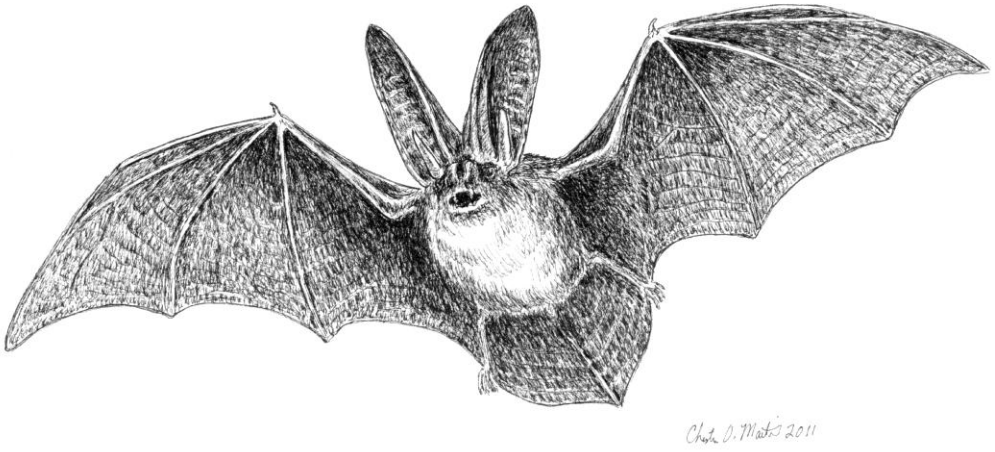
SOUTHEASTERN BAT DIVERSITY NETWORK 17th Annual MEETING, and 22nd COLLOQUIUM ON THE CONSERVATION OF MAMMALS IN THE EASTERN UNITED STATES

Louisville, Mississippi
February 23rd - 25th, 2012



We thank the Following Sponsors for Their Support!

Mississippi State University
College of Forest Resources
Forest and Wildlife Research Center

Weyerhaeuser

MISSISSIPPI Wildlife FEDERATION

TiTLEY SCIENTIFIC USA

THE WILDLIFE SOCIETY
Southeastern Section

THE WILDLIFE SOCIETY
MS Chapter

We Listen. wildlife ACOUSTICS

17th Annual Meeting of the Southeastern Bat Diversity Network

Thursday, 23 February 2012

Lake Tiak O'Khata, Pine Ridge Lodge

BUSINESS MEETING

1:00 – 2:20	Call To Order	Michael J. Lacki, SBDN President
	Introductory Remarks	
	Accomplishments in 2011	
	Transition to Executive Committee	
	New Committees	
	Treasurer's Report	Tim Carter, SBDN Treasurer
	Committee Reports	
	-Awards Committee	Stephen Burnett, Incoming Chair
	-Bat Blitz Committee	Trina Morris, Chair
	-Bat Database Committee	Eric Britzke, Co-Chair
	-Bats on Federal Lands Committee	Jeff Gore, Incoming Chair
	-Membership Committee	Chris Comer, Incoming Co-Chair
	-SBDN Newsletter	Michael J. Lacki, SBDN President
	-WNS Committee	Mike Baker, Incoming Chair
	-Big-eared Bat Working Group	Mary K. Clark, Chair
	Future Meetings	Michael J. Lacki, SBDN President
	Business from the Floor	Membership

2:20 – 2:40 **PROPOSED CHANGES TO INDIANA BAT SURVEY PROTOCOLS**
Mike Armstrong, *Biologist, U.S. Fish and Wildlife Service*

2:40 – 3:00 **DISCUSSION**

3:00 – 3:30 **BREAK**

3:30 – 3:40 **WELCOME TO MISSISSIPPI**
Bruce D. Leopold, *Head of the Department of Wildlife, Fisheries, and Aquaculture, Mississippi State University*

PLENARY SESSION

3:40 – 5:40 **INCORPORATING BATS INTO REGIONAL CONSERVATION PLANS**
Moderator: Darren Miller, *Weyerhaeuser NR Company*

LARGE-SCALE BAT CONSERVATION NEEDS
Edward Arnett, *Director of Science and Policy, Bat Conservation International*

THE GULF COASTAL PLAINS AND OZARK LANDSCAPE CONSERVATION COOPERATIVE
John Tirpak, *Science Coordinator, Gulf Coastal Plains and Ozarks LCC*

THE LOWER MISSISSIPPI VALLEY JOINT VENTURE – WILDLIFE FORESTRY AND DESIRED FOREST CONDITIONS
Dan Twedt, *USGS Patuxent Wildlife Research Center*

DESIRED FOREST CONDITIONS ON SOUTHEASTERN REGION NATIONAL WILDLIFE REFUGES
Janet Ertel, *U.S. Fish and Wildlife Service, National Wildlife Refuge System*

ROOST TREES AND BAT SPECIES OF CONCERN ON NOXUBEE NATIONAL WILDLIFE REFUGE: A CASE STUDY
Jeanne Jones, *Mississippi State University* and Henry Sansing, *Noxubee National Wildlife Refuge*

PANEL DISCUSSION

5:40 **ADJOURN** Michael J. Lacki, SBDN President

5:40 – 7:00 **DINNER (provided with registration)** Restaurant

7:00 - ? **SOCIAL/SILENT AUCTION,** Pine Ridge Lodge

7:00 – 9:00 **POSTER SESSION,** Pine Ridge Lodge

Colloquium on the Conservation of Mammals in the Eastern US
Friday, 24 February 2012
Lake Tiak O'Khata, Pine Ridge Lodge

8:00 Welcome/House-Keeping, Darren Miller

Student Presentations – Bats

Moderator: Chester Martin

8:15 **DO LITTLE BROWN BATS (*MYOTIS LUCIFUGUS*) MAKE EFFECTIVE SURROGATES FOR ENDANGERED INDIANA BATS (*MYOTIS SODALIS*)?**
Scott M. Bergeson, Michael D. Whitby, and Timothy C. Carter

8:30 **MOVEMENTS AND ROOST FIDELITY BY INDIANA BATS (*MYOTIS SODALIS*) IN THE SOUTHERN APPALACHIAN MOUNTAINS**
Kristina R. Hammond, Joy M. O'Keefe, and Susan Loeb

8:45 **ROOST MOVEMENTS OF THE EASTERN SMALL-FOOTED BAT (*MYOTIS LEIBII*) IN THE SOUTHERN APPALACHIAN MOUNTAINS**
Tara J. Thomson and Joy M. O'Keefe

9:00 **LAND USE HISTORY AND MATERNITY ROOST SELECTION BY *MYOTIS SEPTENTRIONALIS* IN A MESOPHYTIC HARDWOOD FOREST**
Alexander Silvis, W. Mark Ford, and Eric R. Britzke.

9:15 **FORAGING HABITAT PREFERENCES OF BATS IN EASTERN OKLAHOMA**
Andrea Korman, Karen McBee, and Shea Hammond

9:30 **UTILIZATION OF HIGHWAY CULVERTS BY WINTER-ROOSTING BATS IN CENTRAL MISSISSIPPI**
Nicole Hodges, Jeanne Jones, Dave Richardson, Kathy Shelton, Amber Breland, and Andrea Schuhmann

9:45 **EVALUATING THE EFFECTIVENESS OF MOBILE ACOUSTIC TRANSECTS CONDUCTED ON ROADS AND RIVERS**
Michael D. Whitby, Timothy C. Carter, and Scott M. Bergeson

10:00 **A COMPARISON OF ACTIVE AND PASSIVE ACOUSTIC SAMPLING IN THE POST-WNS WORLD: A PILOT STUDY AT FORT DRUM MILITARY INSTALLATION**
Laci S. Coleman, Chris A. Dobony, W. Mark Ford, and Eric R. Britzke

10:15 **WINTER TORPOR AND MOVEMENTS OF *CORYNORHINUS RAFINESQUII* IN MAMMOTH CAVE NATIONAL PARK, KENTUCKY**
Joseph S. Johnson, Steven C. Thomas, and Michael J. Lacki

10:30 – 11:00 **Break (sponsored by Titley Scientific)**

Students Presentations – Non-bats

Moderator: Mark Ford

11:00 **EFFECTS OF INTERCROPPING SWITCHGRASS (*PANINUM VIRGATUM L.*) AND LOBLOLLY PINE (*PINUS TAEDA*) ON ABUNDANCE, RICHNESS, AND DIVERSITY OF SMALL MAMMAL COMMUNITIES**
Kristy L. King, Jessica A. Homyack, Darren A. Miller, and Matina C. Kalcounis-Rüeppell

11:15 **EFFECTS OF HABITAT TREATMENTS ASSOCIATED WITH INTERCROPPING SWITCHGRASS ON THE DISTANCE THAT PURE TONE SOUND TRAVELS**
Ashley M. Matteson, Jessica A. Homyack, Darren A. Miller, and Matina C. Kalcounis-Rüeppell.

11:30 **PHYLOGEOGRAPHY OF SHORT-TAILED SHREWS (GENUS *BLARINA*) OF SOUTHEAST TENNESSEE**
Casey Carpenter, Timothy Gaudin, Joey Shaw, and Thomas Wilson.

11:45 **SUCCESSFUL DNA EXTRACTIONS FROM MUSEUM SPECIMENS OF ALLEGHENY WOODRATS (*NEOTOMA MAGISTER)***
Jennifer M. Kanine, Travis C. Glenn, Michael T. Mengak, & Steven B. Castleberry

12:00 **RESPONSE OF SMALL MAMMALS TO WOODY BIOMASS HARVESTING IN THE LOWER COASTAL PLAIN OF GEORGIA**
Christopher. B. Farrell and Steven B. Castleberry

12:00–1:30 **Lunch (Provided with Registration – Restaurant)**

Non-Student Oral Presentations

Moderator: Roger Perry

1:30 **REPRODUCTIVE CYCLE OF BAIRD'S POCKET GOPHER (*GEOMYS BREVICEPS*) IN NORTHERN LOUISIANA**
Matthew B. Connior, Douglas C. Cagle, Heather E. Peek, Christopher R. Ellington, and John L. Hunt

1:45 **NATIVE AND NON-NATIVE MOUSE INTERACTIONS IN INTERCROPPED SWITCHGRASS-PINE SYSTEMS**
Kristen E. Lucia, Jessica A. Homyack, Darren A. Miller, and Matina C. Kalcounis-Rueppell.

2:00 **EXPERIMENTAL TRANSLOCATION OF SOUTHEASTERN POCKET GOPHERS**
Jonathan M. Owens, Steven B. Castleberry, Bob Brinkman, and Nikole L. Castleberry

2:15 **INDIANA BAT FALL HABITAT USE AND MIGRATION FROM NORTHERN KENTUCKY TO SOUTHERN INDIANA**
Piper L. Roby and Mark W. Gumbert

2:30 **KENTUCKY WHITE-NOSE SYNDROME UPDATE – SITE-SPECIFIC IMPLEMENTATION OF A WNS STATE RESPONSE PLAN**
Brooke A. Hines

2:45 **PRE- AND POST-HIBERNATION CHANGES IN THE BODY CONDITION OF BATS SUSCEPTIBLE TO WHITE NOSE SYNDROME AT MAMMOTH CAVE NATIONAL PARK**
L. E. Dodd, J. S. Johnson, L. K. Rieske-Kinney, S. C. Thomas, R. S. Toomey, and M. J. Lacki

3:00 **WHY WOULD A FUNGUS GROW ON BAT AND HOW CAN WE INVESTIGATE THE PROCESS?**
Evan L. Pannkuk, David F. Gilmore, Brett J. Savary, and Thomas S. Risch

3:15 **MODELING CURRENT AND FUTURE POTENTIAL FOR PERIPHERAL POPULATIONS OF SOUTHEASTERN BATS TO MITIGATE EFFECTS OF WHITE NOSE SYNDROME IN CORE POPULATIONS.**
M. C. Kalcounis-Rueppell, Christopher Thawley, M. J. Vonhof and L. J. Rissler

3:30–4:00 **BREAK**

4:00–4:30 **AWARDS, FAREWELL**

Plenary Session Abstracts

PERSPECTIVES ON LANDSCAPE-SCALE ISSUES FACING BATS: CONSERVATION NEEDS, CHALLENGES, AND OPPORTUNITIES

Edward B. Arnett, *Director of Science and Policy, Bat Conservation International, Austin, Texas*

As with many vertebrate and invertebrate taxa, bats are faced with a plethora of interacting cumulative pressures associated with anthropogenic disturbance, emerging diseases, and a changing climate. Conservation of bats is at a critical point in history given the exponential population declines due to white-nosed syndrome, human population growth and expanding urbanization, rapid growth of energy developments, and what is seemingly a competitive landscape with declining options for mitigation and conservation opportunities for bats. Today, I will discuss several key issues surrounding bat conservation and management, present some challenges we face, and offer some suggestions for advancing conservation of bats during these challenging and changing times.

THE LOWER MISSISSIPPI VALLEY JOINT VENTURE – WILDLIFE FORESTRY AND DESIRED FOREST CONDITIONS

Dan Twedt, *USGS Patuxent Wildlife Research Center*

The objective of *Wildlife Forestry* is to provide forested habitat capable of supporting sustainable populations of all native species. However, within the Mississippi Alluvial Valley, forest loss, fragmentation, and hydrological change have altered habitat conditions and negatively impacted some wildlife species. To provide habitat for these 'priority' wildlife species, forest conditions that are conducive to their continued viability are required. These conditions, as identified by quantitatively defined landscape and site (stand) conditions (i.e., composition - structure), are referred to as *Desired Forest Conditions* (DFC). Historically forest management focused on production via silviculture that promoted optimal growth and vigorous health of economically desirable tree species, but resultant in habitat conditions that may not be optimal for priority wildlife species. Alternatively, wildlife forestry silviculture, via variable retention harvests, can be used in conjunction with forest restoration, regeneration, and natural processes to achieve DFC that benefit priority species. Desired Landscape Conditions have >10,000 predominately forested acres with ≥70% of forest area actively managed using wildlife forestry silviculture. Within stands, silvicultural prescriptions should induce disturbances to stimulate development of Desired Stand Conditions. Although each site is unique, desired within stand conditions often have 60-70% heterogeneously distributed canopy cover, a basal area of 60-70 ft^2 per acre, and 60-70% stocking with ≥2 dominant trees retained per acre. Midstory and understory cover are between 25-40%. Some cavity/dead/stressed trees should be retained to contribute to >200 ft^3 per acre of coarse woody debris. To ensure future merchantability of stands, shade-intolerant regeneration should be present on 30-40% of the area. Because many bat species avoid spatial clutter, they may be more abundant in forests with open canopy structure (e.g., post-harvest or old-growth) compared to closed-canopy, mid-successional forests. Thus more open canopies, and retained (increased) diversity of woody species associated with DFC may enhance foraging opportunities for bats. Similarly, retention of large decadent or cavity trees within stands that have open canopies and high snag densities, as advocated by DFC, may provide tall, large-

diameter roost trees used by bats. Finally, protection of existing (large) roost trees, regeneration of water tupelo and blackgum for future roost trees, and conservation of mature bottomland hardwood forests are important for priority bat species.

SOUTHEASTERN REGION NATIONAL WILDLIFE REFUGES AND CONSERVATION OF BAT RESOURCES

Janet Ertel, *U.S. Fish and Wildlife Service, National Wildlife Refuge System*

The National Wildlife Refuge System is *"To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans."* The conservation, management, and restoration of specific refuges are driven primarily by their establishing purposes as set by statute. One of the significant directions set by the NWRS Improvement Act (1997) was that of Comprehensive Conservation Planning for every refuge in the NWRS. Almost every refuge in the southeast now has a Comprehensive Conservation Plan. Refuges in the southeast are now beginning the process of developing Habitat Management Plans, which further refine habitat objectives and management guidance to meet CCP goals and objectives.

Many refuges conduct active and passive forest management in bottomland hardwood habitats, using Joint Venture Desired Forest Conditions to define target conditions meeting local objectives and contributing to conservation on a landscape scale. Several refuges have contributed specifically to our knowledge of forest bats and bat conservation through support of research and management. Refuge staff across the southeast are now conducting bat monitoring on and around refuges to contribute to the landscape assessment of bat trends, impacts of WNS, and other landscape level impacts. On a local level they are assessing presence of species and identifying roost resources. Refuges of the Southeast include important bat caves, with Logan Cave, Key Cave, Fern Cave, and Sauta Cave NWRs. Refuge staff from Alabama, and elsewhere, have been active participants in teams and workgroups addressing WNS threats. Refuges will continue to develop plans, administer habitat management and participate in landscape efforts for wildlife, including bats. Refuges in the Lower Mississippi Valley have proposed a broad assessment of the affect of forest management objectives on forest bats through the Gulf Coastal Plains and Ozarks LCC partnership.

RAFINESQUE'S BIG-EARED BAT AND SOUTHEASTERN MYOTIS ON NOXUBEE NATIONAL WILDLIFE REFUGE: CONSERVATION AND FOREST MANAGEMENT IMPLICATIONS

Jeanne C. Jones, Heather L. Fleming, Candice L. Stevenson, David M. Richardson, Jerry L. Belant, and Henry Sansing. *Department of Wildlife, Fisheries, and Aquaculture, Box 9690, Mississippi State University, MS 39762 (JCJ, HLF, JLB), U.S. Fish and Wildlife Service Box 2683, Titusville, FL 32781 (CLS), U.S. Fish and Wildlife Service, Grenada, MS 38901(DMR); U.S. Fish and Wildlife Service, Department of Wildlife, Fisheries, and Aquaculture, Box 9690, Mississippi State University, MS 39762 (HS)*

Rafinesque's big-eared bats (*Corynorhinus rafinesquii*) and southeastern myotis (*Myotis austroriparius)* are species of concern in many states of the southeastern U.S. Bottomland hardwood forests represent important roosting and foraging habitat for these bats yet ≥ 80% has been lost or degraded in Mississippi. Because of the importance of tree roosts in Mississippi forests, we summarized findings from a 5-year study that monitored use of roost trees by these bats species at Noxubee National Wildlife Refuge (NNWR), Mississippi. About 1,250 ha of bottomland hardwood forests on NNWR were surveyed from 2006-2009. Over 600 potential roost trees were located and marked with a unique identification number, identified to species, and inspected for bat use. We measured tree and tree cavity attributes of each potential roost tree. Roost tree locations were evaluated during 2008–2009 on NNWR to estimate influences of landscape level features on bat use of roost trees. For this portion of the study, additional roost trees were inspected on public lands adjacent to NNWR to estimate bat use of roost trees in upper reaches of Noxubee River. Data from 2006-2007 indicated that Rafinesque big-eared bats and southeastern myotis most often used cavities of large diameter trees (>70 cm DBH). Roost trees used most frequently in descending order of importance included baldcypress (*Taxodium distichum*), black tupelo (*Nyssa sylvatica*), American sycamore (*Platanus occidentalis*), sweetgum (*Liquidambar styraciflua*) and oaks (*Quercus* spp.). Landscape level analyses indicated that roost trees in lower elevations in bottomland hardwood forests and greentree reservoirs of the Noxubee River were most frequently used by bats compared to areas in upper reaches of the Noxubee River. This information is important for forest management planning in bottomland hardwood forests of NNWR. Knowledge of occupied and potential roost trees should be used to develop integrated forest management at NNWR for improved conservation of these forest-dwelling bats.

Student Oral Presentation Abstracts

DO LITTLE BROWN BATS (*MYOTIS LUCIFUGUS*) MAKE EFFECTIVE SURROGATES FOR ENDANGERED INDIANA BATS (*MYOTIS SODALIS*)?

Scott M. Bergeson, Michael D. Whitby, and Timothy C. Carter. *Department of Biology, Ball State University, Muncie, IN 47306*

The use of common species as surrogates for those that are threatened or endangered is best conducted using species that are biologically related. If the two species are fairly dissimilar then conclusions based on data collected from surrogates may be misleading. The abundant little brown bat (*Myotis lucifugus*) has been suggested as a suitable surrogate for the endangered Indiana bat (*Myotis sodalis*) due to their close morphological similarities. In order to examine the suitability of little brown bats as surrogates in ecological based research and management, research was conducted on the home ranges, habitat selection, and roosting ecology of both species. While research is available on Indiana bats, in these subjects, there is a paucity of information on little brown bats. Therefore, data were collected concerning these ecological factors to determine the similarity between the species. Data were collected during the summers of 2003, 2007, and 2009-2011 from 2 study areas in the Shawnee National Forest, IL, and 2 study areas in south-central Indiana. Bats of both species were tracked during the day to record maternity roost characteristics and again at night to record foraging locations. A total of 39 Indiana bats and 32 little brown bats were tracked during our study. Our results show that while the species are similar in some ecological characteristics (roosting habitat, roost tree species) they are also different in several other characteristics (roost type, home range, and habitat selection). Therefore, little brown bats may be suitable surrogates for some research and management projects and unsuitable for others, depending on the objectives of the project.

PHYLOGEOGRAPHY OF SHORT-TAILED SHREWS (GENUS *BLARINA*) OF SOUTHEAST TENNESSEE

Casey Carpenter, Timothy Gaudin, Joey Shaw, and Thomas Wilson. *Department of Biological & Environmental Sciences, University of Tennessee at Chattanooga, 615 McCallie Avenue, Chattanooga, Tennessee.*

Shrews of the genus *Blarina* are among the most common small mammals of the southeastern United States. Two species are found in the area surrounding Chattanooga, TN: *Blarina brevicauda*, the northern short-tailed shrew and *Blarina carolinensis*, the southern short-tailed shrew. In an effort to clarify geographic ranges of the two species in southeast Tennessee, *Blarina* vouchers were collected throughout the study area and mitochondrial DNA cytochrome *b* genes were isolated and sequenced. These sequences were then compared to GenBank data and phylogenetic relationships were determined for the vouchers. Results indicate *Blarina brevicauda* is found in areas north and west of the Tennessee River and *Blarina carolinensis* is found in areas south and east of the Tennessee River. Most *B. brevicauda* specimens from the study area were similar to haplotypes classified as either ‘Appalachian’ or ‘East-Central’ by previous publications. *Blarina carolinensis* specimens were monophyletic, and more similar to *B. carolinensis* from Arkansas, Illinois and Loiusiana rather than those from Georgia, Florida and Virginia.

A COMPARISON OF ACTIVE AND PASSIVE ACOUSTIC SAMPLING IN THE POST-WNS WORLD: A PILOT STUDY AT FORT DRUM MILITARY INSTALLATION

Laci S. Coleman, Chris A. Dobony, W. Mark Ford, and Eric R. Britzke *Department of Fisheries and Wildlife Conservation, Virginia Polytechnic Institute and State University, Blacksburg, VA (LSC), Fort Drum Military Installation, Natural Resources Branch, Fort Drum, NY (CAD), U.S. Geological Survey, Virginia Cooperative Fish and Wildlife Research Unit, Blacksburg, VA (WMF), U.S. Army Engineer Research and Development Center, Vicksburg, MS (ERB)*

Since white-nose syndrome (WNS) onset in 2008, there has been a marked decline in bat activity at Fort Drum. Summer mist-netting, although costly, has been a typical and accepted way to monitor bats, however, as bat populations decline in the Northeast, this method has become inefficient and ineffective. We suggest acoustical methodologies will likely become the best primary means of monitoring declining populations. In the summer of 2011, we utilized Anabat detectors to repeat passive monitoring at sites previously sampled in 2006, pre-WNS. We also performed active acoustic sampling at these sites and compared methods. Wilcoxon two-sample tests showed a significant decline in mean nightly activity from 2006 to 2011 in *Myotis lucifugus* (78.2 vs. 7.25 passes, $P < 0.0001$), *Myotis septentrionalis* (3.67 vs. 0.34 passes, $P < 0.0003$), *Myotis sodalis* (8.76 vs. 1.67 passes, $P = 0.002$), and *Perimyotis subflavus* (3.76 vs. 0.46 passes, $P = 0.0230$). Additionally, we observed declines from 2006 to 2011 in two species not known to be affected by WNS: *Lasiurus borealis* (10.62 vs. 3.46 passes, $P = 0.0435$) and *Lasiurus cinereus* (24.62 vs. 9.91 passes, $P = 0.0136$), possibly due to increased regional wind energy development. High detection probabilities of extant species were achieved in 2 nights per survey site in 2006 vs. $\geq$3 nights in 2011 for WNS-impacted species. Overall detection probabilities of 1 for little brown bats and Indiana bats in 2006 declined to 0.87 and 0.58, respectively, by 2011. Active sampling appears to be ineffective post-WNS, accounting for lower recorded nightly species richness (2.8 vs. 4.7 species) and far lower overall detection probabilities for myotids (< 0.45). We also initiated a pilot study at Fort Drum to determine the most efficacious ways to deploy Anabat detectors for monitoring bats. Analysis is ongoing; however, methodology and preliminary results will be discussed.

RESPONSE OF SMALL MAMMALS TO WOODY BIOMASS HARVESTING IN THE LOWER COASTAL PLAIN OF GEORGIA

Christopher. B. Farrell and Steven B. Castleberry. *Warnell School of Forestry and Natural Resources, University of Georgia, Athens, GA 30602*

Removal of woody debris for biofuels during timber harvest may negatively affect small mammals and other vertebrate fauna. To create effective guidelines for biomass harvesting, research is needed to quantify the effects of increased debris removal. We sampled small mammals among six treatments representing varying levels of woody debris retention and distribution on two sites in the Lower Coastal Plain of Georgia. Treatments included traditional clearcut, 15% and 30% woody debris retention in clusters, 15% and 30% woody debris retention scattered throughout the treatment areas, and a complete biomass harvest. Using Sherman traps and drift fence arrays, we sampled sites three times each between April and July, 2011. We

captured a total of 181 small mammals across treatments and sites over the three sampling periods. Captures consisted of cotton mice (*Peromyscus gossypinus*), hispid cotton rats (*Sigmodon hispidus*), and eastern harvest mice (*Reithrodontomys humulis*). The highest number of captures occurred in the 15% clustered treatment (n=41), followed by 30% clustered (n=37), 15% dispersed (n=32), biomass harvest (n=32), 30% dispersed (n=26), and traditional clearcut (n=13). Preliminary analysis showed no statistical difference between treatments. The small numbers of captures within treatments were likely due to insufficient time after treatment implementation for small mammals to colonize sites. We expect capture numbers to increase in the second year and that treatment differences with respect to habitat quality for small mammals will be evident.

MOVEMENTS AND ROOST FIDELITY BY INDIANA BATS (*MYOTIS SODALIS*) IN THE SOUTHERN APPALACHIAN MOUNTAINS

Kristina R. Hammond[1], Joy M. O'Keefe[1], and Susan Loeb[2]. [1]*Department of Biology, Indiana State University, Terre Haute, IN 47809.* [2] *USDA Forest Service, Southern Research Station, Clemson, SC 29634.*

Management guidelines for protecting Indiana bat habitat are based on the assumption that Indiana bats make fairly short movements (< 4.2 km) during the summer maternity period (15 May to 15 August). There are few available data on Indiana bat roost area fidelity and movements during this period. On the northern edge of the range, Kurta et al. found that Indiana bat roost changes were mostly under a kilometer but ranged up to 5.8 km, with roost switching occurring every 2.4 days. However, we know little about foraging movements and it is not clear that bats stay in the same focal area all season. Further, reproductive status may be an important factor in how far bats can move though, at present, all bats are given the same consideration. We examined 4 years of Indiana bat (n = 41 bats) tracking data from the southern Appalachian Mountains. Between 11 May and 6 August 2008–2011, reproductive bats (adult females or juveniles) moved as much as 3.8 km between roosts, and 3.8 km between capture site and farthest known roost, which suggests a 4.2 km radius buffer is adequate. However, our telemetry data suggest bats were shifting the center of their focal areas. Long distance movements were common during the reproductive season, as 19 pregnant or lactating bats were lost after 1 or more roosts were found. With a passive datalogging receiver, we recorded several long-distance foraging bouts ranging from 1 km to 24.5 km (n = 4 bats); the 24.5 km movement was recorded 4 days after the last known roost location. In the southern Appalachians, Indiana bats sometimes make long movements during the reproductive season, which may relate to availability of roost habitat and the ephemeral nature of favored roosts in this region.

UTILIZATION OF HIGHWAY CULVERTS BY WINTER-ROOSTING BATS IN CENTRAL MISSISSIPPI

B. Nicole Hodges, Jeanne C. Jones, David M. Richardson, Kathy R. Shelton, Amber D. Breland, and Andrea N. Schuhmann. *Department of Wildlife, Fisheries, and Aquaculture, Mississippi State University, Mississippi State, MS 39762 (BNH, JCJ); U.S. Fish and Wildlife Service, Grenada, MS 38901 (DMR); Mississippi Museum of Natural Science, Jackson, MS 39202 (KRS, ANS); U.S. Fish and Wildlife Service, Crystal River, FL 34429 (ADB)*

We inspected culverts beneath highways in central Mississippi during winter months 2007-2012 to ascertain use by roosting bats. Inspections conducted in 2007-2009 primarily occurred in large, multi-chambered culverts. Due to high numbers of bats during these inspections, we began more widespread survey efforts by including searches of > 20 to 25 highway culverts annually within Webster, Winston, Oktibbeha, and Noxubee counties. Numbers of bats of different species and their roosting locations were recorded. Structural morphology of culverts was recorded including internal dimensions, construction substrate, and chamber branching. Temperatures of air and culvert walls were also measured. Big brown bats (*Eptesicus fuscus*), Rafinesque's big-eared bats (*Corynorhinus rafinesquii*), and tri-colored bats (*Perimyotis subflavus*) were observed roosting in culverts. Tri-colored bats were the most abundant species detected and constituted > 95% of enumerated individuals. Greatest numbers of bats were recorded in a large culvert beneath the junction of Highways 25 and 15 near Louisville, MS. This box culvert was a complex, multi-chambered, concrete structure measuring 701 m in length, 2 m in width, and 2 m in height. During winters of 2007-2008 and 2008-2009, we detected $\geq$ 500 – 600 tri-colored bats during each survey event. During winters of 2009-2010, 2010-2011, 2011-2012, we recorded > 700 to 948 tri-colored bats in this culvert during each survey event. Smaller culverts measuring approximately 70 m in length x 4 m in width x 2 m in height exhibited bat numbers ranging from 0 to 18 individuals during each survey in 2009-2011. We suggest that larger box culverts may be important to wintering bats due to size, structural characteristics, and warmer internal temperatures. Large underground culverts may serve as important refugia for selected species of wintering bats in Mississippi. Expanded efforts are ongoing to assess bat use of culverts beneath highways of Mississippi.

WINTER TORPOR AND MOVEMENTS OF *CORYNORHINUS RAFINESQUII* IN MAMMOTH CAVE NATIONAL PARK, KENTUCKY

Joseph S. Johnson, Steven C. Thomas, and Michael J. Lacki. *Department of Forestry, University of Kentucky, Lexington, KY 40546 (JSJ, MJL); US National Park Service, Mammoth Cave, KY 42259 (SCT)*

An estimated 5.5–6.7 million bats have died as a result of White-Nose Syndrome (WNS) in the United States as of January 2012. It is notable that no bat in the genus *Corynorhinus* (big-eared bats) has been found exhibiting histological symptoms of WNS to date, although known expansion of WNS into the range of *Corynorhinus* bats is currently limited. Historical records of Rafinesque's big-eared bats (*Corynorhinus rafinesquii*) suggest this species may arouse from hibernation more frequently than other North American bat species. If WNS causes mortality through increasing arousal rates and duration in infected bats, a natural pattern of frequent winter arousals may help big-eared bats withstand infection or mortality. Our study describes winter torpor patterns and movement among winter roosts by Rafinesque's big-eared bats and compares these data with similar studies of species susceptible to WNS in the northeastern United States. We radiotagged six (four female, two male) Rafinesque's big-eared bats during the winter of 2010–2011 and 14 (eight female, six male) during the winter of 2011–2012 with temperature-sensitive radiotransmitters. We deployed datalogging receivers outside known winter roosts to record bat skin temperatures at 5-minute intervals. Radiotagged bats switched roosts within 2–6

days following initial capture and did not return during the winter of 2010–2011. We were unable to locate radiotagged bats after they left the hibernaculum. Bats switched roosts frequently during the winter of 2011–2012, and we were able to locate radiotagged bats moving among three caves and two man-made structure separated by 9 km. Our data demonstrate these bats typically use deep torpor bouts (body temperatures <10ºC) of relatively short duration (≤10 days duration) during winter. Data presented will include analyses of torpor depth, duration, and roost-switching frequencies between sexes.

SUCCESSFUL DNA EXTRACTIONS FROM MUSEUM SPECIMENS OF ALLEGHENY WOODRATS (*NEOTOMA MAGISTER)*

Jennifer M. Kanine, Travis C. Glenn, Michael T. Mengak, & Steven B. Castleberry. *D.B. Warnell School of Forestry and Natural Resources, University of Georgia, Athens, GA 30602 (JMK,MTM, SBC); Environmental Health Science, University of Georgia, Athens, GA 30602 (TCG)*

Allegheny woodrats (*Neotoma magister*) have been declining over the last 30 years throughout their range, with the most precipitous declines along the northern and western areas of the range. Although causes of the declines are uncertain, decreased genetic diversity may have contributed to declines or may have negative future consequences in declining populations. An understanding of contemporary genetic characteristics compared to characteristics of historic populations will provide essential information for mitigating potential impacts of low genetic diversity. As a part of a larger study designed to examine genetic structure in Allegheny woodrats in Virginia, we conducted a pilot study to determine if Allegheny woodrat DNA could be extracted from museum specimens. Samples were obtained from three museums. Depending on the specimens, tissue was obtained from the ventral incision, skulls, skeletons or the incisions around the mouth. A total of 83 samples were collected from specimens collected between 1860 and 1989. DNA was extracted and amplified using PCR and mitochondrial cytochrome b sequencing primers. Samples were amplified with 88% success on the first PCR run following the first extraction. Eleven samples were extracted again and successful on the second attempt. To date, 98.8% of the samples have been successfully amplified. Our results show that amplifiable DNA can be extracted from museum specimens at least 151 years in age. The extracted DNA will be used to compare current and historic genetic characteristics of Allegheny woodrat populations.

EFFECTS OF INTERCROPPING SWITCHGRASS (*PANINUM VIRGATUM L.*) AND LOBLOLLY PINE (*PINUS TAEDA*) ON ABUNDANCE, RICHNESS, AND DIVERSITY OF SMALL MAMMAL COMMUNITIES

Kristy L. King[1], Jessica A. Homyack[2], Darren A. Miller[3], and Matina C. Kalcounis-Rüeppell[1]. [1]*Department of Biology, University of North Carolina at Greensboro, Greensboro, NC 27412, USA*; [2]*Weyerhaeuser NR Company, 1785 Weyerhaeuser Road, Vanceboro, North Carolina 28586-7606, USA*; [3]*Weyerhaeuser NR Company, P.O. Box 2288, Columbus, MS 39704, USA*

Small mammals are important components of forest ecosystems because they disperse seeds and fungi, regulate invertebrate populations, and are prey for higher order consumers. Intercropping

switchgrass (*Paninum virgatum* L.) in loblolly pine plantations (*Pinus taeda*) is a potential way to grow and harvest a feedstock for biofuel production. In 2008, Catchlight Energy LLC (CLE), a Chevron |Weyerhaeuser Joint Venture was formed in part to assess the large-scale viability of such a management system. Intercropping has the potential to change the understory vegetation composition of pine forests, which could influence the small mammal community and individual populations. Therefore, we examined effects of switchgrass intercropping in managed pine forests on community and population responses of small mammals. We conducted seven intensive live-trapping sessions between 1 July 2011 and 16 October 2011 in Kemper County, Mississippi. Our study site included fifteen 10-ha plots, established and maintained by CLE, that were distributed over a 19,000 ha tract of intensively managed pine plantations owned and managed by Weyerhauser Company. The 15 plots included 12 newly-established pine plantations and 3 fully-established pine stands intercropped with switchgrass. We captured *Peromyscus leucopus, Sigmodon hispidus, P. gossypinus, Mus musculus, Oryzomys palustris, Neotoma floridana, Reithrodontomys humulis, Ochrotomys nuttalli,* and *Cryptosis parva* during our study. Preliminary results suggest that *S. hispidus* and *C. parva* are associated with fully-established intercropped treatment plots, whereas *P. leucopus* and *P. gossypinus* are associated with pine-only treatment plots. Whether observed results are due to stand age or treatment cannot be determined without further study. We will present estimates of population abundances using Program MARK from common species and will discuss future research plans.

FORAGING HABITAT PREFERENCES OF BATS IN EASTERN OKLAHOMA

Andrea Korman[1, 2], Karen McBee[1], and Shea Hammond[2]
[1]Department of Zoology and Collection of Vertebrates, Oklahoma State University, Stillwater, OK 74075; [2]US Fish and Wildlife Service, Ozark Plateau National Wildlife Refuge, Jay, OK

We collected acoustic data monthly during summer and early autumn from six 30-mile mobile transects across five eastern Oklahoma counties to gather baseline data on species composition and population sizes of bat communities so that comparisons can be made if White Nose Syndrome (WNS) becomes established in these areas. We also used GIS spatial data to compare habitat types within each route because abundance of bats will vary depending on the available habitat. The transects cover a range of habitat types including urban, agriculture, streams, and forests. Calls were collected using an Anabat ZCAIM unit, which was also attached to a GPS unit. I used the GIS program to estimate the predominant habitat surrounding each call using buffers with radii of 1 and 2 km. An ANOVA test showed that habitat type was significant in determining bat abundance. A Post Hoc model showed that forested habitats were most significantly used by bats at both buffer levels and that pasture habitat was significant only at the 1 km buffer level. My landscape results suggest that retention of forest habitat would be most beneficial to the bat species of eastern Oklahoma while urbanization and landscapes dominated by intensive agriculture are least beneficial. Ultimately, this project should enable us to trace impacts if WNS moves through bat populations in Oklahoma. Increasing our knowledge of bat behavior and how bats use various types of habitat will strengthen conservation efforts by identifying important roosting and foraging environments that should be preserved to maintain a stable ecosystem.

EFFECTS OF HABITAT TREATMENTS ASSOCIATED WITH INTERCROPPING SWITCHGRASS ON THE DISTANCE THAT PURE TONE SOUND TRAVELS

Ashley M. Matteson, Jessica A. Homyack, Darren A. Miller, and Matina C. Kalcounis-Rueppell. *Biology Department University of North Carolina at Greensboro, Greensboro, NC USA. (AMM, MCKR); Weyerhaeuser NR Company, 1785 Weyerhaeuser Road, Vanceboro, NC 28586-7606 USA. (JAH); Weyerhaeuser NR Company, P.O. Box 2288, Columbus, MS 39704, USA. (DAM).*

Muroid rodents produce ultrasonic vocalizations (USVs) for interspecific communication and these USVs are an important component of their behavioral repertoire. Physical properties of sound such as spreading loss, acoustic impedance, absorption, and scattering can impact sound propagation. Vegetation type and density may have a significant impact on how animal sound propagates, especially high frequency sounds like USVs. Catchlight Energy LLC (CLE), a Chevron | Weyerhaeuser joint venture, is investigating intercropping switchgrass between rows of intensively managed loblolly pine (*Pinus taeda*) plantations for biofuel production. Intensively managed pine forests provide habitat for a wide range of wildlife species, including muroid rodents. Planting switchgrass likely changes understory of managed pine forests and may impact how rodent USVs propagate. Therefore, we quantified distance (m) it takes pure tone sound to completely attenuate when broadcasted into different treatments associated with switchgrass production. Our study was conducted in Kemper County, MS on study plots established and maintained by CLE on land owned and managed by Weyerhaeuser Company. Pure tone sound was broadcasted at 10KHz, 20KHz, 40KHz, and 60KHz, which are frequencies relevant to rodent USVs. We broadcast sound into an intensively managed pine forest, a pine stand intercropped with switchgrass, and a gravel road adjacent to treatment stands for a "no vegetation" control. Treatment type significantly affected distance that all frequencies of pure tone sound traveled. The distance pure tone sound traveled was lowest in the intercropped stand and highest in the "no vegetation" control. Additionally, the distance pure tone sound traveled was highest at 40KHz and lowest at 10KHz and 60KHz. In the future, we will examine influence of habitat succession in treatments on propagation of pure tone sound and effects on prerecorded muroid rodent USVs.

LAND USE HISTORY AND MATERNITY ROOST SELECTION BY *MYOTIS SEPTENTRIONALIS* IN A MESOPHYTIC HARDWOOD FOREST

Alexander Silvis, W. Mark Ford, and Eric R. Britzke. *Department of Fisheries and Wildlife Conservation, Virginia Polytechnic Institute and State University (AS, WMF), U.S. Geological Survey, Virginia Cooperative Fish and Wildlife Research Unit (WMF), U.S. Army Engineer Research and Development Research Center, Environmental Lab (ERB)*

Preservation of summer maternity roosts is considered critical for bat conservation in North America, yet little is known about factors that drive patterns in roost selection. To examine patterns of maternity roost selection by northern bats (*Myotis septentrionalis*) we tracked 61 females to 105 roost trees of 21 different species on the Fort Knox military reservation during the summer of 2011. Sassafras (*Sassafras albidum*) trees accounted for 48.6% of the roosts located and were used more than expected based on their availability ($\chi^2 = 6.8$, *d.f.* = 1, $P < 0.0001$). We detected no differences in dbh (W = 181.5, $P = 0.15$), height (W = 221.5, $P = 0.52$), decay (W = 296.0, $P = 0.4199$) or percent bark (W = 194.5, $P = 0.24$) between sassafras and the next most

commonly used species, *Acer saccharum*. Similarly, we detected no difference in slope location (W = 168.0, *P* = 0.09), aspect (W = 226.0, *P* = 0.58), elevation (W = 302.0, *P* = 0.36), gap fraction (W = 158.5, *P* = 0.06), photon flux density (W = 210, *P* = 0.39) or leaf area index (W = 261.5, *P* = 0.91) at roost sites. We suggest that roost species selection is not a function of differences between individual tree species *per se*, but rather of land use history conditions that affect forest composition and structure. At out sites, succession from a single-age forest following old field abandonment to a multi-aged forest dominated by shade tolerant species has created a cohort of senescing sassafras that represent a locally available, suitable roosting resource. Current conditions are the result of decades old processes. Present successional trajectories may not provide this roost structure again without management intervention. This pattern underscores the need to take a "long-view" of bat habitat management.

ROOST MOVEMENTS OF THE EASTERN SMALL-FOOTED BAT (*MYOTIS LEIBII*) IN THE SOUTHERN APPALACHIAN MOUNTAINS

Tara J. Thomson and Joy M. O'Keefe. *Department of Biology, Indiana State University, Terre Haute, IN 47809.*

Little is known about the ecology of the eastern small-footed bat (*Myotis leibii*), a rare species currently being petitioned for federal listing. Our objective was to examine the roosting ecology of *M. leibii*, including locating natural roosts and measuring bats' movements. We hypothesized that bats would travel short distances, roost close to the road, and switch roosts frequently. From 1 July to 7 October 2011, we attached 0.30- 0.36 g transmitters (5.8-7.7% of body weight) to 10 males and 5 females (≥ 4.5 g) captured from expansion joints of 2 bridges in the southern Appalachian Mountains. On average, males (n = 8) moved further from the capture site to the first roost site (2.6 ± 1.2 km) and between subsequent roosts (0.64 ± 0.17 km) than females (0.25 ± 0.05 km; 0.20 km; n = 2). Males also showed higher fidelity to roost sites (mean of 5.3 ± 1.3 consecutive days in a roost) than females (mean of 2 ± 1 days). Males and females roosted approximately the same distance from the road, 21.7 ± 8.9 m and 14.3 ± 8.6 m, respectively, if we discount one male that roosted 1.2 km from the road. Movements between roosts were greater, and switching rates were lower than values reported for this species in the central Appalachians. Both individuals and the population as a whole showed fidelity to specific rock outcrops, suggesting these outcrops will be important to local and regional management plans for this species. Future work may include collecting more detailed movement data with PIT tags and molecular analysis to assess the relatedness of bats in this population.

EVALUATING THE EFFECTIVENESS OF MOBILE ACOUSTIC TRANSECTS CONDUCTED ON ROADS AND RIVERS

Michael D. Whitby, Timothy C. Carter, and Scott M. Bergeson *Department of Biology, Ball State University, Muncie, IN 74303*

Understanding population status and trends of any species is essential to conservation and management of that animal. However, landscape level population status of many bat species is not well understood. Recent threats (e.g. White-nose Syndrome and wind energy development) to bat populations have exacerbated the need to better understand the status of bat populations

and provide baseline information to monitor population trends. In an effort to resolve this issue, a national mobile acoustic monitoring protocol was developed to survey summer bat populations. Following the guidance document, mobile acoustic transects were established along roadways by many state and federal agencies. However, some species are known to occur more frequently near or along river corridors, leading us to hypothesize that mobile transect conducted from boats may provide a more accurate picture of a landscape's bat community and increase monitoring opportunities by gathering data on more species. To test this hypothesis, a study comparing road and river mobile transects was conducted to determine if mobile sampling along rivers recorded a greater abundance of calls or species than mobile transects conducted on roadways. An ~8 mile stretch of river and an associated levee were sampled simultaneously a total of 22 times in 2010-2011 in Shawnee National Forest, IL. Species richness and abundance of the two methods were compared with rarefaction. Preliminary results indicate that species assemblages are similar, but a greater number of bat calls are recorded along the river. However, sample variances differ at the species level revealing that each method could advantageous for monitoring different species. When examined in light of time investment for each method, we hope this study will help managers allocate their limited resources in a manner that will give them tools to design the most powerful monitoring protocol for the most species.

Non-Student Oral Presentation Abstracts

REPRODUCTIVE CYCLE OF BAIRD'S POCKET GOPHER (*GEOMYS BREVICEPS*) IN NORTHERN LOUISIANA

Matthew B. Connior, Douglas C. Cagle, Heather E. Peek, Christopher R. Ellington, and John L. Hunt· *Health and Natural Sciences, South Arkansas Community College, El Dorado, Arkansas 71730 (MBC); School of Mathematics and Sciences, University of Arkansas at Monticello, Monticello, Arkansas 71656 (DCC, HEP, CRE, JLH)*

Knowledge of the reproductive patterns of a species can be critical in making decisions regarding conservation or agricultural pest control. One species in Louisiana that is sometimes an economic pest is Baird's pocket gopher (*Geomys breviceps*), a small fossorial rodent that spends almost its entire life within subterranean burrows. Because of these habits, pocket gophers cause damage to agricultural fields and urban yards. Reproductive data on pocket gophers in Louisiana could be used to help control pest populations. Studies have been conducted in Missouri and Texas to determine reproductive patterns of pocket gophers but no studies have been conducted in Louisiana, although patterns have been assumed based on nearby studies. We collected gophers in Union Parish, Louisiana for 18 months in 2010 and 2011 and dissected them to determine reproductive cycles. Reproductive data, sex ratios and body size data are presented. The majority of reproduction occurs in spring and early summer, as evidenced by juveniles and subadults in our collections.

PRE- AND POST-HIBERNATION CHANGES IN THE BODY CONDITION OF BATS SUSCEPTIBLE TO WHITE NOSE SYNDROME AT MAMMOTH CAVE NATIONAL PARK

L. E. Dodd, J. S. Johnson, L. K. Rieske-Kinney, S. C. Thomas, R. S. Toomey, and M. J. Lacki. *Department of Forestry, University of Kentucky, Lexington, KY 40546 (JSJ, LED, MJL); Department of Entomology, University of Kentucky, Lexington, KY 40546 (LKRK); National Park Service, Mammoth Cave, KY 42259 (RST, SCT).*

As our understanding of White Nose Syndrome (WNS) continues to grow, there is an increasing need for data regarding the body condition of bats before and after hibernation. We collected morphometric data from bats captured during harp trap surveys at a hibernaculum at Mammoth Cave National Park during staging (April) and swarming (late August – September) periods in 2011. A total of 168 bats were captured during staging; no differences were observed in overall weight (g), forearm length (mm), nor body condition index (BCI; weight / forearm) across survey dates or between sexes for any species ($P>0.05$). A total of 260 bats were captured during swarming. Overall weight and BCI for *Myotis septentrionalis* (n=61), and *Myotis* species in general (n=91), increased with the onset of winter ($P\leq0.05$). The same temporal trend was observed for *Perimyotis subflavus*; females of this species also had larger forearms, greater weights, and higher BCI than males ($P\leq0.05$). We considered these data alongside blacklight surveys of insects throughout the year (150 trap / nights). Temporal patterns of prey (Coleoptera, Diptera, and Lepidoptera) varied within staging and swarming periods. Abundance of Diptera varied, but Coleoptera and Lepidoptera were more abundant as staging progressed and less abundant as swarming progressed ($P\leq0.05$). Our data demonstrate that hibernating bats face a reduced availability of prey during the crucial times leading up to and following hibernation ($P\leq0.05$).

KENTUCKY WHITE-NOSE SYNDROME UPDATE – SITE-SPECIFIC IMPLEMENTATION OF A WNS STATE RESPONSE PLAN

Brooke A. Hines. Kentucky Department of Fish & Wildlife Resources, *#1 Sportsman's Lane, Frankfort, KY 40601*

White-nose syndrome (WNS) is a disease responsible for the deaths of over five million bats since its initial discovery in 2006 (USFWS 2012). In response to this on-going crisis, many states have adopted WNS Response Plans that include surveillance and monitoring programs. Kentucky was the first state to develop a Response Plan and has one of the most aggressive surveillance and monitoring programs. After the discovery of the first infected site in Kentucky, the Kentucky Department of Fish & Wildlife Resources (KDFWR) began implementation of the post-WNS phase of the Kentucky WNS State Response Plan. KDFWR, in cooperation with the U.S. Fish & Wildlife Service Kentucky Field Office outlined a site-specific plan tiered from the state-wide plan. This site-specific plan documented a timeline of activities at the site prior to and after WNS was detected and addressed potential research and management opportunities for the site. Development of a plan specific to the constraints of the site allowed for quick action and coordination. The management strategies implemented may provide information on the efficacy of environmental manipulations designed to slow the spread of WNS and survivorship of certain species from a known infected site. Also, documentation of a timeline of activities at the

infected site, both pre- and post-WNS, provided researchers with baseline information allowing us to address specific research questions.

MODELING CURRENT AND FUTURE POTENTIAL FOR PERIPHERAL POPULATIONS OF SOUTHEASTERN BATS TO MITIGATE EFFECTS OF WHITE NOSE SYNDROME IN CORE POPULATIONS.

M. C. Kalcounis-Rueppell, Christopher Thawley, M. J. Vonhof and L. J. Rissler, *University of North Carolina at Greensboro, Greensboro, NC (MCKR); Pennsylvania State University, University Park, PA (CT); University of Western Michigan, Kalamazoo, MI (MJV); University of Alabama, Tuscaloosa, AL (CT, LJR).*

Bat species impacted by White Nose Syndrome (WNS) are characterized by winter hibernation in caves. Many of the WNS affected species have peripheral populations at the southern edge of their species range in the southeastern United States and may not hibernate. If core and peripheral populations of bats differ in behavior or physiology, peripheral populations may mitigate regional species extinction from WNS in core populations. Understanding how species' behavior and physiology vary across space in relation to the environment is essential to understanding the potential mitigating effects of peripheral populations in the face of WNS. We determined with ecological niche modeling (ENM), current and future probabilities that peripheral populations will mitigate core extinctions in WNS-affected bat species by using ENM to predict the location and distributional limits of peripheral and core populations and to identify regions where bat populations should have low susceptibility to WNS and high viability. We focused on *Myotis lucifugus*, *M. septentrionalis*, and *Perimyotis subflavus*. ENM models based on future climate trends increase the likelihood for peripheral populations of species to be established in the Gulf Coastal Plain at localities further south than current distributional limits. ENM models show high variability in peripheral population locations along the southern extent of species distributions. Our ENM results underscore the potential for peripheral populations of bats in the southeastern United States to mitigate effects of WNS on core populations.

NATIVE AND NON-NATIVE MOUSE INTERACTIONS IN INTERCROPPED SWITCHGRASS-PINE SYSTEMS

Kristen E. Lucia, Jessica A. Homyack, Darren A. Miller, and Matina C. Kalcounis-Rueppell. *Biology Department, University of North Carolina at Greensboro, Greensboro NC, USA (KEL, MCKR); Weyerhaeuser NR Company, 1785 Weyerhaeuser Road, Vanceboro, North Carolina 28586-7606 USA (JAH); Weyerhaeuser NR Company, P.O. Box 2288, Columbus, MS 39704, USA (DAM)*

Increased production of alternative energy sources from forests, including perennial grasses and residual biomass, may influence both native and non-native members of biological communities. However, very little is known about direct effects of biofuel feedstock production on native biodiversity. Additionally, there are possible indirect effects on native biodiversity potentially mediated by interactions between biofuel feedstock production and non-native species. Thus, we examined rodent community dynamics in an intercropped switchgrass (*Panicum virgatum*)-pine (*Pinus* spp.) system in eastern North Carolina, USA within study plots maintained by Catchlight

Energy LLC on land owned by Weyerhaeuser Company. We used a randomized and replicated experimental design to examine effects of biofuel feedstock treatment options, including biomass removal and intercropping switchgrass, on native and non-native rodents from 2009-2011. Switchgrass influenced relative abundance of two rodent species: in the presence of switchgrass, non-native *Mus musculus* was more abundant while relative abundance of native *Peromyscus leucopus* was lower. Our results suggest residual biomass removal had no effect on rodent community dynamics in an intensively managed southern pine system. However, switchgrass had a positive influence on the invasive *M. musculus*, a negative influence on native *P. leucopus*, and no influence on other native species. Currently, we are evaluating whether the relationship between switchgrass and two mouse species continues as forest succession occurs. Additionally, we are determining if *P. leucopus* avoids switchgrass or is being competitively excluded from switchgrass by *M. musculus* by examining their habitat preferences and niches and with an experimental exclusion of *M. musculus* from experimental plots.

EXPERIMENTAL TRANSLOCATION OF SOUTHEASTERN POCKET GOPHERS

Jonathan M. Owens, Steven B. Castleberry, Bob Brinkman, and Nikole L. Castleberry. *Warnell School of Forestry and Natural Resources, University of Georgia, Athens, GA 30602 (SBC, JMO); Southern Company, Waynesboro, GA 30830 (BB); Georgia Department of Natural Resources, Nongame Conservation Section, Social Circle, GA 30025 (NLC)*

The southeastern pocket gopher (*Geomys pinetus*) was historically common in the Coastal Plain of Georgia, but the current distribution consists of small, scattered populations isolated by unsuitable habitat. As restoration efforts increase the area of available habitat, translocation may be a viable tool for restoring southeastern pocket gopher populations onto restored habitats. We conducted a pilot study to compare survival and movements of translocated southeastern pocket gophers to reference (un-translocated) pocket gophers at Plant Vogtle Electric Generating Plant in the Upper Coastal Plain of Georgia. We subcutaneously implanted radio transmitters into 9 pocket gophers. Five of the telemetered pocket gophers were translocated to an area with suitable habitat but no extant population. The 4 reference individuals were released back into their burrows. We located pocket gophers weekly throughout the study period (December 2010-March 2011). We calculated distance of the initial movement after release, farthest location from the release site, and movement rate over the study period. One of the translocated individuals was known alive at the end of the study compared to 2 reference individuals. Both of the confirmed mortalities in translocated pocket gophers were from predation. Mean initial movement away from the release site, farthest distance from the release site, and movement rate were greater for translocated than reference individuals. All translocated pocket gophers exhibited an above-ground movement away from the release site within the first week after release. The farther distances from the release site and greater movement rates were largely due to the initial above-ground movement rather than subsequent below-ground movements. Above-ground movements by translocated pocket gophers also appeared to increase predation risk. We recommend a "soft-release" approach in future efforts to prevent initial above-ground movements and reduce predation risk until a burrow system is established.

WHY WOULD A FUNGUS GROW ON BAT AND HOW CAN WE INVESTIGATE THE PROCESS?

Evan L. Pannkuk, David F. Gilmore, Brett J. Savary, and Thomas S. Risch *Graduate Program of Environmental Science, Arkansas State University, Jonesboro, AR 72401 (ELP, TSR); Department of Biological Sciences, Arkansas State University, Jonesboro, AR (DFG, TSR); Arkansas Biosciences Institute, Jonesboro, AR (BJS).*

White-Nose Syndrome (WNS) is a fungal disease of bats caused by *Geomyces destructans* and has resulted in the mass mortality of North American cave bats. Symbiosis between a fungal pathogen and a host involves a myriad of complex biochemical reactions for a disease process to occur. Two broad groups of molecules implicated in fungal disease include lipids and proteins. Host lipids can be involved in sensing and attachment, whereas fungal extracellular enzymes have important roles in disease processes. Thus, these two groups of molecules are prime targets for study to elucidate pathogen mechanisms in WNS. The overall objective of this research is to:

1) Determine species specific secreted lipid content that may affect *G. destructans* growth.
2) Characterize enzymes secreted in response to bat tissue that may be vital to its survival and/or pathogenicity.

In our studies we extracted and fractionated lipid residue from bat integument. Total lipid content was quantified according to broad lipid class and select groups were analyzed through profiling experiments. In addition, we isolated secreted enzymes from *G. destructans* in chemically defined aqueous media. Proteolytic enzymes were collected and prepared for biochemical and proteomic studies. Conclusions from these studies will provide baseline data on the molecular makeup of bat skin and offer insights into the pathogenesis of *G. destructans*.

INDIANA BAT FALL HABITAT USE AND MIGRATION FROM NORTHERN KENTUCKY TO SOUTHERN INDIANA

Piper L. Roby and Mark W. Gumbert. *Copperhead Environmental Consulting, Inc., P.O. Box 73, Paint Lick, Kentucky 40461*

There is a plethora of information about Indiana bat summer ecology, a few studies have been conducted during the post-maternity season, and even fewer studies have researched Indiana bat migration, most of which have taken place in the spring. This study was intended to link individuals from the Indiana bat maternity colony at Ft. Knox to their hibernacula. Bats were captured on base from 23 Aug – 16 Oct 2011 for radio tagging (n = 28). Bats were tracked to day roosts and followed at night to monitor migration activity. Mean weight of bats increased throughout the sampling period as they prepared for migration and subsequent hibernation. Twenty-five roost trees were identified. Mean roost tree dbh (39.4±2.8 *SE* cm) and mean roost tree height (14.1±1.2 *SE* m) were not different from summer roost trees found in previous studies at Ft. Knox. First date of confirmed migration was 7 Oct and bats were still exiting Indiana bat roost trees on 16 Oct. When bats started migrating, they did so within the first couple of hours after sunset. Four radio-tagged bats were located in 2 caves in S. Indiana, 45.9±2.0 *SE* km NW of the base. A combination of bat mass, ambient temperature, distance to the hibernaculum, and possibly barometric pressure are factors in determining when a bat leaves its summer grounds to migrate to its hibernaculum.

Poster Session Abstracts

OPEN-SOURCE BAT RESEARCH: THE ECHOLOGGER SYSTEM FOR TRACKING BAT ECHOLOCATION ACTIVITY.

Stephen C. Burnett, *Department of Natural Sciences, Clayton State University, Morrow GA, 30260*

Monitoring the behavior of bats using echolocation calls tends to suffer from a number of difficulties including very expensive equipment. This tends to limit the number of sites that researchers can examine at a given time. This study took advantage of low-cost, open-source hardware and software to develop monitoring devices that can detect bat echolocation activity and use wireless communication to collect data on the number of calls detected from multiple sites at one time. This system is based on Arduino microcontrollers and XBee wireless communication devices, which are capable of transmitting signals over extended distances, thus allowing a researcher to monitor a fairly wide area. The monitoring devices transmit their data to a central base station which can provide real-time updates on activity to the researcher. All the software used in the system is free and the cost of the hardware is fairly low, so assembling this system can be done with reasonable cost. Because these devices are associated with the open-source movement, there is a worldwide base of users that can be tapped as a source of example software, advice, and troubleshooting. This allows someone with minimal experience to produce results in a reasonable amount of time. These devices will not replace more expensive systems that are more precise, but they can be included in the set of overall techniques used by bat researchers while keeping costs low.

THE DISCOVERY OF A BREEDING POPULATION OF THE EASTERN SMALL-FOOTED MYOTIS (*MYOTIS LEIBII*) IN ILLINOIS

Timothy Carter, Michael Whitby, Rod McClanahan, Scott Bergeson, Stephanie Rutan. *Department of Biology, Ball State University, Muncie, IN 47306; USDA Forest Service, Shawnee National Forest-Hidden Springs RD, Vienna, IL (RM)*

The only record of eastern small-footed myotis (*Myotis leibii)* in Illinois was from a 2005 discovery of 2 individuals under a rock at the Fink Sandstone Barrens of Shawnee National Forest. The Illinois Department of Natural Resources lists *M. leibii* as a species of possible occurrence but it is not considered a resident species. In 2011, the Fish and Wildlife Service found "substantial information indicating that listing a species may be warranted" and requested information on the species in order to complete the review. In response to this request the Shawnee National Forest initiated a survey of likely areas of *M. leibii* occurrence. A survey of likely roosting habitat for the rock dwelling species was conducted in July and August 2011. Twenty-nine individuals, including post lactating females and juveniles, were discovered by surveying rock outcrops around the original site of discovery. While, the extent of *M. leibii* occurrence in Illinois is still poorly understood, this survey indicates that a resident breeding population occurs within the southern tip of the state.

SURVEYING FOR THE ELUSIVE RAFINESQUE'S BIG-EARED BAT (*CORYNORHINUS RAFINESQUII*) IN SOUTHEASTERN MISSOURI: ONLY THE BEGINNING

Shelly N. Colatskie, Anthony G. Elliott, Bree K. McMurray, Shannon R. Romeling, Ben Hale, C. Ryan Allen, and Larisa Loros-Bishops and Lynn W. Robbins. *Missouri Dept. of Conservation, Jefferson City, MO 65102 (SNC); Missouri Dept. of Conservation, Kirksville, MO 63501 (AGE); Missouri Dept. of Transportation, Jefferson City, MO 65102 (BKM); Missouri State University, Springfield, MO 65807 (SRR, BH, CRA, LLB, LWR)*

August 11, 2009, a male Rafinesque's big-eared bat (*Corynorhinus rafinesquii* – CORA) was captured at Otter Slough Conservation Area (OSCA) in Stoddard County, Missouri as part of the Southeastern Bat Diversity Network's Bat Blitz. This was the first bat survey on OSCA. The 12g scrotal male was captured in a double high 9m mist net placed in the interior of a small forest block between a road and office building. A 0.5g transmitter was affixed, which allowed tracking to a day-roost in an area building. On August 9, 2011 the Missouri Department of Conservation surveyed OSCA again with more effort. On August 9 three mist nets were placed in the area where the CORA was captured in 2009. One scrotal male CORA was captured in a single high 9m mist net placed in the middle of a dry, wooded swamp. Another site consisted of 4 nets and captured 1 eastern red bat (*Lasiurus borealis*). A 0.6 gram transmitter was placed on the CORA and it was tracked for 10 days. The bat day roosted in a large overcup oak (*Quercus lyrata)* with a cavity halfway up the trunk. Two nights of foraging data were taken and 10 days of homing to the day-roost were completed. Each day of homing, the CORA was found in the same roost tree until the transmitter failed or left the area. Staff searched the entire OSCA on day 10 and the signal was not found. Mist nets set near the roost tree on August 10 captured two eastern red bats and one evening bat (*Nycticeius humeralis*). The two records for CORA at OSCA are half of the records in Missouri. These surveys show that more effort is needed in bottomland hardwood forests of southeastern Missouri. Plans are being developed to survey similar areas during spring 2012.

EFFECTS OF FATTY ACIDS ON *GEOMYCES DESTRUCTANS* GROWTH AND SPORULATION?

Cheyenne Gerdes, Amy W. Fischer, Hannah Blair, Evan L. Pannkuk, and Thomas S. Risch *Department of Biological Sciences, Arkansas State University, Jonesboro, AR (AWF, HB, CG, TSR); Graduate Program of Environmental Science, Arkansas State University, Jonesboro, AR 72401 (ELP, TSR)*

Geomyces destructans is the causative agent of White-Nose Syndrome (WNS) and the associated death of over 5 million North American bats. Free fatty acids (FFAs) have been investigated as potential antimicrobial agents for over a century. Host lipids have been implicated in disease processes ranging from fungal attachment, microbial growth inhibition, providing nutrient sources, and spore germination. If specific lipids are either detrimental or essential to *Geomyces* growth, these biomolecules may present important antifungal targets. The overall objective of this study is to determine if host lipids are involved in *G. destructans* pathogenicity. Specifically, we sought to determine the effects of common fatty acids on the growth and sporulation of *G. destructans*. In this study, we added 14:0, 16:0, 18:0, 18:1, 18:2, and 18:3

FFAs (at 1.0%, 0.1%, and 0.01% concentrations) to minimal growth media and inoculated with standardized amounts of *G. destructans* spores. Colony growth was analyzed by total area and sporulation efficiency was determined with the use of a hemocytometer. We found that 16:0, 18:0, 18:1, and 18:2 FFAs drastically reduced fungal growth at concentrations over 0.01% while 14:0 and 18:3 had little to no effect on overall growth or sporulation. We have provided preliminary evidence in this study that host lipids may have an effect on *G. destructans* growth and that species specific differences in host lipid content should be thoroughly investigated to determine WNS susceptibilities.

HOME RANGE DELINEATION AND ACTIVITY OF THREE INDIANA BAT MATERNITY COLONIES

Benjamin T. Hale, Joseph R. Lemen, and Lynn W. Robbins, *Missouri State University, Springfield, Missouri 65897*

The determination of home range size and areas of activity are critical for assessing risk to individuals within a reproductive unit (maternity colony). We used the methodology presented in response to the question "How do we delineate an Indiana bat maternity colony home range?" (www.fws.gov/midwest/endangered/mammals/inba/pdf/IndianaBatWindGuidance22August2011.pdf). In this methodology, a buffer with a 2.5 mile radius from a roost tree is used as the estimated home range for the colony. Our methodology includes all relevant points including capture locations, roost trees, and estimated locations using telemetry in a minimum convex polygon to estimate colony home range. We conducted a survey during the summer of 2011 to determine the possible presence of one or more maternity colonies. We tracked 12 reproductively active females during a total of 41 tracking nights (one bat tracked for one night) for an average of 27 hours of tracking per bat. These efforts resulted in a total of 9 primary or multiple bat/multiple day roost trees, 594 separate telemetry points, and three distinct colonies based on a minimum convex polygon inclusion of capture sites, roost trees, and estimated locations. We placed three Anabat detectors in an area of activity associated with primary and alternate roosts and 50 and 300 feet away from this forested habitat. These data indicated that activity of this species is concentrated in areas of suitable habitat relative to adjacent and potentially unsuitable habitat. Home range estimates based on capture site, roost sites, and telemetry differed by bat and by capture date but showed large areas of overlap. Combining these data increased the home range estimate for these three colonies but still resulted in a lower overall estimate when compared to the USFWS method. Home range estimates alone should not be used to infer risk without describing and delineating suitable habitat within that area.

USING OCCUPANCY ESTIMATES TO ASSESS THE EFFECTIVENESS OF INDIANA BAT MANAGEMENT IN NORTHEAST MISSOURI

Sarah Pennington[1], Sybill Amelon[2], Matthew Gompper, [1] and Anthony Elliott[3]
[1] Department of Fisheries and Wildlife, University of Missouri, Columbia, MO; [2] US Forest Service Northern Research Station, Columbia, MO; [3] Missouri Department of Conservation, Kirksville, MO

This study is one component of a long-term interagency collaboration between the Missouri Department of Conservation, The Northern Research Station of the U.S. Forest Service, and the University of Missouri in an effort to provide a tool to measure the effectiveness of habitat mitigation efforts for the benefit of the federally endangered Indiana bat. The overall objectives are to determine probability of patch occupancy and probability of detection for Indiana bats on Charlie Heath Memorial Conservation Area, Fox Valley Lake Conservation Area, and Deer Ridge Conservation Area and develop predictive occupancy and habitat use models based on site, and landscape covariates. Furthermore, we look to understand the role that competition among co-occurring bats may have on the patch occupancy of Indiana bats. We will sample 100 points for two consecutive nights across different types of forest management within each of the three study areas. We will passively collect bat echolocation calls using Anabat I and Anabat II detectors coupled with Zero-Crossing Analysis Interface Modules with CF memory card storage (CF ZCAIM; Titley Electronics). We will analyze the resulting detection history using the program PRESENCE 3.0 to estimate proportion of sites occupied and objectively evaluate multi-season models and Nichols-Royal heterogeneity models relative to both probability of detection and site occupancy. We will also evaluate two species models to assess interspecies interactions.

THERMAL CHARACTERISTICS UNDER LEAF LITTER DURING WINTER: IMPLICATIONS FOR LITTER-ROOSTING BATS

Roger W. Perry. *U.S. Department of Agriculture, Forest Service, Hot Springs, AR 71902*

During winter, several species of tree bats, especially red bats (*Lasiurus borealis*) and Seminole bats (*L. seminolus*) use leaf litter for roosting during colder periods of winter. However, information is needed on how under-litter locations affect energy expenditures of bats during hibernation. Thus, I initiated a study examining thermal properties under litter during winter in forests of the Ouachita Mountains, Arkansas. Temperatures were measured every 15 minutes under 2 cm, 5 cm, and 8 cm of leaf litter and compared to ambient temperatures on 14 plots over 7 nights. In addition, temperatures 2 cm below the soil surface were measured. Average temperatures below leaf litter remained above ambient during both day and night. At night, average temperatures differed significantly among litter depths, with deeper litter maintaining higher temps. During daytime, no difference existed among litter depths. Preliminary results suggest that the interaction of ambient temperature and litter depth is complex, and may be affected by previous bouts of cold weather, aspect, litter moisture, wind, cloud cover, and other factors. Minimum ambient temperature during the study was only -6.3^{o}C and additional nights with colder temperatures (<-12^{o}C) are needed to fully evaluate litter thermal profiles. This study is ongoing and substantially more plots will be measured. Eventually, models of litter thermal characteristics incorporating litter depth, aspect, litter moisture, weather, and forest structural characteristics such as hardwood and pine basal areas will be created.

A COMPARISON OF FULL SPECTRUM AND ZERO-CROSSING BAT CALL IDENTIFICATIONS IN SOUTHERN MISSOURI

Shannon Romeling, Ryan Allen and Lynn Robbins, *Missouri State University, Springfield, MO*

In 2011, we conducted a study to explore the make up of individual call files and reported call parameters produced by two zero-crossing Anabats (SD1 and SD2 units by Titley Electronics, Inc.), and an SM2 (Wildlife Acoustics). For this study, these calls were analyzed by two different bat identification software systems in order to understand the differences between the two systems. The three detectors were aligned next to each other on a table approximately 1 meter off the ground and manually set to record in unison for 15 second sessions on August 6-8, 2011 in Current River State Park, MO. Both Anabats used a division ratio of 16 and sensitivity of 5.5. The SM2BAT was configured in mono with a sampling rate of 192 kHz according to the manual and suggestions from Wildlife Acoustics and SonoBat. SM2BAT files were also converted to zero-crossing files using WAC2WAV. Calls will be identified using SonoBat 3.03 Ozark and BCID East 2.4.1.1 software. Files that will be analyzed by SonoBat 3.03 Ozark were processed first by SM2 Batch Compensator (SonoBat). Sonobat 3.03 Ozark classifier will be set to consider the maximum number of calls per file (100), an acceptable call quality of 0.70, and a discriminant probability threshold of 0.90. BCID East will be set to have a minimum of 5 calls present within 15 seconds and to have the default species turned on for the state of Missouri. Number of calls identified and species identifications will be analyzed. This information will assist others in understanding any differences that may exist when using these software systems to analyze bat calls.

THE MISSISSIPPI BAT WORKING GROUP

Becky Rosamond, *Mississippi Bat Working Group, Grenada, MS*

The Mississippi Bat Working Group (MBWG) was formed in 2002 and currently has over 100 members. This conservation-oriented group consists of professionals, students, and anyone interested in bats. Annual events include our Summer Mist Net Event where people get an opportunity to see bats up close and learn more about this ecologically important group of animals. We also have an annual meeting where current bat research and issues are discussed. The group is actively engaged in environmental education and research.

ACOUSTIC SURVEY FOR VERTICAL DISTRIBUTION OF HABITAT USE BY BATS IN THE NANTAHALA NATIONAL FOREST

Daniel Schaefer and Joy O'Keefe, *Department of Biology, 600 N. Chestnut St., Indiana State University, Terre Haute, IN 47809*

There are few data on the vertical stratification of foraging activity by forest bats, but it is important to understand the vertical distribution of foraging areas when making forest management decisions. The objective of this study was to compare bat foraging activity near the canopy and near the ground in small canopy gaps in a mature hardwood forest in the southern Appalachian Mountains. The average area of the canopy gaps was 89.3 m^2 ± 33.9 (min = 8.1 m^2, max = 325.3 m^2). Data collected may serve as baseline data for future studies after scheduled timber harvests have occurred. From 2 June through 1 July 2011, we passively deployed Anabat SD2 detectors at 26 points in 16 stands (sampling an average of 3.6 stands/night; with a range of 1-7 stands/night) within a 3 km radius of the central plot, with detectors simultaneously recording data in canopy gaps (n = 29 nights) and just above ground level (n = 33 nights) at each point. Of 85,010 files collected, 3715 were determined to be bat calls. Of these, 2234 came from the canopy recorders and 1481 were recorded by ground level detectors. Canopy Anabats monitored higher activity levels (mean=77.03 ± 15.8 calls/night) than ground level Anabats (mean=44.88 ± 9.3 calls/night). We plan to compare activity levels for high and low frequency phonic groups. It appears bat foraging activity was higher in the higher strata of the forest, though the difference was not statistically significant (P = 0.052). This higher activity may relate to the presence of less clutter, as clutter might attenuate bat echolocation calls or obstruct flight. Bats may find canopy gaps easier to navigate or canopy gaps may contain more insect prey. Therefore, management activities that create small open patches may provide foraging grounds for forest bats.

BAT OCCUPANCY OF FOREST AND MANAGED SAVANNA AND WOODLAND IN THE MISSOURI OZARKS

Clarissa A. Starbuck, Sybill K. Amelon Ph.D., and Frank R. Thompson, Ph.D., *University of Missouri, Columbia, MO (CAS); U.S. Forest Service, Northern Research Station, Columbia, MO (SKA, FRT)*

Many Missouri agencies are restoring native savannas and woodlands with prescribed fire and forest thinning. Little is known about how bat foraging varies among savanna, woodlands and forest. We identified management compartments that are actively managed for savanna and woodland conditions and control areas that consist of sites with similar landform but no recent management and have succeeded to more closed canopy forest. We are using Anabat II bat detectors with Zero-Crossing Analysis Interference Modules with Compact Flash memory storage (CF ZCAIM) and SD1 (combined Anabat detectors and CF ZCAIM unit; Titley Electronics) to survey bats at several points during May to July of 2011 and 2012. The objectives are to evaluate a priori hypotheses concerning how bat foraging activity varies among savanna, woodland, and forest habitats in the Missouri Ozarks and their relative location within the landscape. We hypothesize that: the probability of detecting bat species with acoustic detectors will vary by species and is affected by temperature, relative humidity, tree density, Julian date, distance to water, time of night and abundance; the probability a site is occupied by

foraging bats varies among species as a function of forest type, tree density, distance to water, distance to flyways (trails or small forest roads), distance to urban areas, canopy closure, tree diameter, vegetative composition, interspersion and road density; and vegetative structural conditions created by savanna woodland restoration and management result in greater occupancy of *Myotis septentrionalis*, *Lasiurus borealis*, *Nycticeius humeralis*, *Eptesicus fuscus*, and *Perimyotis subflavus* than in mature, un-managed forest.