Project Title: **Distribution and Day Roost Preferences of Eastern Small-footed Bats (*Myotis leibii*) in the Ouachita Mountains**

Project Summary: The goal of this project is to define the distribution of roost sites for *Myotis leibii* in glades, talus slopes, and rock outcrops in the Ouachita Mountains of west-central Arkansas. Specifically, we will randomly select potential locations and survey using a combination of acoustic monitoring, roost searching, and mist-netting. The objectives are to: 1) map potential habitat throughout the region; 2) define the distribution and frequency of occurrence of this species in the region; and 3) derive a model to predict occurrence of the species based on characteristics of sites.

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Project Budget: Total budget for the project is $119,390 over 2 years. Of this we are requesting $66,323 (56%) in SWG funds through the Arkansas Game and Fish Commission. The remaining $53,067 (44%) will be provided by Stephen F. Austin State University as matching in-kind contributions.

Project Statement

a. Need

The eastern small-footed bat (*Myotis leibii*) is a rare insectivorous bat that is susceptible to the devastating disease white-nose syndrome. While this species is widely distributed across the eastern United States and Canada, its occurrence is highly fragmented due to the patchy distribution of its preferred roosting habitat of cracks or crevices in open, rock-dominated areas (e.g., talus slopes and rock faces). The species is considered rare in Arkansas and has a state ranking of S1 (Critically Imperiled) by the Arkansas Natural Heritage Program and is considered an Arkansas Species of Greatest Conservation Need (Sasse et al. 2013). Information on the relative abundance of this species is complicated by its unique roosting habitat. Because of its reliance on these limited habitat features, its true abundance across Arkansas and the Ouachita Mountains remains unknown and no studies have examined its relation to these features in the state. With ongoing concerns about population declines, the spread of white-nose syndrome in Arkansas, and the possibility of future listing of this species, obtaining reliable information regarding its distribution and abundance as well as habitat preferences are crucial to future management.

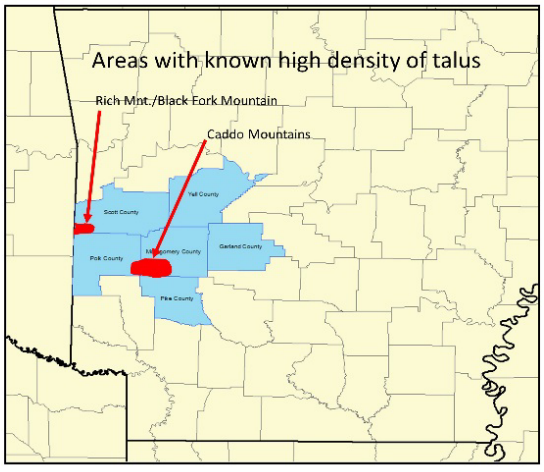
b. Purpose and objectives

The purpose of this project is to better define the distribution and approximate abundance of eastern small-footed bats in the Ouachita Mountains of Arkansas and to improve our understanding of the factors that favor use of various rock features as day roost during summer. Specific objectives include:

1. Create a GIS layer of habitat features across the region, including talus slopes, rocky outcrops, and boulder fields that can be used for future study and management of the species.
2. Determine presence of small-footed bats at sites and estimate detection probability via various survey methods (e.g., acoustic surveys, constrained searches, mist netting).
3. Using occupancy modeling, quantify the influence of various local (e.g. percent loose rock, area of exposed rock, size of component materials) and landscape (e.g., distance to forest, distance to river or stream, slope, aspect) factors on the probability of occupancy by eastern small-footed bats.

c. Location

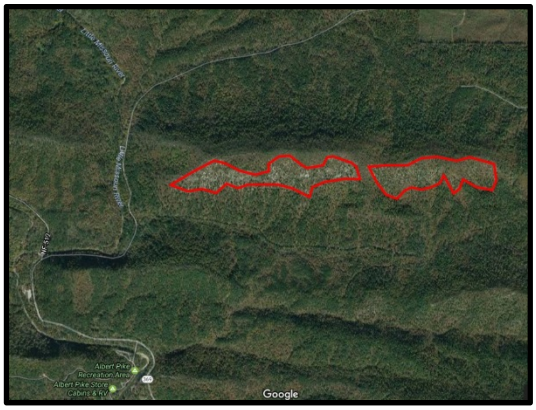
The study will occur in the Ouachita Mountain ecoregion, primarily in Yell, Scott, Polk, Montgomery, Garland, and Pike Counties. Two areas are noteworthy for extensive talus, rocky outcrops, rocky glades, and boulder fields: the Rich Mountain and Black Fork Mountain area and the Caddo Mountains.



d. Approach

The eastern small-footed bat roosts in crevices and under rocks in talus slopes, rock outcrops,

and cliff faces (Johnson et al. 2011) and anthropogenic structures such as bridges (Thomson 2013). Therefore, we will focus our surveys on rock features in the area using multiple survey techniques (e.g., acoustic monitoring, area-constrained searches, and mist-netting) at a randomly selected subset of identified potential habitat. Surveys will focus on determining occupancy and relative abundance of *M. leibii*; multiple visits will allow calculation of detection probabilities (MacKenzie et al. 2006). This approach will consist of four tasks. Over the two survey years, we estimate that we will survey between 60 and 65 rock features that are potential roost sites for *M. leibii*.



***Task 1*:** We will create a GIS layer of potential habitat (rock features including talus slopes, rock glades, rock outcrops, and boulder fields) within the Ouachita Mountains ecoregion digitized from aerial and satellite imagery.

***Task 2*:** During summer, we will visit a subsample of habitats. At each site, we will place 2 Pettersson D500x (or similar) acoustic monitoring devices, and sites will be monitored for 5 consecutive nights. Data will be analyzed using Sonobat 4 (Ozark-nGA) to determine presence of *M. leibii*. Concurrently with acoustic surveys, we will conduct visual searches in 8-10, 6m-radius plots following the methods of Moosman et al. (2015).

Task 3: For areas with positive *M. leibii* acoustic results but without positive search results, mist-net surveys will be conducted. All bat capture and handling will be done in accordance with established guidelines for handling wild mammals (Sikes et al. 2011) and the latest version of the National White-Nose Syndrome Decontamination Protocol.

Task 4: For each survey site, we will estimate various parameters that my influence suitability for occupancy by *M. leibii*, including feature type (talus, cliff, outcrop, glade), average size of rock fragments, percent sun exposure, canopy cover, aspect, slope, area of the rock feature, elevation, and distance to the nearest road and water feature.

Data Analysis

We will determine occupancy and detection probability for rock features using program PRESENCE or a similar program (MacKenzie et al. 2006). We will develop a set of candidate models incorporating the survey method (acoustic, search, net) and the various feature-specific variables, as well as a null model and global model. Models will be ranked using information theoretic (e.g., Akaike's Information Criterion) and/or maximum likelihood methods. Highest ranked models will be used to estimate method-specific detection probabilities, overall probability of occupancy, and the influence of feature variables on the probability of occupancy.

Timeline

October 1-December 31, 2017: Initial meetings with project partners to identify potential sites and gather spatial data. Recruit M.S. student to start January 1, 2017.

January-April 2018. Initial identification of rock features from digital imagery, construction of priority list, prepare for first field season.

May-August 2018. First season field surveys.

September-December 2018. Analysis of year 1 data. Refine survey techniques based on experience in first season.

January-April 2019. Reevaluate digital imagery to refine list of rock features based on year 1 experience. Revise priority list as needed. Prepare for field season 2.

May-August 2019. Second season field surveys.

September 2019. Prepare final report.

e. Expected results and benefits

This project will benefit the AGFC and the Arkansas Natural Heritage Commission by allowing more informed management of *Myotis leibii*, a species of greatest conservation need and giving managers a better idea of the relative abundance of the species across the region. We will provide a GIS layer of potential habitat across the region along with known occupied sites, which can be used to guide future conservation efforts for this species. Furthermore, the modeling effort will indicate what features are most important in determining suitability of a rock feature for day roosting, and will aid in targeting future survey and conservation efforts towards sites with greatest probability of occupancy. Finally, as a side benefit of acoustic and mist net surveys, we will obtain information regarding distribution and relative abundance of other SGCN bat species in the region, potentially including the Seminole bat (*Lasiurus seminolus*), southeastern bat (*Myotis austroriparius*), and gray bat (*M. grisescens*). Results will be presented at regional (e.g., Southeastern Bat Diversity Network), national (e.g., American Society of Mammalogists), and international (e.g., North American Symposium on Bat Research) scientific meetings and published in peer reviewed publications (e.g., *Journal of Mammalogy*, *Southeastern Naturalist*).

f. Budget

	Year 1		Year 2		Total	
Budget Category	AGFC	Applicant	AGFC	Applicant	AGFC	Applicant
Salaries	17,320	16,920	17,320	16,920	34,640	33,840
Supplies	2,816	-	1,400	-	4,250	0
GIS Lab	-	6,000	-	4,000	0	10,000
Travel	9,158	-	9,658	-	18,816	0
Total Direct Costs	29,294	22,920	28,378	20,920	57,672	43,840
Indirect Costs[1]	4,394	4,687	4,257	4,540	8,651	9,227
TOTAL PROJECT	33,688	27,607	32,634	25,460	66,323	53,067

[1]IDC charged at 15% of direct costs. The difference between this and SFA standard rate (31%) is listed as matching contribution.

Qualifications

Christopher E. Comer is a Professor of Forest Wildlife Management at Stephen F. Austin State University in eastern Texas. He received his B.A. in biology from Carleton College in Minnesota, M.S. in environmental pollution control from Penn State, and Ph.D. in Forest Resources/Wildlife Management from the University of Georgia. He has been conducting research on wildlife ecology and forest ecology in the region since 2005, including extensive work on bat ecology and conservation for approximately 10 years. He has published over 25 articles in peer-reviewed journals on a variety of wildlife ecology and management topics, including several related to bat ecology. Dr. Comer has been conducting research on forest management and wildlife in the Ouachita Mountains since 2015.

Roger W. Perry is a Research Wildlife Biologist with the U.S. Forest Service, Southern Research Station in Hot Springs, AR. He received his B.S. in Fisheries and Wildlife from the University of Missouri, his M.S. in Zoology at the University of Arkansas, and his PhD. in Wildlife Ecology from Oklahoma State University. He has been conducting research in ecosystems of the Ouachita Mountains for 25 years. Because of his extensive work in the region, he is familiar with most areas, including potential sites for study. He has published over 25 peer-reviewed publications in national and international scientific journals on bat ecology and bat habitat, along with numerous studies on various aspects of ecology and management in the Ouachita Mountains. His expertise includes many aspects of bat ecology, including roosting and foraging ecology, physiological ecology, disease ecology, and the effects of forest management and climate change on bat populations.