

FINAL PERFORMANCE REPORT
South Carolina State Wildlife Grant F06AF00025 (T-23-R)
Controlling Access to Known and Potential Bat Roosts
October 1, 2006 – September 30, 2011

GRANT OBJECTIVE

Restriction of human access to large colonies of priority species contributes to bat population stabilization because human disturbance is a very significant threat to most bat colonies. Properties need to be evaluated for significant roosts and in some cases agreements can be developed to ensure important tree, cave, rock shelter, and man-made roosts (mines, bridges, and old cisterns) continue to be available to bats as roosts.

This project primarily focused on three “high” priority species from South Carolina’s Comprehensive Wildlife Conservation Strategy (CWCS), the Rafinesque’s big-eared bat (*Corynorhinus rafinesquii*), southeastern myotis (*Myotis austroriparius*), and small-footed myotis (*Myotis leibii*), but also included other formerly more common colonial species. Installation of bat-friendly gates or otherwise restricting human access to known significant roosts of those species was the foremost objective of this project. Locating additional significant bat roosts was another important aspect of this project. Our efforts included partners from federal, state, and local government as well as private and nonprofit organizations.

It is important to note that since the implementation of this project a new threat to colonial cavity roosting bats emerged. White-nose Syndrome (WNS) is a new source of mortality to all cave or mine roosting bats. The newly described fungus associated with WNS, *Geomyces destructans* prefers to grow in a cool moist environment. This disease may cause once common colonial species, such as *Myotis lucifugus*, to become rare or be extirpated.

Since its discovery, WNS has rapidly spread throughout the northeast and into the southeast. It is currently as far south as Transylvania County, North Carolina, which bounds South Carolina. It is reasonable to expect WNS in South Carolina. Because one source of WNS spread may be via recreational cavers, the US Forest Service has temporarily banned public access to caves and mines. Our proposed gating of some significant mines serves that mandate very well.

ACTIVITY OVERVIEW:

The activities associated with this grant are provided under each objective. The two objectives for this grant were to protect and monitor known significant bat roosts where willing partners or landowners were available and to survey for and identify additional potential bat roosts.

Objective: I. Protect and sample at known significant bat roosts at sites where we have willing private or public partners or cooperators.

Jobs:

Job 1. Construct bat-friendly physical barriers to reduce human disturbances to roosts at 2 or more significant sites.

Job 2. Work with partners to secure funding and management support for future incorporation of a private tract in Oconee County into the Sumter National Forest.

Job 3. Seek written agreements, such as Memoranda of Understanding or Site Registrations, with government or nonprofit, owners/managers of significant roost sites. Potential partners would be the SC Army National Guard, SC Parks Services, and the SC Department of Transportation.

Activity: Job 1 minimum goals were met in the first two years of the project. The first two mines gated were done by insertion of a four-foot diameter pipe; and then the gates were welded to the outside of the pipe. The metal culvert pipe insertion prevents vandals from easily digging around a gate that is placed in soft substrate. It also reduces the likelihood of entrance collapse. The US Forest Service provided some financial assistance to gating efforts on the Sumter National Forest. That allowed this project to include more sites than first anticipated.

We considered bat-friendly gating of ten high priority sites (based on bat numbers or the presence of state endangered Rafinesque’s big-eared bats). An expert at bat-friendly gating, Joel Tigner, of BatWorks, was hired to construct the first mine and tunnel bat-friendly gates, and also he provided his expert opinion whether most of the sites were amenable to gates. Of the ten sites, only six sites could accept a gate if access issues could be resolved. With his help we determined that two major cave roosts, the Table Rock and Santee caves on South Carolina State Parks property, were not amenable to gating. The Table Rock site could be damaged or disrupted by the gating and the entrances are too small. The Santee site has multiple entrances, some of which are unstable and/or too small, and a year-round stream flows through the relatively small entrance and exit. Gating could result in blockage or flooding.

All of the mines or tunnels fitted with bat-friendly gates were in Oconee County, South Carolina (Table 1). This was by geographic happenstance, not by design. The sites with important roosts and cooperating land owners happened to be in Oconee County. It is a mountainous county with numerous intact mines and several intact tunnels whereas many of the old mines in other (mostly Piedmont) counties were either pushed closed or filled (sometimes used as dumps), had entrances too small for gating, were not significant bat roosts, or gating was not desired by landowners. In numerous sites with old gold mines, the mines were being worked.

Table 1. Mines or tunnels gated (G) or modified (M) to benefit bats in Oconee County, South Carolina. Sites are listed by latitude and longitude. Dates are the day the gates were completed as month/day/year. *Perimyotis subflavus* and *Corynorhinus rafinesquii* have been documented in all of these sites.

Site	Alteration & Date	# entrances	Ownership	Additional Funding
34.9386°N, 83.0675°W	G 5/22/07	1	Private	none
34.939°N, 83.067°W	G(2) 9/17/07	2	Private/federal	US Forest Service
34.9321°N, 83.098°W	G 6/02/10	1	federal	US Forest Service
34.932°N, 83.097°W	G 6/02/10	1	federal	US Forest Service
34.8085°N, 83.1139°W	G 10/23/08	1	state (DNR)	The Nature Conservancy
34.8107°N, 83.1238°W	M 4/22/10	2*	state**	none

*Existing gate was modified, an open shaft is only secured by a breached chain-link fence.

**Owned by Clemson University and leased and managed by the City of Walhalla Recreation Department.

The second site, listed above in Table 1, is the most significant known maternity roost and hibernaculum for Rafinesque's big-eared bats in upstate South Carolina. We monitored the entrances with infrared lights and cameras with a night vision mode, for at least one hour for bat activity prior to gating and after gating. Prior to gating in May 2007, 21 Rafinesque's big-eared bats were seen exiting the mine in one hour. After gating (September 2007), we monitored the exits on May 29, 2008 but we experienced failure of auxiliary lights on both systems. There were 58 big-eared bats there on September 29, 2008. We followed up in July 15, 2009 and recorded approximately 84 Rafinesque's big-eared bats exiting the mine (103 exits and 19 re-entries).

We investigated construction of a bat-friendly cupola on an open shaft at the main Stumphouse railroad tunnel and a modification of a wall/gate within the tunnel entrance. That is an incomplete tunnel constructed by the Blue Ridge Railroad prior to the Civil War. It, along with the Middle Tunnel, which we gated in October 2008, is a registered historic site. We evaluated both sites with our cultural resources expert, Sean Taylor, and secured permission from the State Historic Preservation Office to do bat-friendly gating work. However cost estimates for a bat-friendly cupola exceeded this project budget. We then came up with a modified design, a bat-friendly grate, to be done for a lesser cost. We applied for funding from Upstate Forever to help fund that work. The bat friendly-grate funding proposal was declined. However, we did complete a small portion of the proposed improvements to the Clemson University-owned Stumphouse Tunnel. A contractor was hired to 1) install bat-friendly openings in an existing reinforced screen wall, and 2) move and secure the locking mechanism on that gate to be more vandal-proof. Now the existing wall and door within the tunnel (in between the open shaft and the tunnel entrance) allows bat passage and is more vandal-proof to reduce public entry beyond that point. The modifications were completed on April 22, 2010.

Species known to use the main Stumphouse tunnel and the Middle tunnel include big brown bats (*Eptesicus fuscus*), eastern pipistrelles (*Perimyotis subflavus*), Rafinesque's big-eared bats, and Northern long-eared bats (*Myotis septentrionalis*). In both, the predominant species is the eastern pipistrelle or tri-colored bat. The winter count for bats prior to gating of the Middle Tunnel was 123 tri-colored or eastern pipistrelle bats on 15 February, 2008. No other species were noted on that survey. After the bat-friendly gate was completed (October 23, 2008), the winter count on December 11, 2009 yielded 160 tri-colored bats and one big brown bat. An informational sign was erected outside of the entrance of the Middle Tunnel to inform the public that the tunnel was gated to protect the bats from disturbance.

SCPRT prohibits public access to their caves but had no signage, fences or gates in place to protect the Santee limestone sinks at Santee State Park. That site has a significant southeastern myotis colony (*Myotis austroriparius*). As mentioned, the sinks themselves are not amenable to cave gating (due to small entrance size and stream flow), but we offered the SCPRT some assistance in putting up a fence around the site. At one point SCPRT expressed an interest in fencing and we expected to expend the remainder of this funding on that high priority site. But SCPRT decided, given their current staffing and budget constraints; they did not want to have to maintain a fence, so they declined to have a fence placed around the sinks. In 2011 the Parks Service did extend their cave closure to parks staff to reduce potential disturbance to the bats.

Fencing at the Table Rock site isn't a viable option either; it is essentially a massive boulder pile amongst a heavy clay soil component. Drilling could destabilize that system.

Once we had worked through our list of high priority 'permanent-type' roosts we evaluated new sites found and also less permanent building and tree roosts. In some cases it is not possible to retain or protect roosts when the tree or building structure is in decline. Rafinesque's big-eared bats require large open structures for roosts and natural roosts tend to be massive hollow trees. At Silver Bluff, an Audubon Sanctuary, in Aiken County, established to demonstrate active forestry and wildlife conservation, a colony of Rafinesque's big-eared bats has been using an abandoned house. The structure is in disrepair and is slowly collapsing. In anticipation of the eventual collapse of the structure and loss of that roost site, we erected an alternate, concrete CORA (Rafinesque's big-eared) bat roost nearby. We solicited and received input for the design from the Southeastern Bat Diversity Network and Bat Conservation International. Other states have erected similar concrete pipe-type bat towers successfully, but this was the first alternate roost erected for CORA bats in South Carolina. The roost was custom-made in four sections. The diameter is four foot, with a roughened interior for improved roosting, and the middle section of pipe has a triangular entrance hole with a maximum width of 24 inches. We installed the roost on March 15, 2011. By May the roost has been in use by a solitary CORA bat. We expect use to increase as the building roost deteriorates.

In August 2011, we had a similar concrete CORA roost structure erected at Hamilton Ridge Wildlife Management Area in Hampton County. That tract is a recent acquisition by the South Carolina Department of Natural Resources. The majority of the property is in young pine plantation with little promising roosting habitat. Some Rafinesque's big-eared bats are using an old building that is slated for removal. Therefore the concrete roost was placed nearby. That particular roost has a round entry hole rather than a triangular entrance.

Another CORA roost, at Ashmore Heritage Preserve (owned and managed by the South Carolina Department of Natural Resources) in Greenville County, is also in decline. That roost is a large hollow tulip poplar (*Liriodendron tulipifera*). When first located in 1997, the tree was partially alive, but in early 2011 it died. Ashmore Heritage Preserve and neighboring tracts are protected conservation properties, but very few large hollow trees can be found near the roost due to past uses by prior owners. We erected a concrete CORA roost, similar in design to the first one (entrance was reduced to a maximum width of 20 inches), in September 2011, to provide suitable roosting habitat in the interim while other trees grow to suitable size. This site is in the mountains of South Carolina, and the preserve is known to be used by other colonial cavity roosting bats, including Northern-long-eared and little brown bats and tri-colored and big-brown bats, therefore we installed some wooden crevice roosting substrate into the concrete bat tower. A similarly modified concrete bat roost was erected in Pickens County on Sassafras Mountain, within the Jim Timmerman Natural Area at the Jocassee Gorges. There an old CCC area fire tower cabin that sometimes housed bats, predominately little brown bats, had been partially dismantled by vandals. Bats no longer use what remains of that cabin.

Sometimes bats will roost in historic, Civilian Conservation Corps-era, picnic shelters and cabins on state parks. Restrictions on modifications to the structures make it very difficult to adapt the structures to both maintain the bats and continue recreational use of the site. In those situations

providing nearby alternative roosts is the best way to maintain a colony. At Oconee State Park *Myotis* and big brown bats have been using the largest and most popular picnic shelter and the bath house. The bats had filled the very limited roosting area of the picnic shelter between a support beam and the roof. We provided the park with 4 four-chamber bat boxes in September 2010, as alternate roosts, and within two months most of the *Myotis* bats moved to the nearby bat houses.

After that success, we worked with the South Carolina State Parks Service to provide alternate roosts (bat boxes) at Table Rock State Park (Pickens County), and Kings Mountain State Park (Cherokee County) in 2011. A bat box was also provided to the South Carolina Department of Natural Resources Walhalla Fish Hatchery which has a little brown bat maternity colony. That colony is not being excluded. We also provided technical guidance for alternate roosting structures for little brown bats at Devils Fork State Park (Oconee County) because the bats have been entering rental cabins. Those at Devil's Fork will be funded, in part, by Duke Energy, not this project.

Regarding Job 2 of Objective 1, we discussed the possibility of acquisition or easement protection of the site with several nonprofit organizations (Upstate Forever and The Nature Conservancy), the U.S. Forest Service, and the landowner, but currently the owner has decided not to sell and rejected overtures from a conservation buyer. A friendly, open dialogue remains with the landowner and we have good access to the gated bat roost sites for monitoring.

Per Job 3, the South Carolina Department of Transportation was contacted about highway bridge use by bats but the agency was not responsive to entering into any MOA. However, we have been able to encourage inclusion of Rafinesque's big-eared bat roosting structures in at least two highway bridge replacement projects.

The South Carolina Army National Guard has been responsive to further protections of their Rafinesque's big-eared bat roosts in old firing range tunnels at Leesburg Training Site, Richland County. We provided technical assistance on specifications for gates for those sites. Those sites remain off-limits to public and military personnel.

The National Audubon Society and the South Carolina Department of Natural Resources entered into a Memorandum of Agreement to provide for and monitor an alternate roost for Rafinesque's big-eared bats at the Silver Bluff Audubon Center and Sanctuary in Aiken County in March 2011.

Significant deviations: None.

Locate and evaluate potential bat roosts not previously recorded or surveyed.

Objective II: Locate and evaluate potential bat roosts not previously recorded or surveyed.

Jobs:

Job 1. Determine locations and ownerships of potential cave, mine and cistern roost sites, and gain landowner permission to survey these sites.

Job 2. Survey, map, and evaluate the potential roost sites.

Activity: Using “Gold Resources of South Carolina, Bulletin 32” by C.K. McCauley and J.R. Butler (reprinted in 1998 by the South Carolina Geological Survey, South Carolina Department of Natural Resources), “Gold Mine Localities for McCormick, Saluda, and Edgefield Counties, South Carolina” by A.H. Maybin, III, (a 1989 South Carolina Geological Survey Open-file Report 66), and an online resource, www.mindat.org, we mapped old mine records from twenty counties. Not all records were mapped, such as granite quarries (which are exclusively surface mines), or those with only vague locations. Counties with mines mapped from the aforementioned sources were: Abbeville (10), Aiken (1), Anderson (19), Cherokee (124), Chester (1), Chesterfield (7), Edgefield (9), Fairfield (4), Greenwood (2), Greenville (13), Kershaw (4), Newberry (1), Oconee (41), Pickens (9), McCormick (14), Richland (1), Saluda (7), Spartanburg (2), Union (5), and York (64). Sites deemed hazardous because of particulate matter, including all of the vermiculite mines in Laurens County, were not mapped. Some sites were under highways, ponds, lakes and developments. We searched tax records in those counties to determine ownerships to request permission to access the sites. In some cases the mines straddled property lines and in other instances there were several mine or prospect records in a single ownership, for example in York County, 65 records were from 55 ownerships. Owner reply was highly variable with only 9% of owners replying to our request in York County compared to a 60% reply and participation rate in Union County. We had a 12.3% reply rate for Cherokee County. No sites in Aiken, Kershaw, Chester, Chesterfield, Newberry or Richland Counties were surveyed because we either did not have permission or we were informed that the sites were being mined, or adits or tunnels were not there.

Sites on state or federal lands were given priority for survey. Unfortunately most of the reported mines or prospects in the piedmont region were no longer extant, or they never had adits or shafts and were placer mines, and therefore provided no underground bat roosts. During this project we surveyed 48 mine sites that were never surveyed for bats prior to this study. Those sites are listed in Table 2 on the following page. Only fifteen of the sites had adits or an underground component, 9 of those had *Perimyotis subflavus* bats present. Information on the tri-colored bat roosts were sent to the U.S. Fish and Wildlife Service. No other bat species were found. Six of the sites were being mined for gold by amateurs. None of the newly located bat roosts were good candidates for bat-friendly gating because they were either being mined and permissions for gating could not be obtained, or they had entrances too small for gating. Signs, stating “Please do not disturb this bat roost,” were placed at two of the Union County mine sites per landowner request. We also monitored two large open shafts on National Forest, previously known to us, with IR lights and cameras. Those two sites were subsequently sealed closed with foam and covered with soil after we determined they were not used by bats.

We also evaluated 17 old wells, all on the Sumter National Forest, as potential roosts. Many of the old wells were slated for closure by the U.S. Forest Service, Long Cane District; one was on the Andrew Pickens District. Sites with any potential for bats were checked using IR lighting and a night vision camera. No bats were observed at any of the wells, only one black rat snake was recorded.

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Table 2. Mine sites or prospects surveyed, from 2007-2010, for underground bat roosts. The only bat species found was *Perimyotis subflavus*. Only sites with bats are evaluated for physical suitability for gating. P=private, F=federal, S= state, L= local.

Site	Location	structure	# bats	ownership	Suitable for Gating
MC2	34.03312°N, 82.35169°W	none	0	federal	
MC3	34.029248°N, 82.346729°W	none	0	federal	
MC17(3)	34.9122 °N, 82.2997°W	Shafts/adits	1	local***	yes, but low priority
MC4	34.026828°N, 82.337269°W	none	0	federal	
MC5	34.023581°N, 82.3331274°W	none	0	federal	
MC6	34.0135510°N, 82.3347899°W	none	0	private	
MC7	34.009299°N, 82.3259499°W	none	0	private	
MC15	33.9991°N, 82.3137°W	shaft	0	federal**	
MC16	33.9187°N, 82.2937°W	shaft/adit	0	private (used as a dump)	
MC18	33.904°N, 82.293°W	adit	1	private	yes, but low quality site
MC8	33.94317°N, 82.42929°W	none	0	private/federal	
EDG9	33.9695°N, 81.94927°W	shaft/adit	17	private (LLC)**	yes
SPG5	34.93995°N, 81.77476°W	adit	33	private**	yes
AB23	34.068395°N, 82.388967°W	none	0	federal	
AB24	34.066469°N, 82.39186°W	none	0	federal	
OC2	34.961509°N, 83.07937°W	none	0	federal	
OC5	34.92240°N, 83.116233°W	none	0	federal	
OC6	34.921260°N, 83.118336°W	none	0	federal	
OC8	34.91252°N, 83.073633°W	none	0	federal	
OC28	34.982588°N, 83.058204°W	none	0	federal	
EDG4	33.961616°N, 81.997257°W	none	0	private	
EDG6	33.95671°N, 81.998905°W	none	0	private	
EDG5	33.959821°N, 81.993627°W	none	0	private	
EDG7	33.95116°N, 81.020952°W	none	0	private	
OC12	34.7267999°N, 83.3022399°W	none	0	federal	
OC22	34.728705°N, 83.3021059°W	none	0	federal	
OC23	34.68398°N, 83.3259°W	none	0	Federal/state	
OC45	34.9313°N, 83.0996°W	adit	0	federal	
OC50	34.728781°N, 83.306065°W	adit	0	federal	
Y43A	35.05258°N, 81.40858°W	adit	8	private	yes
Y49	35.02847°N, 81.212018°W	none	0	private	
Y14	35.03596°N, 81.442309°W	none	0	private	
Y15	35.03513°N, 81.442309°W	none	0	private	
UN1	34.804209°N, 81.78629°W	adit	8	private**	
UN2(2)	34.804203°N, 81.78021°W	adit	15	private	
UN3(2)	34.772634°N, 81.7751673°W	adit/shaft	9/1	private**	
CHE30(3)	34.9214°N, 81.6658°W	shaft/adit	?	private	Unsafe/adits collapsed
CHE95	35.13148°N, 81.4302132°W	none	0	private	
CHE96	35.12808°N, 81.427954°W	none	0	private	
CHE97	35.12837°N, 81.43729°W	none	0	private	
CHE98	35.12835°N, 81.43756°W	none	0	private	
CHE123	35.05361°N, 83.409129°W	adit	0*	private**	
AND7	34.35843°N, 82.80208°W	none	0	private	
Y1	35.15421°N, 81.35509°W	none	0	state	
Y2	35.147104°N, 81.340693°W	none	0	state	
Y3	35.144134°N, 81.338893°W	none	0	state	
Y4	35.135675°N, 81.342117°W	none	0	state	
CHE91	35.1521°N, 81.3936°W	shaft	0***	federal	

*Site previously had bats, was actively mined in 2010.

**Evidence of current mining or other disturbance.

***Monitored w/ IR camera for 1 night.

Only one significant *Myotis lucifugus* and *Myotis septentrionalis* hibernaculum is known in South Carolina. That site is on Table Rock State Park and the volume of *Myotis* bats there is not large enough to account for all of our summer colonies. We don't know where most of our summer little brown bat and northern long-eared bat colonies spend their winters. In partnership with the USDA Forest Service Southern Research Station, we attempted to locate the hibernation site of little brown bats that use the SCDNR Fish Hatchery in northern Oconee County. Using Holohil transmitters, designed for use on bats, four bats were tracked in fall 2011. In mid-September (September 17, 2011) the bats had left their summer building roost, but they could not be relocated. Therefore we still do not know where this colony goes to over-winter, but we now have improved information of when they leave their summer/fall roost.

Location and other information on all bat roosts found during our winter surveys were sent to the U.S. Fish and Wildlife Service, per their white-nose syndrome (WNS) monitoring recommendations, although no evidence of WNS was found at the time.

We continue to learn about new potential roosts in the form of old mines and caves. During this study, we investigated rumors of a cave within the Greenville Water System in Pickens County, in the South Saluda watershed. That area is under Conservation Easement held by The Nature Conservancy and can be accessed only by special permission. The site is an extensive boulder field below a massive outcrop. Previous harp trapping in the watershed yielded captures of pregnant *Myotis leibii* (small-footed bats), Rafinesque's big-eared bats, northern long-eared and little brown bats and some tri-colored bats. Two staff members and two watershed personnel searched the area but no entrances or caves were found.

Significant deviations: None.

Total Federal Cost: \$37,615

Recommendations: Protecting known roosts and providing alternate roosts for significant colonies will continue to be a significant goal in bat conservation, particularly in light of WNS caused declines. The southeastern bat colony at Santee State Park remains vulnerable to human disturbance and potential changes in water flow and volume. One entrance to that site is within 1/10 mile from private land that has been cleared for development. An un-gated old roadbed enters the park through open woods from the private tract. No physical barrier is in place to reduce unwanted entry. That site would benefit from a fenced perimeter, electronic monitoring of the entrances, and acquisition of land adjacent to the site. The main Stumphouse tunnel, owned by Clemson University, has a fence that has been repeatedly breached, around the open shaft. That site would benefit from a bat-friendly cupola. That work could be completed with approximately \$40,000. Landowner and manager approvals have already been secured, as well as necessary requirements to satisfy the South Carolina Historic Preservation Office, in the event that funding becomes available.

If the concrete CORA roosts prove successful, two additional roost structures should be considered for Hampton Plantation State Historic Site and the Donnelley Wildlife Management Area. Both of those properties have Rafinesque's big-eared bats using old buildings.

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South Carolina does not certify nuisance wildlife control operators, and the timing of bat exclusions is based on recommendations, not by permit or regulation. Any efforts to improve technical expertise and prudent exclusion methodologies among nuisance wildlife control businesses could improve colonial bat productivity and survivorship in South Carolina. Also, in South Carolina we need to know where our summer *Myotis* colonies go to hibernate, given that this species is so vulnerable to white-nose syndrome, it is increasingly important to locate their winter locations.

Continued support of projects like this one should be considered.

Mary Bunch
November 22, 2011