

**2015 ARKANSAS STATE WILDLIFE GRANT PROPOSAL:**  
**FALL ROOSTING ECOLOGY OF RAFINESQUE'S BIG EARED BAT**  
**(*CORYNORHINUS RAFINESQUII*) AND SOUTHEASTERN MYOTIS**  
**(*MYOTIS AUSTRORIPARIUS*)**

Project Summary: Very little is known about the roosting ecology of bats outside of the maternity season (i.e., summer). We propose to radio-tag and track a total of up to 16 Rafinesque's big-eared bats and 16 southeastern myotis to diurnal roosts in order to describe habitat used by these species in two fall seasons: 8 bats of each species in September 2015 and 8 bats of each species in October 2016. The specific study area will be determined jointly between Copperhead Consulting biologists and the Arkansas Game and Fish Commission, but we propose that state or federal land be used in southern or eastern Arkansas. These areas house optimal habitat as established by the Arkansas Wildlife Action Plan and there are Wildlife Management Areas within the range of this habitat. In addition to locating diurnal fall roosts, we will place temperature data loggers in select anthropogenic roosts if possible and use weather data to determine if there is a correlation with roost use. The data collected will provide land managers with information about roosting requirements to allow for preservation of roosts and help fill knowledge gaps for these sensitive species.

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Project Partners:

None

Budget:

65% SWG amount requested: \$30,612.65

35% match amount provided: \$16,483.74

**100% Total amount of project: \$47,096.39**





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(*MYOTIS AUSTRORIPARIUS*)**

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## TABLE OF CONTENTS

Project Summary .....	1
Statement of Need.....	1
Goals and Objectives .....	1
Location.....	2
Approach.....	2
Bat Capture and Transmitter Attachment.....	2
Radio-Telemetry.....	4
Expected Results and Benefits.....	5
Budget.....	5
Literature Cited .....	7
Qualifications.....	8

### List of Tables

Table 1. Total project funds breakdown for Fall 2015 and Fall 2016 CORA and MYAU roosting ecology study.....	6
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### List of Figures

Figure 1. River drainages within Arkansas for potential study of fall roosting ecology of Rafinesque’s big-eared bat ( <i>Corynorhinus rafinesquii</i> ) and southeastern myotis ( <i>Myotis austroriparius</i> ).....	3
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## PROJECT SUMMARY

### Statement of Need

Although summer surveys have provided roosting information for maternity colonies of many species of bats, information outside of this life stage is very limited. Arkansas Game and Fish Commission (AGFC) personnel specifically identified Rafinesque's big-eared bat (*Corynorhinus rafinesquii*; CORA) and southeastern myotis (*Myotis austroriparius*; MYAU) as species of interest regarding fall roosting ecology. Even less is understood about their ecology than some other bat species due to their lack of federal protection and low capture rates during summer surveys targeting federally endangered bats. Although not federally endangered, CORA are considered state listed as threatened, endangered, or a species of special concern in 89% of the states where they are found (16 out of 18 states), and MYAU are state listed in all 16 states in which they are found (BCI and SBDN 2013). Major threats to these species include loss and degradation of bottomland hardwood and mature upland forests, altered hydrology, loss of natural and anthropogenic roosting habitat, climate change, disturbance at roosts, and potentially white-nose syndrome (WNS; BCI and SBDN 2013). Both species utilize a variety of roost types including hollow trees, abandoned buildings, cisterns, culverts, caves, and bridges, both in summer and fall (BCI and SBDN 2013) with portions of the same roost being used in different times of the year (Hoffmeister and Goodpaster 1963, Hurst and Lacki 1999, Roby et al. 2011). Much of the fall and winter information about CORA and MYAU has been gathered by periodic checks of anthropogenic structures for habitation rather than concerted effort to determine roost use during these times. As a result, very little is known about the natural roost use of these species during the non-reproductive time of the year.

### Goals and Objectives

The goal of this study would be to understand the roosting ecology of CORA and MYAU during the fall in southern or eastern Arkansas. Objectives to meet that goal would include:

- 1) Document fall roost use by CORA and MYAU
- 2) Document movement between roosts
- 3) Compare and contrast natural and anthropogenic roosts
- 4) Analyze weather data (e.g., ambient temperature, precipitation, relative wind speed) with roost type and roost switching

## **Location**

According to the Arkansas Wildlife Action Plan, Optimal Habitat for both species appears to be in the Ouachita River and Saline River drainages in the southern portion of the state. In addition, the Cache River drainage is considered Optimal Habitat for CORA and Suitable Habitat for MYAU (Fig 1). We will work closely with Arkansas Game and Fish Commission (AGFC) to determine the best location for this project. Several WMAs exist near these drainages and federal land is also a possibility as a project location.

## **Approach**

### *Bat Capture and Transmitter Attachment*

In order to determine fall roosting ecology of CORA and MYAU, Copperhead will attach radio-transmitters to bats in September 2015 and again in October 2016. We will work closely with AGFC to determine the most likely areas of catching these species in fall. Bats will be captured in mist-nets and/or collected from anthropogenic structures and radio-transmitters will be placed on up to eight bats of each species in each year. Radio-transmitters are expected to be operational for 20-25 days, so it is anticipated that we will collect approximately a month of data each year.

Mist-netting will take place on the landscape as determined by AGFC and Copperhead biologists. The location of each survey site will be recorded using handheld GPS units. Mist-nets will be checked every 10-15 minutes and disturbance near the nets will be kept to a minimum. Weather data will be recorded for each site on an hourly basis. Low visibility nylon nets, 6 - 18 meters wide will be used. Single, two, and/or three tier net sets, 6 - 9 meters high, with nets stacked on top of one another, will be used as deemed necessary.

Data recorded for captured bats will include capture time and location within the anthropogenic roost (if appropriate), species, sex, age, reproductive condition, weight (g), forearm length (mm), and potential WNS based on the Reichard wing damage scoring index (Reichard and Kunz 2009). Captured bats will be fitted with uniquely numbered aluminum-lipped bands (Porzana Ltd, East Sussex, United Kingdom) supplied either by the state or Copperhead, if approved.

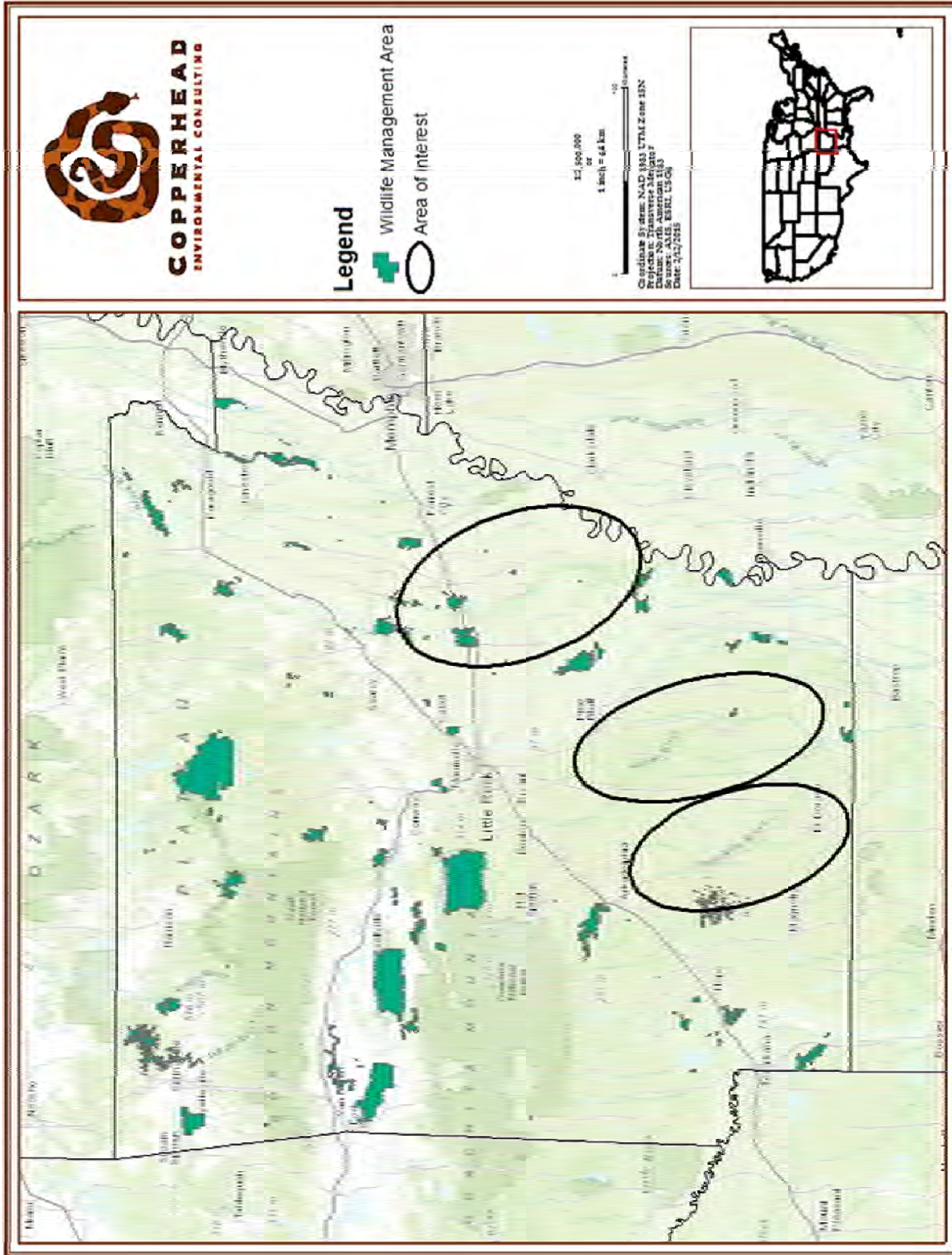


Figure 1. River drainages within Arkansas for potential study of fall roosting ecology of Rafinesque's big-eared bat (*Corynorhinus rafinesquii*) and southeastern myotis (*Myotis austroriparius*).

Focal bats will be fitted with radio-transmitters (Holohil LB-2N or LB-2X) that will weigh  $\leq 0.42$  grams and will be activated and tested before being attached to bats. A small interscapular area will be trimmed of fur and the transmitter affixed with non-toxic Perma-Type Surgical Cement® (Plainville, CT). Transmitter weight will not exceed 5% of the bat's body weight and the transmitter plus adhesive will not exceed 6% of the bat's body weight.

Special caution will be taken during all activities to minimize the potential for transmission of WNS by following the "Disinfection Protocol for Bat Field Research/Monitoring" and/or other USFWS approved methods.

### *Radio-Telemetry*

The day following transmitter attachment, at least two ground crews will mobilize to search for transmitter signals from radio-tagged bats. Ground crews will be in trucks consisting of two people each. Ground vehicles will be outfitted with mast-mounted five-element Yagi directional antennas, telemetry receivers, two-way radios, cell phones, GPS units, compasses with magnetic declination setting, and laptops with GIS software. All field personnel will be well trained and proficient with the use of all equipment.

Once a roost is identified, coordinates for each roost will be collected with a handheld GPS unit, photographed, and the surrounding habitat will be described. Roost tree data will include: species, DBH, height, type of roost (i.e., bark, crevice, or cavity), canopy cover, condition (i.e., snag, live, or live damaged), and dates used by radio-tagged bats. Surrounding habitat will be characterized and a 10 factor English prism will be used to determine basal area (centered on roost tree). If the roost is not a tree, notes will be taken on the type of structure and the roost location within. Other notable features such as water sources, roadways, managed forest areas, and agriculture will be determined via GIS in post-processing of the data. If it is not possible to visually count all the bats in a roost, efforts will be made to conduct exit counts on as many roosts as possible on as many nights as possible. However, exit counts of these species from natural roosts are notoriously difficult without night vision equipment. In order to collect temperature data, iButton temperature data loggers (Maxim Integrated, San Jose, CA) will be placed in anthropogenic roosts that are stable and available for entry. Additional weather data will be collected from Weather Underground ([www.wunderground.com](http://www.wunderground.com)).



Copperhead owns two planes and employs two biologist pilots. If ground tracking proves to be unsuccessful, we will conduct aerial searches for missing bats. This method has been useful for locating radio-signals that were not detectable by ground crews, either because of their distance from a road or the bat being outside of an expected radius from the capture site. It saves several hours of multiple ground crews driving in search of a signal and often results in the collection of more data than from ground crews alone.

### **Expected Results and Benefits**

A full project report will include, at minimum, summaries of all captured bats, summary of all roosts identified, description of bat movement, analysis of weather data as it relates to roosting bats, maps of capture sites and roosts, representative photographs of bats and roosts, and copies of data sheets.

By determining roosts used by CORA and MYAU in the fall, Copperhead would address knowledge gaps identified in Arkansas' Wildlife Action Plan by documenting their use of habitat outside of the summer maternity season. These data would allow landowners and land managers to more accurately identify and manage potential roost trees and anthropogenic structures that these species may use. Since bottomland hardwood forests have dwindled in the last several decades with approximately 60% loss in the last 200 years (EPA 2012), non-natural structures have become important roost resources for these potentially imperiled bats. Many abandoned buildings, silos, wells, and other anthropogenic structures used as roosts can be modified to provide optimal habitat. An excellent example of this is at Mammoth Cave, Kentucky where an old silo-type building was converted into a maternity roost for CORA, complete with monitoring system (MACA 2014). In addition, it is possible to erect artificial roosts specifically constructed for these bats in areas where roosts are limited. Determining what requirements are needed in particular areas can help determine which structures would be most useful in the conservation of these species statewide.

### **Budget**

This budget narrative provides our best estimate of when project activities will occur. Copperhead will dispatch two teams of two biologists each (four people total) to capture, attach transmitters to, and track focal bats over the course of the project. We anticipate two study

periods of data collection. The actual length of each study period will be dictated by transmitter life but we anticipate approximately 30 days per study period for travel, reconnaissance, bat capture, and tracking. The first study period will take place from approximately 5 October - 3 November 2015. The second study period will take place from approximately 5 September - 4 October 2016. Our goal will be to attach 8 transmitters to each species in each study period (i.e., total of 16 CORA and 16 MYAU). Table 1 and Table 2 provide a breakdown of SWG funding and Copperhead matching funds, respectively.

Table 1. Total project funds breakdown for Fall 2015 and Fall 2016 CORA and MYAU roosting ecology study.

		Hourly Rate	Hours	Cost	Total Cost
<b>Personnel</b>	Principal	\$ 22.57	8	\$180.56	
	Project Manager	\$ 22.57	548	\$12,368.36	
	GIS Analyst	\$ 16.83	40	\$673.20	
	Biologist 1	\$ 12.69	442	\$5,608.98	
<b>Personnel Total</b>					\$18,831.10
<b>Travel</b>		<b>Rate/mi</b>	<b>Miles</b>	<b>Cost</b>	
	Mileage	\$ 0.56	3,500	\$1,960.00	
		<b>Rate/Day</b>	<b>Days</b>	<b>Cost</b>	
	Lodging	\$ 50.00	120	\$6,000.00	
	Meals	\$ 46.00	120	\$5,520.00	
<b>Travel Total</b>					\$13,480.00
<b>Equipment</b>		<b>Rate/Unit</b>	<b>Units</b>	<b>Cost</b>	
	Transmitters	\$ 204.00	16	\$3,264.00	
	Plane	\$ 135.00	32	\$4,320.00	
<b>Equipment Total</b>					\$7,584.00
<b>Fringe (.17)</b>					\$3,201.29
<b>Overhead</b>					\$4,000.00
<b>TOTAL PROJECT VALUE</b>					<b>\$47,096.39</b>
<b>Matching funds</b>					\$16,483.74
<b>SWG funds</b>					\$30,612.65

## Literature Cited

- BCI and SBDN (Bat Conservation International and Southeastern Bat Diversity Network). 2013. A conservation strategy for Rafinesque's Big-Eared Bat (*Corynorhinus rafinesquii*) and Southeastern Myotis (*Myotis austroriparius*). Bat Conservation International, Austin, TX. 101 pp.
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- Roby, P.L., M.W. Gumbert, P.L. Sewell, and S.W. Brewer. 2011. Characteristics of roosts used by Rafinesque's big-eared bat (*Corynorhinus rafinesquii*) on Camp Mackall, North Carolina. Pages 101-110 in Loeb, S.C., M.J. Lacki, and D.A. Miller (eds.), Conservation and management of eastern big-eared bats: a symposium. USDA, Forest Service, Southern Research Station, GTR SRS-145. Asheville, North Carolina.

## QUALIFICATIONS

**Piper Roby** has an M.S. in Biology for the University of Louisville and has worked with bats for 10 years. She is proficient at mist-netting, harp trapping, and hand collection of bats, as well as radio-tagging, tracking, and evaluating roost habitat. Ms. Roby radio-tagged and tracked CORA for four years at Ft. Bragg, NC. Bats were tracked to natural roosts which were identified to species and habitat characteristics were identified. Many bats were also tracked to artificial structures including abandoned buildings and underground culverts. Ms. Roby is the lead author of an article describing these roosts and their various temperature regimes (Roby et al. 2011). MYAU were also captured and tracked on this project, but no roosts were located for the species. It is believed that the current plane and biologist pilot combination would be able to detect any bats that were not accounted for by ground crews.

**Mark Gumbert** has an M.S. in Biology from Eastern Kentucky University and has worked with bats for 20 years. Mr. Gumbert also radio-tagged and tracked CORA for four years at Ft. Bragg, NC. As co-author on the article mentioned above (Roby et al. 2011), Mr. Gumbert was intimately involved in the data collection for that project. He has also tracked CORA at Mammoth Cave and at Ballard WMA, both located in Kentucky. As a biologist pilot, he would be capable and qualified to aerially search for missing bats on the landscape, should the need arise.

**Steve Samoray** has an M.S. in Biology from Middle Tennessee State University and has worked with bats for 17 years, including various capture techniques and tracking. He has extensive experience in trapping, identifying, and radio-tracking bats via ground and aerial methods. As a biologist pilot, he would be capable and qualified to aerially search for missing bats on the landscape, should the need arise.