotis (*M. volans*). Over the past ten years, the project has provided 14 bat-house building workshops, 73 community programs and 182 school programs. Almost 450 bat-houses were constructed as a result of this project. An Annual Bat Count was initiated in 2012 to incorporate citizens in bat population monitoring and over 20 sites are being monitored annually. The involvement of community members in bat conservation holds great potential for the collection of long-term monitoring data. This project is the model for the province-wide BC Community Bat Project Network that was established in 2014.

CREATION OF ROOST TREES FOR INDIANA BATS: EFFECTS OF TREE SPECIES, SIZE, AND SEASON OF HERBICIDE TREATMENT

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Snags suitable as roost trees are an essential but ephemeral resource for the Indiana bat (*Myotis sodalis).* Production of roosting habitat ensures that maternity colonies have adequate primary and alternate roosts to rear their young. Our objective was to determine an effective approach to producing natural snags with sloughing bark suitable for Indiana bat roosting. We tested for effects of season of herbicide treatment (Triclopyr® 3a), tree size, and tree species on rate of tree decay and production of sloughing bark. The tree species injected were green ash (*Fraxinus pennsylvanica*), shagbark hickory (*Carya ovata*), silver maple (*Acer saccharinum*), and white oak (*Quercus alba*). Small (<16" DBH) and large (≥16" DBH) trees of each species were injected during summer or winter. Rate of tree death differed significantly among species. Two years post-herbicide treatment, most of the green ash and white oak trees were dead; but 90% of the silver maples and 70% of the shagbark hickories were still alive. Tree size was associated

significantly with tree death; with larger trees taking longer to die than smaller ones. The rate of production of suitable bark was slow. No tree reached a level of high suitability (> 25% sloughing bark) as a bat roost tree and most trees were in still in the not-suitable category (0% sloughing bark) in the third year of the study. Rate of production of suitable bark was associated significantly with tree species, but not tree size category, DBH, height, crown class, or season of herbicide treatment. Shagbark hickories and sliver maples were more likely to have a higher level of suitable bark compared with other species. Based on results to date, the shagbark hickory was the species of choice for production of standing roost trees for Indiana bats.

INCIDENTAL CAPTURES OF EASTERN SPOTTED SKUNK IN A HIGH-ELEVATION RED SPRUCE FOREST IN THE SOUTHERN APPALACHIANS

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The Eastern Spotted Skunk (*Spilogale putorius* L.) is considered rare in the southern Appalachian Mountains and throughout much of its range. We report incidental captures of 6 spotted skunks in a high elevation Red Spruce (*Picea rubens* Sarg.) forest in southwestern Virginia during late February and March, 2014. These observations are the highest elevation records for this species in the Appalachian Mountains at 1520 m. They are also the first known records of Eastern Spotted Skunks using Red Spruce forests in the southern Appalachians. These observations highlight new information on the distribution and habitat use of this species, which are both important for conservation of this declining carnivore.

IMPORTANCE OF COMPLIANCE MIST-NETTING SURVEYS FOR NON-TARGET SPECIES, ESPECIALLY OZARK BIG-EARED BATS IN ARKANSAS

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For over 15 years the Ozark-St. Francis National Forest in northern Arkansas has been conducting compliance mist-netting within several five-mile buffers of known Indiana bat *(Myotis sodalis)* hibernacula, following the guidelines of the Endangered Species Act. Indiana bat monitoring since 2011 has resulted in a considerable number of Ozark big-eared bat *(Corynorhinus townsendii ingens; COTO)* captures. In 2011 three males were captured. Pregnant females were captured both in 2013 and 2014, bringing the total captures to eight individuals in the Boston Mountain Ranger District. Although most captures were near known COTO bachelor sites and minimally used hibernacula, the capture of two pregnant females was not. Deciding radio telemetry was too invasive, directionality and timing was used to isolate probable maternity roost locations. A roost was located in a large talus area in July in close

proximity to the location of the pregnant females captured in 2014. This location is a suspected maternity roost, but was not confirmed in order to minimize disturbance. The location was re-checked in January and was not being used as hibernacula. The 2013 capture was 4.8 km from the newly discovered roost and ongoing searches are planned for 2015. As the Ozark big-eared bat is difficult to detect with acoustic monitoring devices, our captures indicate that mist-netting is an invaluable tool for collecting data on 'non-target' bat species while conducting compliance mist-netting.

HIBERNATING BAT COUNTS IN NEW MEXICO CAVES

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Information on habitat and stability of the bat population is important in cave and wildlife management, especially now with the threat of White Nose Syndrome (WNS). For more than 15 years, volunteer cavers have conducted hibernating bat counts in several caves within the Roswell NM BLM district and for five years in the Lincoln National Forest. Historical data on hibernacula including temperatures and humidity has been collected for some caves as far back as the late 70's. Information to be presented in this poster will include historical count data and a brief analysis of some of the hibernacula characteristics of New Mexico caves. The hibernacula caves are located in lava, gypsum, and limestone. One cave is only about 150' long, and one hibernacula is located in the entrance of a 31 mile long cave. The most common bat species inventoried include *Myotis velifer, Myotis ciliolabrum/californicus, and Corynorhinus townsendii*. One cave hibernaculum has had variations between 300 and 14000 bats counted due to unknown reasons. The most populous cave hibernacula roosts in New Mexico vary between 30 and 48 f and 29-59% humidity. In general, our hibernating bat roosts vary significantly from year to year.

PRELIMINARY RESULTS OF A LONG-TERM MARK-RECAPTURE STUDY OF SMALL MAMMALS OF PRARIE RIDGE ECOSTATION, A RESTORED NATURAL AREA IN URBAN, CENTRAL NC

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With a history of heavy use, first as a military training site, then in agriculture, in 2004 the North Carolina Museum of Natural Sciences began converting a 38.5 acre tract to what is now Prairie Ridge Ecostation. Most recently, the majority of the tract was comprised of fescue fields and used for cattle grazing. The area has been partially transformed into native tall grass prairie, bottomland forest and arboretum, ponds, and a stream. Though undeveloped forest and pastures exist nearby, four-lane roads lie just to the west and south edges of Prairie Ridge and commercial and residential development are encroaching on all sides. In the summer of 2011 we began a long-term mark-recapture project to monitor small mammal populations of Prairie Ridge. We established three permanent grids of 50 traps each in three distinct field types: bottomland, fescue, and switchgrass. Trapping occurs seasonally, with trapping sessions conducted in January, April, July, and October. To date, 1166 uniquely numbered ear tags have

been applied to hispid cot rats (*Sigmodon hispidus*), 67 to white-footed mice (*Peromyscus leucopus*), 19 to house mice (*Mus musculus*), 16 to eastern harvest mice (*Reithrodontomys humulis*), and 3 to woodland voles (*Microtus pinetorum*). Additionally, 30 southern short-tailed shrews (*Blarina brevicauda*) were captured but not tagged. Findings are preliminary and both the study and analyses are ongoing. We are seeing seasonal variation and significant difference among field types ($p < 0.05$).

SHORT-TERM EFFECTS OF WILDFIRE ON BAT ACTIVITY

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Bats are important components of forested ecosystems. Most bat species depend on forest habitats for roosting or foraging, and are also beneficial to forests (e.g., insect suppression). In the American Southwest, large and unprecedented wildfires are occurring more frequently. Although wildfires can be beneficial to bats (i.e., fires weaken trees and stimulate flowering plant growth, attracting wood-boring beetles, pollinators, and other prey insects; and create roost sites and thin cluttered forests), the relationships between bats and forest fires are still not well understood. In particular, we have a limited knowledge of how increasingly common wildfires may influence bat activity and community composition. The focus of this study is to determine how bat activity is influenced by wildfire, and more specifically, how burn severity and vegetation type affects activity levels in the years immediately post-fire, at a landscape-level scale. Acoustic surveys were conducted at the Valles Caldera National Preserve, New Mexico from June-October in 2013 and May-July in 2014 at four study sites within each treatment: unburned, the Las Conchas Wildfire (2011), and the Thompson Ridge Wildfire (2013). Six sites were randomly surveyed each night. Mean bat activity levels were correlated with proportions of burn severities and vegetation types around each study site using a series of buffers. Bats were found to be more active in burned areas than in unburned areas. Within burned areas, activity levels were higher in areas that burned at lower severities, and lower in those that burned at higher severities. Bats also tended to be less active in particular vegetation types, while being more active in others. A mosaic of burn severities and vegetation types across the landscape appears to most beneficial for bats. These patterns are hypothesized to be a result of prey availability, but further analyses are needed to better understand these relationships.

SEASONAL SEX RATIO VARIATION OF GRAY BATS *(MYOTIS GRISESCENS)* NEAR A HIBERNACULUM IN SOUTHWEST MISSOURI

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Sex ratio data of a *Myotis grisescens* population at a single large hibernaculum were studied across the winter and following fall and spring hibernating season by month. During the fall of

2013, a trend was observed skewing the expected 1:1 sex ratio. The ratio of males in early fall outnumbered that of females by 2:1 in September (N=40) and then reversed one month after in October to a 1:5 ratio (N=48). The previous hibernation season, December 2012-February 2013, the ratio of males to females was close to a 1:1 ratio and remained that way until early spring. From March to April of 2014 a trend of declining male presence was observed, changing from 4:1 in March (N=22) to 1:4 sex ratio in April (N=27). This trend suggests that males arrive first in fall in order to have first male advantage to breed, and leave first in order to establish territory in male summer and reduce competition with females for spring resources.

NOT ON THE SAME BAT CHANNEL: CHALLENGES IN COMMUNICATING ABOUT BATS

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Although bats are endearing to us, they not as universally appealing as babies or kittens, so talking about them through conventional and social media is challenging. Even well-researched coverage sometimes sends inadvertent messages, like when a national news anchor repeatedly says she is "creeped out by bats" or when photo editors attach pictures of vampire bats to stories about white-nose syndrome. This poster shows examples of headlines, stories, posts and tweets about bats and white-nose syndrome to show what people are saying and how messages can sometimes literally get lost in translation. It also shows positive results of coordinated messaging and campaigns and suggests ways to achieve success by coordinating messaging and leveraging partners, for example through the White-Nose Syndrome Communications and Outreach Working Group.

USE OF MULTIPLE METHODS TO VERIFY BAT SPECIES OCCUPANCY IN NORTHERN ILLINOIS

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Increased concern for bat populations due to the arrival of white-nose syndrome, reductions in available habitat, and the disturbance of roost locations has stimulated a growing need for information on bat habitat use. Our research goal was to verify species presence in the McHenry County Conservation District (MCCD) properties and examine capture data to validate acoustic recording detections. We sampled at 15 sites in the summer of 2013 and repeated five of those sites in the summer of 2014 using mist nets and acoustic recorders. We captured 109 bats in wooded, riparian areas including big brown, eastern red, hoary, little brown, northern long-eared, and silver-haired bats. Approximately 37,515 acoustic files were recorded near the mist net locations using SM2BAT+ detectors and are being verified using Sonobat 3.2.1. Combining capture and acoustic data will provide a robust analysis of occupancy patterns to relate to land cover parameters in future analyses. Additionally we conducted a roost count in the Glacial Park barn of approximately 1,229 bats and later confirmed with the use of a harp trap that the majority were little brown bat females. This information along with future analyses will assist land managers with decision making when considering bat habitat protection and survey methods.

THE MAN IN THE MOON: BATS' MORTAL ENEMY? AN EXPLORATION INTO BATS AND MOONLIGHT AVOIDANCE

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The purpose of this study was to explore a novel approach in evaluating whether bats change their behavior based on the illumination of the moon, specifically if bats are less active during periods of bright moonlight to avoid predation by sight-based nocturnal predators. It is important to examine this potential behavior in bats because it is a largely unstudied area and could have fascinating consequences in the field of bat behavioral studies. We hypothesized that if bats avoid moonlight then bats should begin to emerge from their roosts later on brighter moonlit nights. Data were collected from March to October 2003-2014 as part of a larger project monitoring a population of endangered Indiana bats (*Myotis sodalis*). Bat data used for this analysis consisted of emergence begin and end times and were collected at known Indiana bat roosts 2-3 times/week over this period. We used >2500 observations in this analysis, with counts ranging from 0-220 bats/roost/night. Environmental data were collected from a nearby weather station, while sun and moon data were collected from the U. S. Military. When considering only moon-phase illumination and emergence time there seems to be very little correlation ($r = 0.03$), but there was a significant negative correlation between colony size and emergence time ($r = -0.21$; $p < 0.0001$). This data suggests they neither seek out, nor avoid moonlight, but that colony size is the largest factor determining emergence time. We were not able to reject our null hypothesis, that there is no relationship between emergence times and moon illumination. However, there many other interacting environmental factors that have not been considered yet, but will be addressed in the future.

SURVEILLANCE OF VIRAL PATHOGENS FROM ALASKAN BATS

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Recent advances in molecular virology have led to the identification of many different mammalian (or related) viruses in diverse species of birds and bat species—and even apparently healthy bats are now known to carry pathogens that are virulent in humans ("zoonotic disease"). The high potential for wide-spread dispersal of rabies (and other pathogenic viruses) by bat populations is high due to their unusual immune system that allows persistent infection and shedding of viral pathogens for months, their ability to fly and migrate, their gregarious social structure (which contributes to the amplification of viruses in bat colonies) and the known close association of bats with human habitation. We report the initial results of single sample pan-viral assays for the detection of RNA viruses of wildlife and human concern: Coronaviruses, Orthmyoxoviruses (Influenza A), Orthoreoviruses, Paramyxoviruses, and Lyssaviruses (Rabies). We have focused on Coronoviruses, which are ubiquitous viruses in wildlife (and especially insectivorous bat) populations. Recent and ongoing population surveys

by us and other researchers have identified significant populations of *Myotis lucifugus* (Little Brown Bats) in southeastern Alaska, but it is unclear at present whether they are migratory or resident. We discuss how the use of pan-viral surveillance assays allow us to gather the type of data needed to study bat ecology, bat conservation, and infectious disease ecology using a systems approach.

NORTHERN LONG-EARED BAT ROOST SITE SELECTION IN A MANAGED FOREST AND TRANSMITTER RETENTION TIMES

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The northern long-eared bat (*Myotis septentrionalis;* MYSE) is proposed to be federally listed under the Endangered Species Act in April of 2015 due to the spread of white-nose syndrome and subsequent population declines. Listing of this species will have implications for land managers since MYSE use forested landscapes for summer roosting and foraging. Therefore, understanding summer roost selection is essential to effectively integrate this species needs into current forest management practices. Our study was conducted on the Hardwood Ecosystem Experiment (HEE) located in Morgan Monroe State Forest and Yellowwood State Forest in southern Indiana. We hypothesized that adult females would congregate in maternity colonies within crevices or cavities or under exfoliating bark of living and dead trees. During the summers of 2012-2014, 55 female MYSE were fitted with radio transmitters and tracked to their day roosts (143 roosts). Northern long-eared bats were tracked for an average of 4.79 days which was about half as long as simultaneously tracked Indiana bats. Characteristics of all roost trees were recorded. Preliminary results show that female MYSE tended to select live trees with oak, sassafras, and maple species being most common. Roost trees had an average DBH of 29.4 cm. Northern long-eared bats selected cavities almost twice as often as crevices or under bark. Data suggest that in southern Indiana, MYSE are roost generalists for many roost tree characteristics when compared to other Myotis species and may tolerate some forest management practices as long as adequate roost trees remain available on the landscape.

EXPLORING THE RELATIONSHIP BETWEEN ECOLOGICAL NICHE BREADTH & DISPERSAL AMONG PACIFIC NORTHWEST BATS: A PRELIMINARY REPORT.

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Habitat loss and fragmentation represent two of the greatest threats to bats worldwide. While it is generally assumed that bats are highly mobile across fragmented habitats, recent research has challenged this assumption. Dispersal patterns vary significantly among bat species, and may be linked to traits such as social organization, roosting, and dietary ecology. We present preliminary data testing this hypothesis in bat communities of the San Juan archipelago in the Pacific Northwest. The known geological history and proximity to the mainland make this region an excellent model to investigate the consequences of habitat fragmentation. The aims

of this study are to: 1) assess the distribution of bat species throughout the archipelago, 2) characterize the dietary and roosting ecology and the population genetics for a subset of species and 3) evaluate whether ecological needs influence patterns of population connectivity/dispersal between the islands and the mainland. Between July and September 2014, we deployed mist nets and harp traps on various sites located on the coastal mainland of Washington State, Vendovi, San Juan, and Orcas Islands. For each bat, we collected morphometric data, wing biopsies and fecal samples for functional, population genetics, and dietary analyses. Additionally, roosts were surveyed using a newly developed method that employs scent detection dogs to locate bat roosts. Across sites, we documented at least seven species of bats. *Myotis californicus, M. yumanensis,* and *M. lucifugus* were most commonly captured, and *Eptesicus fuscus, Corynorhinus townsendii M. keenii/evotis, and M. volans* most rarely. Roosting sites were successfully located by scent detection dogs, highlighting the potential of this technique for future studies. Using this sample, we provide a preliminary assessment of San Juan bat communities, and how their population structure and gene flow may be affected by natural habitat fragmentation.

CITIZEN SCIENTISTS COLLECT BASELINE DATA ON BAT DISTRIBUTION, HABITAT USE, AND SEASONAL ACTIVITY IN SOUTHEAST ALASKA

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Little is known about the ecology of bats in Southeast Alaska. The Alaska Department of Fish & Game's Wildlife Diversity Program initiated a citizen science program in the summer of 2014 to collect baseline information on the distribution, habitat use, and seasonal activity of bats in the region. Southeast Alaska is an island archipelago, and most communities are accessible only by boat or plane, making it logistically challenging and expensive for biologists to collect data at multiple locations. In Southeast Alaska, public libraries connect the community members to local events and serve as a 'hub' for information sharing. We partnered with public libraries in 2 communities to establish a citizen science acoustic survey project. The libraries served as centers for advertising the project and recruiting citizen scientists and librarians were responsible for checking out the equipment and downloading and submitting the data. A total of 30 community members participated in 15 driving surveys that covered specific survey routes and followed standardized protocols. Through this citizen science effort, we were able to identify which species are present in these remote communities, as well as the habitats they are using. These data will also be contributed to a new national database for monitoring bat population trends. The successful partnership established between ADFG biologists and community libraries will enable us to continue monitoring bat populations in these remote communities.

DETERMINING SPECIES DIVERSITY AND POPULATION SIZE OF BATS AT THE REMAC MINE, PEND D'OREILLE VALLEY, BC

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In Canada, the greatest species diversity of bats occurs in British Columbia (BC). Little is known about bat ecology in the province, particularly in winter. Bats play a critical environmental role and now face unprecedented threats due to White Nose Syndrome (WNS). Of urgency is to locate hibernacula, so that potential mitigation can be strategized and overwintering habitat secured. We focused on a mine in southeastern BC, called Remac. Preliminary investigations suggest it may be the most populous and diverse hibernaculum in the province. Our goal was to quantify the number of bats and species using this hibernaculum. Bats were acoustically monitored at mine entrances to determine species identification and patterns of activity. Free-flying bats were captured using mistnets strung across accessible mine portals from September 2012 – November 2014, with emphasis on late fall and winter. Bats were banded to allow individual identification upon recapture. We captured four species in winter: Californian Myotis, Silver-haired Bat, Townsend's Long-eared Bat and Big Brown Bat. The former 3 species were most commonly captured. In fall and winter, unusual acoustic patterns attributed to Silver-haired bats suggest a 'mating song'; the presence of females, and males with stored sperm for all 3 common species supports the hypothesis that mating is occurring here. We have banded >200 bats and continue to catch many unbanded individuals, suggesting this hibernaculum is large relative to other western hibernacula. Recaptures confirm roost fidelity within and between years, and have provided the first evidence of year-round residency of Silver-haired bats at a mine.

COMPARISON OF DNA COLLECTION METHODS TO IDENTIFY BAT SPECIES

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Bat species can usually be identified by visual morphological analysis in the field; however in some cases, bats are difficult to identify visually. For species where visual identification is difficult, DNA is collected to confirm species identification. Wing punches can be used to collect DNA but this technique can pose risks to individual bats and requires hands on training and experience to ensure it is done properly. To decrease the chance of injury, a less invasive protocol to collect DNA, dry swabbing was tested to see if sufficient DNA for species identification could be collected using this method.

To test this method, 43 wing punches and 44 wing swabs were taken from individual bats captured as part of a baseline data collection program. DNA was isolated from each sample and amplified using three different methods. Overall, 35 of the 38 (92%) of the swab samples produced sequence-able amplification products that aligned to species in the NCBI database from at least one of the three amplification methods, and 50% of the wing swabs produced sequence-able amplification products from all three methods. All 35 of the sequence-able

samples matched both the field identification and the previously obtained wing punch DNA identification. This is compared to 43 out of 43 wing punch samples (100%) that were able to produce a sequence-able product from all three amplification methods. A concern about using wing swabs was that the swab may give an inconsistent identity from skin cells transferring between bats during contact. This study saw no evidence of this transfer; of the 35 samples for which a species identification was obtained, all 35 matched both the field identification and the wing punch identification.

BATS INITIATE STRONG AND SURPRISING TROPHIC INTERACTIONS IN A COSMOPOLITAN AGROECOSYSTEM

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In agroecosystems worldwide, insectivorous bats are voracious predators of crop pests, and may provide a service to agriculture worth billions USD. However, we currently lack knowledge about the role of bats in agricultural systems. Using large exclosures in corn fields, we show that bats exert sufficient top-down pressure on crop pests to suppress larval densities and damage in this cosmopolitan crop. Additionally, bats suppress pest-associated fungal growth and mycotoxin in corn. Corn not genetically modified to express insecticidal properties, like that used in this experiment, is an essential crop for farmers on over 100 million hectares worldwide. A conservative estimate values the suppression of such damage by insectivorous bats at hundreds of millions USD globally on this crop alone. Bats face a variety of threats globally, but their relevance as predators of insects in ubiquitous corn-dominated landscapes underlines the economic and ecological importance of conserving biodiversity.

TRASH TO TREASURE: ASSESSING VIABILITY OF WING BIOPSIES FOR USE IN BAT GENETIC RESEARCH

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The outbreak of white-nose syndrome in North American bats has resulted in massive data collection efforts to characterize the fungus, *Pseudogymnoascus destructans*. Wing biopsies routinely are collected from live bats, placed in agar media to culture the fungus, and ultimately discarded. We tested whether these discarded tissues represent a viable source of host bat DNA. We found no difference in DNA concentration and no reduction of DNA quality between samples that were extracted immediately compared to samples placed in agar for fungal culture. Although recovered DNA quantities were low, concentrations increased using a cleanup

kit. Our study suggests samples collected from live bats can be leveraged across disciplines to further our understanding of bat genetics and the impact of white-nose syndrome.

MONTANA'S BAT ROOST SURVEILLANCE EFFORTS

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Since 2006, White-Nose Syndrome (WNS), caused by the cold-adapted soil fungus *Pseudogymnoascus destructans*, has spread westward to states along the Mississippi River corridor as well as the province of Ontario. With at least 9 of Montana's 15 known bat species facing potentially devastating increases in mortality from WNS, a collaborative effort between state and federal agencies and caving groups was initiated in the fall of 2011 to centralize information on both winter and summer roost sites used by Montana bats. In to document the species composition, number, degree of clustering, and roost temperatures and humidities of bats winter roosting in caves and mines. To-date, collaborators have surveyed over 450 bridges and buildings potentially used as summer roosts and over 50 caves and mines with the highest likelihood of bat use. We have deployed over 40 temperature and relative humidity data loggers near winter roosting bats and most known bat hibernacula in Montana are now being monitored. Most caves and mines surveyed to date support only small numbers of winter roosting bats; typically less than ten roosting in isolation or clusters of two to three. A handful of caves have 50-1750 winter roosting bats with clusters of up to 40 individuals. Many of the caves that have been surveyed have temperatures and humidities that appear to be capable of supporting *P. destructans*, but PCR-based testing of bat and substrate swabs have tested negative for its presence so far. The majority of Montana bats apparently winter roost away from mines or caves that are accessible to, or known by, humans and these roosts need to be located and assessed for their ability to support *P. destructans*.

DETERMINING THE BAT COMMUNITY AT EFFIGY MOUNDS NATIONAL MONUMENT IN EASTERN IOWA THROUGH ACOUSTIC SURVEYS

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We were asked to evaluate the bat community at Effigy Mounds National Monument (EMNM) along the Mississippi River in northeastern Iowa. Three objectives were prioritized: 1) describe the bat community throughout the park, 2) determine the status of Federally Endangered Indiana bats (*Myotis sodalis*), and 3) determine the status of the Proposed Endangered Northern long-eared bats (*Myotis septentrionalis*.) We conducted twelve acoustic surveys at

eight locations within the park. Acoustic sampling was accomplished through a combination of equipment: Titley Scientific Anabat-2, Wildlife Acoustics SM-2, and Wildlife Acoustics EM-3. Acoustic recordings were examined for bat calls using equipment specific software. Bats were successfully detected on each sampling date. Eight species were documented through acoustic recordings with Northern long-eared bats, little brown bats (*Myotis lucifugus*), each being recorded at seven of eight locations. Tricolored (*Perimyotis subflavus*) bats also were commonly recorded. Acoustic recordings suggest the presence of Indiana bats. These results will be used to plan for a thorough effort in 2015.

WHY IS THE RED BAT RED?

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Eastern red bats (*Lasiurus borealis*) are remarkable among insectivorous bats in that they are relatively brightly colored, and they have been described as sexually dichromatic. Fur color in red bats and other lasiurine bats is thought to reduce predation by visually oriented diurnal predators, but this idea has not been tested. Moreover, variation in fur color of red bats is surprisingly understudied. We used digital images to quantify fur color of 251 museum specimens of eastern red bats collected across their range, and modeled variation in fur color using Geographic Information Systems. Analysis of direct measurements suggested fur color varied with longitude, elevation, and due to deterioration of specimens over time; however, no relationship was detected between fur color and sex, time of year, or latitude. A Kriging model suggested fur color followed a geographic pattern and analysis of predicted color values indicated appearance was link with climatic variables and elevation. Bats exhibited wide color variation at low elevation sites and those with relatively dry and hot summers; whereas, variation in color was constrained at high elevation sites and those with relatively wet and cool summers. These results may support the notion that fur color is related to crypsis, but color also could influence thermoregulation and both ideas warrant more testing. Studying fur color in bats is worthwhile because it can uncover aspects of their biology that would be difficult to detect using other techniques.

USING TECHNOLOGY TO INCREASE PARTICIPATION IN CITIZEN SCIENCE BAT PROJECTS

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Citizen science projects are becoming an increasingly important component of data collection and monitoring programs for state agencies. The Georgia Department of Natural Resources often uses volunteers, students and collaborating scientists to collect data and requires submission of either hard copy data sheets or database files sent by email. In the past, we have been collecting data from Anabat routes and bat roost emergence counts with hard copy forms that are returned to us at the end of the field season. Recently, more options have become available for providing instructions and entering data online or using mobile applications. We

have developed an online form for surveys of bats in bridges and are in the early stages of testing the use of this form on mobile devices. We will discuss the advantages and limitations of simple interactive websites, downloadable forms, online forms and mobile applications for bat projects we are currently using or planning to use in Georgia. Many of these products should be applicable for use in other states and may be helpful for states without the ability to develop similar products. We will have examples and are seeking comments and suggestions for changes to improve the products and make them applicable for a wider audience.

HANDHELD BAT DETECTORS AS A TOOL FOR MIST NET SITE SELECTION AND PUBLIC OUTREACH

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Handheld bat detectors are excellent tools for observing bats in real time. Unlike passive acoustic recorders, handheld detectors allow for active monitoring and can help observers cue in on nearby bats. I received a handheld bat detector, the Wildlife Acoustics Echo Meter EM3+, as a Bob Berry Award recipient and have used the Echo Meter in my own research, as well as to engage others during public outreach events. My doctoral dissertation research seeks to elucidate how bats interact with agricultural landscapes. I use diverse methods, including capturing bats with mist nets, to address my research questions. Of the 22 species in the California Central Coast region, I focus on *Myotis yumanensis*, a common species in the study area. To select sites for mist-netting, I use active monitoring with the Echo Meter to identify areas of high *M. yumanensis* activity and to recognize *M. yumanensis* flyways. The Echo Meter translates bat calls into the range audible to humans in real time, often allowing an observer to locate bats flying nearby. The Echo Meter is also a great way to help non-scientists understand echolocation and observe bats in the wild. At the 2014 National Park Service/ National Geographic BioBlitz at Golden Gate National Parks, CA, I used the Echo Meter to help complete a bat inventory at Muir Woods. Bioblitz events bring together scientists and community volunteers to complete a 24hr biological survey, and provide an opportunity to engage the public in conservation. In addition to our survey, I worked with a team of volunteer bat biologists to teach bat biology and echolocation, and the EchoMeter allowed everyone to view sonograms of the bats that we captured.

SELECTION OF TREE ROOSTS BY MALE INDIANA BATS DURING THE AUTUMN SWARM IN THE OZARK HIGHLANDS

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We quantified 162 roosts for 36 male Indiana bats across 3 study areas in the Ozarks of northern Arkansas during the fall swarm. Bats utilized 14 tree species and the most utilized (29%) substrate for roosting was shortleaf pine snags. Five roosts were also located in utility poles. Tree and snag diameter used for roosting was 7.8 to 68.6 cm dbh, but bats used trees ≥20 cm dbh more than their availability. Roosts were located in a number of different forested

habitats, included pine stands, hardwood stands, and mixed pine-hardwood stands. Shelterwood and group selection stands that had undergone partial harvesting were also used. Roosts in 2 of 3 study areas showed no differences in proportional use of forest habitat classes versus availability of those habitats. However, in one area, mature forests (≥50 years old) that had been burned multiple times were used more than their availability and mature forests that were not burned were used less than their availability. Providing forest stands ≥38 years of age and abundant snags >20 cm dbh may help provide adequate roost sites for male Indiana bats during fall.

RESPONSE OF HIBERNATING TRICOLORED BATS TO SMOKE EXPOSURE FROM FOREST BURNING

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Prescribed burning during the winter in the vicinity of caves is commonly restricted due to potential entry of smoke into caves where bats hibernate, which is believed to cause bats to arouse from hibernation and consume vital fat stores. However, because of their low metabolism and oxygen intake, mammals in hibernation are resilient to oxygen depredation and high levels of noxious gasses compared to non-hibernating individuals. Therefore, we evaluated the effects of 2 levels of smoke (carbon monoxide levels of 100-200 ppm and 300-400 ppm) at three hibernacula temperatures (~5^{o}C, ~10^{o}C, and ~15^{o}C) in a laboratory setting to determine if exposure to smoke from forest burning caused 21 tricolored bats (*Perimyotis subflavus*) to arouse from hibernation. Bats were exposed to smoke for 20 minutes in environmental chambers and monitored for 80 minutes for visual signs of arousal. Skin temperatures were measured using iButtons attached to bats. No bats aroused from hibernation at the low smoke levels at any temperature. Under the higher smoke levels, a single bat at the ~5^{o}C temperature exhibited visual signs of a slight arousal with skin temperature increasing by 4^{o}C. No full arousals (skin temperatures of 21-26 ^{o}C) occurred in response to smoke exposure. In general, we found hibernating tricolored bats exposed to smoke did not arouse from torpor.

TRANS, TRANS-FARNESOL FROM *CANDIDA ALBICANS* CAN KILL OR INHIBIT *PSEUDOGYMNOASCUS DESTRUCTANS*

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Bat white-nose syndrome, caused by the psycrophilic fungus *Pseudogymnoascus destructans*, has dramatically reduced the populations of many hibernating North American bat species. The search for effective biological control agents targeting *P. destructans* is of great importance. We

report that the sesquiterpene trans, trans-farnesol, which is produced by the yeast/fungus *Candida albicans*, prevented *in vitro* conidial germination for at least 14 days and caused cell death in hyphal fragments of 5 *P. destructans* isolates in filtered potato dextrose broth at 10 °C. Depending on the inoculation concentrations, both spore inhibition and hyphal cell death occurred upon exposure to concentrations as low as 15-20 µM trans, trans-farnesol. In contrast, 3 different *Pseudogymnoascus* isolates were less sensitive to the exposure of trans, trans-farnesol. Isolate 05NY09 demonstrated dramatic reduction of hyphal growth and increased hyphal branching when exposed to 100 µM trans, trans-farnesol, while another isolate (LJ177) demonstrated no reduction in growth at 100 µM trans, trans-farnesol, but displayed out growths reminiscent of secondary conidia at 300 µM. The growth of a yeast-like isolate (LJ130) appeared unaffected by 300 µM trans, trans-farnesol. Our results suggest that some *Candida* isolates may have the potential to inhibit the growth of *P. destructans* and that the sesquiterpene trans, trans-farnesol has the potential to be utilized as an environmental control agent.

BAT ASSEMBLAGE ACROSS THE SUMMER LANDSCAPE OF KENTUCKY, OHIO, PENNSYLVANIA, AND WEST VIRGINIA

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CEC completed a multi-state mist-net survey along a 704-mile long transect through four states during the summer of 2013. This survey, the largest single mist-netting effort of its kind, was triggered by portions of the transect passing through known Indiana bat (*Myotis sodalis*) habitat. In total, 4778 bats, comprising ten species were captured at 739 mist-net sites. Analysis of the bat assemblage within this four-state area included species diversity, reproductive timing, and sex ratios. Through mist netting, radio-telemetry, and emergence observations, additional Indiana bat and northern long-eared bat (*Myotis septentrionalis*) life history and behavior, including use of novel roosting structures, was identified.

VIABILITY OF *P. DESTRUCTANS* AT ROOM TEMPERATURE

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Pseudogymnoascus destructans (*Pd*), the causal agent of white-nose syndrome (WNS) in bats, is a psychrophilic fungus capable of surviving in caves even in the absence of bats. Previous research has shown that the fungus is transmitted from bat to bat, and spores may be transported by humans on their gear. Decontamination protocols state that clothing, footwear or equipment used in a WNS-affected region should not be used in an unaffected region in order to prevent the spread of fungal spores by humans to new locations. Following protocol, gear and clothing are to be decontaminated between bat surveys and cave visits in WNS-affected regions. The focus of our research was to investigate the capability of *Pd* to survive at room temperature (25°C) on a substrate devoid of the required nutrients for growth. We inoculated an agar plate, cotton fabric, rubber segment, and plastic Petri plate with *Pd* isolate using a sterile swab for each sample (SUB25 plates hereafter). We sterilized each substrate

prior to inoculation and placed the fabric and rubber on plates. All SUB25 plates were sealed with paraffin film and incubated for 14 days at 25°C. Every 24 hours for 14 days, we aseptically inoculated nutrient-rich Sabouraud Dextrose Agar (hereafter SDA7) plates with *Pd* by rolling a swab across each of the SUB25 substrates. Next, we incubated the sealed SDA7 inoculations at 7°C, the optimal temperature for our *Pd* isolate, and checked daily for growth. We replicated each trial. We observed growth on SDA7 plates after 8 days, but not on the SUB25 substrates. Our preliminary results suggest that *Pd* can survive without nutrients at 25°C for > 1 week. Further, when returned to favorable conditions, *Pd* will begin to grow again. Our results substantiate the importance of following strict decontamination protocols in an attempt to lessen the spread of the fungus and the impacts of white-nose syndrome on bats across North America.

CHARACTERIZATION OF ROOST TREES OF THE SOUTHEASTERN MYOTIS IN THE BOTTOMLANDS OF ARKANSAS

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Little is known about the roosting ecology of the southeastern myotis (*Myotis austroriparius*) on the Cache River National Wildlife Refuge, which is one of the largest continuous tracts of bottomland forest in the Mississippi Alluvial Plain. Accordingly, the objective of this study was to describe characteristics of roosts selected by southeastern *Myotis*. We affixed transmitters to 14 bats, 1 juvenile male and 1 juvenile female, 6 adult males and 6 adult females and tracked bats daily to their roost trees for the life of the transmitter. Roosts were discovered from 7 bats and some bats used multiple roosts. Nine of the 12 roost trees were water tupelos (*Nyssa aquatica*) with large basal hollows; the other trees included a black tupelo (*N. sylvatica*), red maple (*Acer rubrum*) and an American sweetgum (*Liquidambar styraciflua*). All roost sites were in living trees. We conducted emergence counts at 6 roost trees: with 3 containing 300 or more bats. We harp-trapped a known roost-tree twice over a one-month period to determine roost occupancy composition. At each roost tree, we measured diameter at breast height (DBH), tree height, canopy coverage and basal area. Roost trees had a larger DBH, higher basal area and higher canopy coverage as compared to random trees.

WHITE-NOSE SYNDROME: AN OVERVIEW OF THE COORDINATED RESPONSE IN CANADA

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Bat White-Nose Syndrome (WNS) is a disease caused by the fungus *Pseudogymnoascus destructans* and has killed over six million bats in eastern North America. First discovered in New York in 2006, it has since spread to 24 additional states and five Canadian provinces. The Canadian Wildlife Health Cooperative (CWHC), a national organization embedded primarily in Canada's five veterinary colleges, coordinates Canada's national wildlife health surveillance

programs. Specifically, CWHC was tasked to direct an organized Canadian response to WNS and has worked through a WNS inter-agency committee to provide this service since 2012. Five technical working groups (TWG) (i.e., population monitoring, surveillance and diagnostics, and mitigation which are supported by communication and outreach, and data management) were created to achieve this goal. In the last two years, the TWG have developed several essential protocols to manage the Canadian response to WNS, including best management practices for decontamination, bat necropsies, and fungal culture. Work currently in progress includes a feasibility assessment for captive management of bats and best management practises for safe removal of bat colonies from buildings. The approach has been to facilitate communication and collaboration amongst universities, nongovernmental agencies and federal, provincial and territorial governments so that current information is available for management decisions and accurate messaging is given to the media and general public. The Canadian TWG work closely with the U.S. WNS working groups, as well as participate in international bat conservation initiatives, such as the North American Bat Monitoring program and the North American Bat Conservation Alliance to ensure a consistent continental approach to WNS. The CWHC will continue to be actively involved in surveillance for and management and mitigation of WNS to best position those responsible for the recovery of Canadian bat populations affected by this devastating disease.

INTERDISCIPLINARY BAT RESEARCH: A TOOL TO FACILITATE COLLECTION OF FIELD AND LABORATORY BIOPSIES OF BAT PATAGIA

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Patagial biopsies are conducted in the field on many different bat species for both genetic studies and to diagnose infection with *Pseudogymnoascus destructans* (*Pd*) and other pathogens. In the laboratory, we use biopsies in an explant model of bat skin for study of *Pd*, but we needed a tool to facilitate collection of the explants. Because the pagatium is extremely thin and elastic, it has to be adhered to a tissue support before it is cut. Our primary challenges in developing a biopsy tool were registration of the blade to the tissue support to ensure a complete and accurate cut, and the ability to quickly change biopsy punches. In addition, current sampling procedures in the field require multiple personnel to handle the bats, lights, biopsy punches and cutting boards. We sought to develop a device that could enable a single person to simultaneously restrain a bat and collect a patagial biopsy, even in inclement conditions. Such a device was subsequently developed in conjunction with the TEAM (Translating Engineering Advances to Medicine) facility and the student chapter of the Biomedical Engineering Society at the University of California Davis. The tool is manufactured via a combination of laser cutting, machining, and 3D printing technologies. It has many features to facilitate biopsy collection in the laboratory and field, such as interchangeable biopsy punch holders for punches sized 2 mm, 6 mm, 10 mm, and 12 mm, and UV LED lights.

The device can be used with one hand, is light, durable and can be sterilized. The washers utilize 3M surgical grade transfer adhesive to keep the skin adhered during transport in media or ethanol. We believe this device will become an essential tool in bat studies and plan to make it widely available for bat research.

EFFECTS OF GATE DESIGN ON BAT USE AND BEHAVIOR AT ABANDONED MINES IN THE SOUTHWESTERN U.S.

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Abandoned mines provide roosting habitat for bats but can pose risks to humans. Often, gates are installed at entrances of abandoned mines to protect humans and bats, but gates may negatively affect bat use. We evaluate how gate design affects bats in the southwestern U.S. by examining use (e.g., activity level, type [maternity, night, day]) and behavior (e.g., circling, fly retreat) of bats as they encounter gates. At 11 mines, we use internal and external surveys in a before-after-control-impact (BACI) study to monitor changes following gate installation. We also use BatLogger II acoustic devices to monitor daily bat activity; we use this relatively new approach to characterize bat activity at these mines. Using an ANOVA, we observed significant differences in activity levels between most mines and roost types ($p<0.001$). To determine which of the measured variables influenced bat use prior to gate installation we used linear regressions and identified top models using an Akaike's Information Criterion (AIC). The best fit model variables included number of entrances, slope of portal, and presence of maternity colony and explained 31% of the variability in bat activity as measured by the BatLogger II ($p<0.001$, $F_{3,48}=8.84$). Three competing models included a combination of the variables above as well as number of rooms. These measured variables do not explain most of the variability in bat activity and so other unmeasured variables must be influencing activity. It is important to consider these variables when assessing post-gating changes in bat use. Most behaviors documented prior to gate installation included circling, passing in front, and passing directly through the portal. We will continue this research through summer 2015 to assess post-gating changes in bat use and behavior. Our study will provide information useful in guiding management strategies aimed at conserving and protecting southwestern U.S. bat species.

ESTIMATING GEOGRAPHIC EXTENTS OF SOURCE POPULATIONS OF EASTERN RED AND HOARY BATS KILLED AT A CENTRAL ILLINOIS WIND FACILITY

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Individual bat mortality due to wind turbines is a growing conservation concern, but its impact on bat populations is difficult to estimate. Wind facilities in Midwest agricultural fields can kill an estimated 4.45-7.14 bats per turbine per year, and Eastern Red (*Lasiurus borealis*) and Hoary

(*Lasiurus cinereus*) bats comprise between 0.2-60.9% and 9.0-88.1% of fatalities respectively nationwide. We have little understanding of the impact of this mortality on these species' population persistence, in part because we have poor knowledge of their migration pathways and hence the source populations for individual mortality. The use of stable isotopes of body tissues is an increasingly successful method for elucidating geographic patterns. In this research, we sampled 75 bats that were salvaged from a central Illinois wind facility and used deuterium ratio (δD) analysis combined with ecological niche modeling (GARP: Genetic Algorithm for Rule-set Prediction) and a web-based isotope modeling program (Isomap: Isoscapes Modeling, Analysis, and Prediction). The goal was to determine whether the bats being killed at a single wind facility are coming from a large portion of their summer geographic range or from a small segment. The GARP summer range models accurately predicted the presence of Eastern Red bats 96.85% and Hoary bats 98.93% of the time, and we found that the geographic extents of individuals from both species covered over 50% of their predicted summer ranges. This shows that one wind facility can affect bat populations from across their summer range. While it could be argued that this dilutes the overall impact on the bat species, if other facilities show this pattern, they could have a cumulative and far reaching effect.

OCCUPANCY OF VARIOUS BAT SPECIES IN NORTH MISSOURI: A BASELINE STUDY FOR IMPENDING CHANGE

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Bats throughout the Midwest of the United States are confronted with an uncertain future. They face collision with wind turbines (especially migratory bats), the disease white-nose syndrome (especially cave hibernating bats), and the uncertainty of climate change. Though North Missouri poses the potential for wind farm development, there have been few constructed. Further, white-nose syndrome is only beginning to affect colonies of cave hibernating bats in Missouri. These threats emphasized the importance of assessing the current status of bat species living in Missouri for better precision when evaluating the effects of these stressors. Since obtaining population estimates of bats can be problematic, we decided to estimate occupancy. We divided our study area into high and low wind-farm development potential, and further divided these areas into locations we predicted would have high versus low bat activity. We then used acoustic bat detectors (Wildlife Acoustics SM2BAT+) to monitor bat activity for three nights, during each of three seasons (late spring, summer, and early fall). This study was conducted during 2013 and 2014, and we plan to continue for another 3 years. For this presentation we estimated detection probabilities, local extinction and colonization probabilities, as well as occupancy estimates using robust occupancy estimation in MARK, for the hoary bat, red bat, Indiana bat, and northern myotis. Detection probabilities and occupancy varied extensively depending on season, area, species, and year. For hoary bats occupancy ranged from 0.60 to 0.99, for red bats 0.77 to 0.99, for Indiana bats 0.38 to 0.91, and for northern myotis 0.44 to 0.94.

VARIATION IN BAT SPECIES RICHNESS DURING SPRING MIGRATION AT A RURAL POND IN NORTHWEST TENNESSEE

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Tennessee bats that utilize caves as winter hibernacula most likely return to their summer roosts in the northwest Tennessee area beginning in mid March and continuing throughout April. We predicted that bat species richness at a rural pond would vary from early April to late May due to some bat species temporarily using the aquatic resource while other bat species remain as residents throughout the study. We used acoustic monitoring to record bat calls by deploying a Wildlife Acoustics SM2BAT+ near a rural pond in Weakley County, Tennessee, 31 March - 31 May 2014. Full spectrum calls were analyzed using SonoBat version 3.1, followed by visual verification by N. Buschhaus. Our results demonstrated that bat species richness did vary at our study site during the study period, most likely due to some bats remaining as summer residents while other bats only used the pond as a temporary resource during migration.

NATIONAL BAT BLITZ 2015

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In 2015 the Southeastern Bat Diversity Network organized a nationwide bat blitz in lieu of its annual group blitz event. The committee encouraged biologists to organize a group or individual netting effort in their study area September 4-10th, 2015. Thirty-two events in nineteen states registered for the effort, with 375 expected participants. We will summarize results of that effort and discuss the benefits of organizing similar events in the future.

SOUTHEASTERN BAT POPULATIONS AFFECTED BY WHITE-NOSE SYNDROME: A REPORT FROM THE SOUTHEASTERN BAT DIVERSITY NETWORK

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In the U.S., cave-hibernating bats are facing a conservation crisis of unprecedented magnitude as a result of White-nose Syndrome (WNS), a disease caused by the fungus *Pseudogymnoascus*

destructans (*Pd*). This disease causes mortality in bats by increasing the frequency of arousal from torpor, resulting in the consumption of energy reserves that bats need to survive the winter. Mortality also appears to result from disruption of physiological process such as water balance and gas exchange. White-nose syndrome is currently known to affect seven cave hibernating bat species. Mortality rates > 90% have been reported for some species in hibernacula in the Northeastern U.S. and the disease is currently estimated to have killed more than 5.7 million individuals nationwide. Since its discovery in a NY cave during the winter of 2006-2007, WNS has spread to 25 U.S. states and 5 Canadian provinces. In the Southeast this includes: AL, AR, GA, KY, NC, SC, TN, and VA. Most recently *Pd* was discovered in MS, although WNS has not yet manifested in the state. It has been suggested that due to warmer winter temperatures, WNS might not have as devastating an effect in the Southeastern U.S. However, 2014 bat populations in some states appear to have exhibited increased mortality from the disease following an unusually cold winter. We present population trends by species across states in the southeast and highlight differences in mortality by state. In addition, we discuss priorities for southeastern bat and cave conservation.

PSEUDOGYMNOASCUS DESTRUCTANS **AND THE COMPOSITION OF MICROBIAL COMMUNITIES IN THE SOILS OF ILLINOIS BAT HIBERNACULA**

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Pseudogymnoascus destructans (*Pd*), the causative agent of bat White Nose Syndrome, is an invasive fungus that can persist in low-temperature soil communities in cave ecosystems. We hypothesized that the arrival of *Pd* in cave ecosystems may change the composition of microbial communities. We performed high-throughput DNA sequencing (Illumina MiSeq) on microbial communities from the soil of Illinois caves used as bat hibernacula in 2012-2014. We used permutational multivariate ANOVA to analyze changes in microbial community composition among caves and across years. Cave soil community composition varied significantly across caves, years, and locations within caves, with significant cave-by-year and cave-by-location interactions. Some of these interactions may relate to the arrival of *Pd*. For example, we detected *Pd* in Blackball Mine for the first time in 2013. Whereas the bacterial communities at the entrance of Blackball Mine changed very little from 2012 to 2013, soil communities of interior cave locations changed substantially. In these locations, the arrival of *Pd* coincided with an increase in the proportion of Proteobacteria and Acidobacteria, largely at the expense of Actinobacteria, Bacteroidetes, and Firmicutes. In contrast, Actinobacteria and Firmicutes increased their relative abundances in the hibernaculum of Equality Cave, where *Pd* was not detected in 2013. These changes provide clues about the ecology of *Pd* establishment in microbial communities, and further analyses may reveal antagonistic interactions that can be used to combat this fungus.