FALL AND WINTER ECOLOGY OF *CORYNORHINUS RAFINESQUII* AND *MYOTIS AUSTRORIPARIUS* IN ARKANSAS

Project Summary:

Many North American bat species have been negatively impacted by human disturbance, disease, and habitat loss. Two species in Arkansas which have suffered tremendous habitat loss due to the conversion of forested wetlands to agricultural use are Rafinesque's big-eared bats and southeastern myotis. Both species use hollow trees in swamps as roosting sites. Very little is currently known about the winter ecology of these species, and comparisons between summer and winter roost locations is lacking. This study seeks to investigate the fall and winter roosting ecology and activity patterns of these bats at two sites in Arkansas. Study objectives include describing winter roost structures, determining if the two species use similar or different winter roosts, comparing winter roosts to summer roosts, identifying yearly home-ranges of both species, determining the timing of seasonal movements, and identifying winter activity patterns.

Project Leader:

Dr. Brian Carver
Assistant Professor of Biology, Tennessee Technological University
Department of Biology, Box 5063, TN Tech University, Cookeville, TN 38505
Phone: 931-372-3127, Email: bcarver@tntech.edu

Project Partners:

None

Project Budget:

AGFC SWG Funding Request:	$153,329
Tennessee Tech Project Match:	$ 82,561
Total Project Costs:	$235,890

Project Statement (pages 2-4)

a. Need – North American bats have been adversely impacted by habitat loss, disturbance, and more recently by disease. The recent discovery of white-nose syndrome (WNS) in North American bats has led many researchers and management agencies to realize that basic ecological data is lacking for many species. Rafinesque's big-eared bats (*Corynorhinus rafinesquii*, hereafter CORA) and southeastern myotis (*Myotis austroriparius*, hereafter MYAU) are closely associated with bottomland floodplain forest systems and as such were once widely distributed across the Mississippi River Alluvial Plain and the West Gulf Coastal Plain physiographic regions. Significant habitat loss and alteration occurred with the conversion of the majority of these areas for agricultural use. Arkansas has lost 72% of its pre-colonial era forested wetlands, including a staggering 89% loss in the Mississippi Delta (Mississippi River Alluvial Plain) region. Both species have an Arkansas state rank of S2 (imperiled), both are listed in the Arkansas State Wildlife Action Plan as species of Greatest Conservation Need (GCN), and both have shown a decreasing population trend.

   Several recent investigations have examined the summer roosting ecology of these species, but to date only a handful of investigations have made any attempt to document the winter ecology of the species including roosting ecology and activity during these time periods. Appropriate management of these species can only be achieved by an improved understanding of their ecology that examines year-round details of their natural history.

b. Purpose and Objectives – The purpose of this investigation will be to document the fall and winter roosting ecology and activity of both CORA and MYAU in Arkansas. The following objectives will be examined: (1) describe the types of roosting structures used by CORA and MYAU in the winter; (2) compare winter roost structures to roost structures used in other seasons; (3) compare winter roost structures to other available structures to determine the features that impact roost selection; (4) compare roost structures selected by CORA and MYAU to determine seasonal differences in roost selection between the species; (5) determine the frequency of roost switching and foraging activity during winter; (6) identify the size of winter roost areas used by colonies of CORA and MYAU; (7) assess the spatial relationship between summer and winter roosts to generate year-round home range estimates; and (8) determine the number of bats occupying winter roosts.

c. Location – Research will be conducted at one or two locations. Two locations (one near the northern end of the state and one near the southern end of the state) will be utilized if possible to examine variability in data related to the objectives. Variability could be influenced by differences in habitats, flood regimes, or temperatures. The northern site would likely be the Earl Buss Bayou DeView Wildlife Management Area in Poinsett County. The southern location would probably be the Overflow National Wildlife Refuge in Ashley County (Fig. 1). Climate at the southern site averages 3-4 °C warmer winter high temperatures, 1.5-3 °C degrees warmer low temperatures in winter, and nearly 23 cm more annual rainfall. Bottomland floodplain forest (especially areas dominated by cypress or tupelo trees) would be the initial target areas during summer or fall to locate bats before they move to wintering sites. Both sites are located within the Mississippi River Alluvial Plain.

d. Approach – Roost structures will be identified through visual searches and via radiotelemetry. Trees within appropriate habitat types will be examined for the presence of cavities that could be used by roosting bats. Cavities will be examined through the use of a flashlight and mirror or with a borescope. When necessary trees will be climbed using basic arborist techniques to access cavity openings for examination. In addition to these opportunistic searches, radiotelemetry will also be used to identify roost structures. Bats will

be captured along flyways with mist nets or exiting roost structures with mist nets or harp traps. Radiotransmitters will be affixed to the back of bats with surgical cement and bats will be tracked daily for the first 7 days of each 14-day period to locate roost structures (radio-transmitters will have an expected battery life of 14 days). Up to 4 bats total (2 CORA and 2 MYAU) will have transmitters affixed during each 14-day period. On day 14 of each tracking period an attempt will be made to capture new bats so that new transmitters can be activated. Daily tracking during days 1-7 will also allow estimation of activity patterns including roost switching. Bats will be tracked year-round so that sufficient data are available for seasonal comparisons of roosting ecology.

Every roost identified will have a suite of variables measured including tree species, tree diameter, cavity opening dimensions, etc. Tree locations will be identified via GPS so that spatial data can be evaluated such as roosting core area, distance between roosts, roost tree densities, distances to permanent water and edge, etc. Opportunistic surveys will also allow for unoccupied trees with cavities to be identified so that available but unused trees can be compared to used trees to help better understand roost tree selection.

Bat activity will be assessed via roost switching of radiotagged individuals. Some night-time telemetry may be conducted if feasible to examine foraging patterns during winter months. Ultrasonic acoustic data will also be collected at selected locations near known roosts to help identify winter activity patterns. Because of known differences in ultrasonic vocalization characteristics, this technique should provide useful data for MYAU but may not be very valuable for assessing CORA foraging (hence the use of some nighttime telemetry data collection).

Dataloggers will be placed in selected roost structures (both summer and winter roosts) to collect temperature and relative humidity data year-round. Dataloggers will also be placed in available but unused structures for comparison and outside roosts to collect ambient data. These climate data will be analyzed to assess climate differences between summer and winter roost structures as well as to determine if differences in temperature or humidity exist in roost structures chosen by the two bat species, and between used and unused roost structures.

Research will be conducted at the northern study site in 2015-2016 and the southern site in 2016-2017. The northern site will not have active telemetry after October 2016, but winter roosts identified the previous year will be periodically examined during the 2016-2017 winter to examine site fidelity.

Roost data will be analyzed via occupancy modeling, multiple regression, or other statistical approaches as appropriate. Winter activity patterns will be examined by species and will incorporate climate data.

The expected timeline is as follows:

October 2015 – Begin capture and telemetry at northern site, deploy dataloggers as roosts are identified

Summer 2016 (May-August) – Measure roost and habitat characteristics at northern site

October 2016 – Begin capture and telemetry at southern site, deploy dataloggers as roosts are identified

December 2016 – Preliminary report summarizing year 1 research

Summer 2017 – Measure roost and habitat characteristics at southern site

30 September 2017 – Cease field data collection

December 2017 – Preliminary report summarizing years 1 and 2 research

May 2018 – Final report submission

e. Expected Results and Benefits – This investigation is expected to document the types of winter roost structures used by both CORA and MYAU, provide information about the timing of seasonal movements to and from summer and winter habitats, provide information about any differences in winter roosting ecology between the species, and determine the level of activity occurring during winter for both bat species. The benefits of this research include the ability to determine times of year when management activities are least likely to impact maternity colonies of these bats, inform managers about the types of winter roosts and provide useful information about the year-round size of habitat patches utilized so that minimum roost areas are known. Results can also be utilized as an aid in habitat management for multiple species to ensure that management actions taken for some species (such as wintering waterfowl) are not harmful to these rare bottomland forest bats. Both bat species targeted in this research are GCN species.

f. Budget – A summary budget is presented below. A more detailed budget is presented separately.

Category	AGFC	TTU
Personnel	55,382	24,000
Benefits	4,889	367
Tuition and Fees		13,589
Travel	10,340	
Civil Air Patrol Costs	2,000	
Supplies	66,779	
Total Direct Costs	139,390	37,956
Indirect Costs @ 10%	13,939	
Indirect Costs Cost Share @42% - 10%		44,605
Total	**153,329**	**82,561**

Qualifications.

Dr. Brian Carver has been working with bats for more than 15 years and has done research or consulting work with bats in Georgia, Illinois, Missouri, North Carolina, Pennsylvania, Tennessee, and West Virginia. Dr. Carver has twice served on the Board of Directors for the Tennessee Bat Working Group (http://www.tnbwg.org/) and will begin serving as President of the Southeastern Bat Diversity Network (http://sbdn.org/) in March. He is federally-permitted to work with both gray bats and Indiana bats throughout their range.

Dr. Carver has extensive experience capturing bats, performing radio-telemetry to identify roosts, and performing emergence counts at roost structures. He has conducted the only research on the ecology of sympatric southeastern myotis and Rafinesque's big-eared bats in Tennessee, working in habitat conditions very similar to the floodplain forest systems of eastern Arkansas. His work has involved monitoring populations of these two species through the fall documenting the timing of movements away from summer roost structures as well as characterizing and comparing habitat features associated with roost structures.

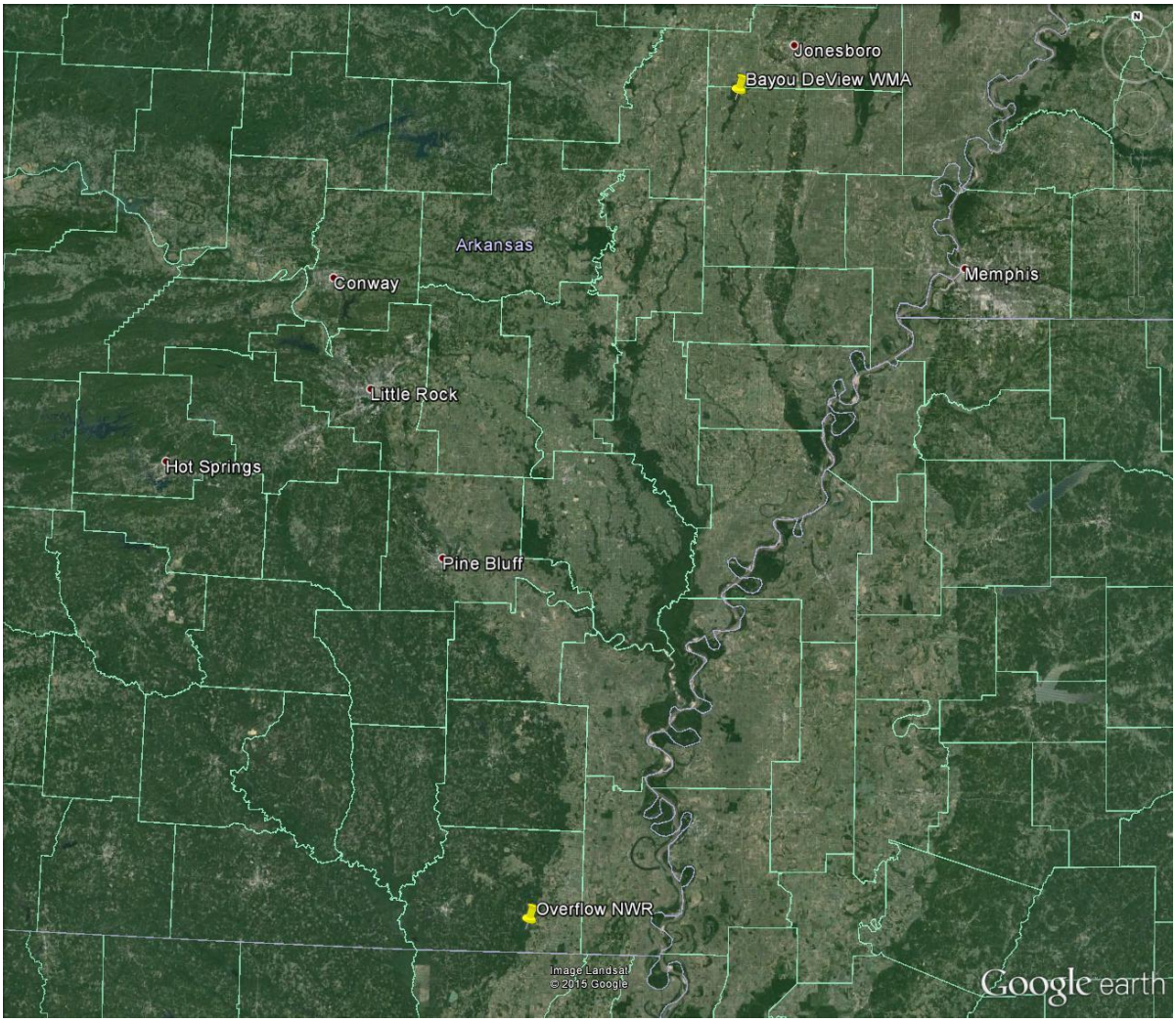

Figure 1. Proposed locations for a study of the fall and winter ecology of Rafinesque's big-eared bats and southeastern myotis in Arkansas, 2015-2017.