

# **SOUTH CAROLINA**

## **Bat Conservation Plan**



**South Carolina Department  
of Natural Resources**

# SOUTH CAROLINA BAT CONSERVATION PLAN

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This is the South Carolina Bat Conservation Plan. It has been revised and updated annually from the initial plan created in September 2015. This plan provides information on legal status, public health, conservation issues, natural history, habitat requirements, species-specific accounts, threats and conservation strategies for bat species known to occur in the state. The primary purpose of this plan is to summarize available information for these species and provide proactive strategies in order to help guide management and conservation efforts.

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# Executive Summary

## ***Purpose***

This South Carolina bat conservation plan provides information on legal status, public health, conservation issues, natural history, habitat requirements, species-specific accounts, threats and conservation strategies for bat species known to occur in the state. The primary purpose of this plan is to summarize available information for these species and provide proactive strategies in order to help guide management and conservation efforts.

## ***Bat Species in South Carolina***

Of the 47 bat species documented in the United States (US), 14 are found in South Carolina. These include the big brown bat (*Eptesicus fuscus*), Brazilian free-tailed bat (*Tadarida brasiliensis*), eastern red bat (*Lasiurus borealis*), eastern small-footed bat (*Myotis leibii*), evening bat (*Nycticeius humeralis*), hoary bat (*Lasiurus cinereus*), little brown bat (*Myotis lucifugus*), northern long-eared bat (*Myotis septentrionalis*), northern yellow bat (*Lasiurus intermedius*), Rafinesque's big-eared bat (*Corynorhinus rafinesquii*), silver-haired bat (*Lasionycteris noctivagans*), southeastern bat (*Myotis austroriparius*), Seminole bat (*Lasiurus seminolus*), and tricolored bat (*Perimyotis subflavus*). Incidental records exist of the big free-tailed bat and the federally endangered Indiana bat. However, these species are not addressed in this document due to their rarity in the state.

All of South Carolina's bat species prey on insects and are of great economic importance to the state. Insectivorous bats are known to suppress nocturnal insect populations, including crop and forest pests, and greatly reduce the need for costly pesticides. The estimated annual value of bats in pest suppression services to South Carolina's agricultural industry is nearly \$115 million, with the US agricultural industry estimate at \$22.9 billion (Boyles et al. 2011). The beneficial ecological effects of bats can extend past insect consumption as they indirectly suppress pest-associated fungus and the toxic compounds they produce in corn (Maine and Boyles 2015), as well as reduce the substantial impact of pesticides on many other wildlife species (Pimentel 2009).

## ***Status and Conservation***

A total of twelve, or 86% of South Carolina's bat species, are on the list of South Carolina's "Species of Greatest Conservation Need" and considered "Highest Priority" in the South Carolina State Wildlife Action Plan or SWAP (SCDNR 2015). None of South Carolina's bats are listed as federally endangered, but the northern long-eared bat is listed as federally threatened. The eastern small-footed bat, Rafinesque's big-eared bat, and tricolored bat are all considered at-risk species by the USFWS. Rafinesque's big-eared bat is state endangered and the eastern small-footed bat is considered "species in need of management" or equivalent to state threatened. Currently, a USFWS petition is being addressed for the little brown bat (Kunz and Reichard 2010), and a status review is being conducted for the tricolored bat.

## ***Conservation Issues***

One of the most devastating threats to bat populations in North America is White-nose Syndrome (WNS). Mortality rates attributed to WNS have reached up to 90 and 100% at hibernacula, causing the death of between 5.7 to 6.7 million bats since it was first documented in New York during the winter of 2006/2007. A ten-fold decrease in the numbers of bats in North American hibernacula has been attributed to WNS, and significant local extinctions in many species have resulted, including up to 69% of former hibernacula of the federally threatened northern long-eared bat in North America.

Another significant, ongoing threat is the loss and degradation of important bat roosting and foraging habitat. From the time of European settlement until around 1970, 80% of bottomland hardwood forests in the Southeast were converted for agriculture purposes. Today, urbanization has been cited as the leading threat to southern forests, and may also decrease the functional value of forests through increased fragmentation, reduced water quality, reduced carbon storage, and increased complexity in the use of fire for forest management practices. Forestry practices can also have a significant effect on bats as the felling of trees and snags, building of roads, disruption of boulders in quarries, prescribed burns, and vegetation and insect control can result in direct mortality of bats. Other major threats include human disturbance, environmental contaminants, wind energy development, and unknown impacts of various agriculture and forest management practices as well as environmental changes associated with climate change.

## ***Natural History and Habitat Requirements***

All of South Carolina's bats use echolocation to identify and capture prey during flight or by gleaning insects from foliage, the surface of water, or on the ground. All of the *Myotis* species in the state, as well as the tricolored bat and Rafinesque's big-eared bat, are considered clutter-adapted species. Migratory bats are generally regarded as efficient flyers in open areas, and though many South Carolina bat species may have small seasonal movements, only the silver-haired bat is regarded as a true migrator. Other efficient open area flyers in South Carolina include the Brazilian free-tailed bat, hoary bat, northern yellow bat, eastern red bat, and Seminole bat. Habitats used during foraging bouts by bats in the state are extremely variable and cover most habitat types available except offshore marine waters.

There are nine colonial roosting and five foliage roosting bat species in South Carolina. Of the colonial roosting species, the big brown bat, tricolored bat, and all of the *Myotis* species are known to hibernate in mines, caves, or tunnels in the state. However, half of all South Carolina bat species may use some level of torpor and wake to forage during warm winter nights. These include colonial roosting species such as the big brown bat, Brazilian free-tailed bat, and northern long-eared bat, and foliage roosting species such as the eastern red bat, northern yellow bat, Seminole bat, and silver-haired bat. Other species are known to be active year round and only enter torpor when the weather is extremely cold, such as Rafinesque's big-eared bat.

Young are generally born between May and June and most bat species in the state produce an average of two young per year, though all except one *Myotis* species gives birth to one per year.

The life span of bats in South Carolina varies by species from an average of two years in the evening bat to a maximum of 30 years in the little brown bat.

### ***Conservation Actions and Strategies***

The conservation objectives for South Carolina's bats are to:

1. Develop Specific Action Plans
2. Continue Baseline Population Inventory and Monitoring
3. Maintain and/or Contribute to a Bat Database
4. Protect and Provide Specific Roost Sites
5. Monitor and Mitigate Emerging Threats
6. Identify, Protect, and Enhance Bat Habitat and Drinking Resources
7. Conduct Necessary Research
8. Provide Education, Extension, and Outreach
9. Partner with Agencies, Landowners, and Other Groups
10. Integrate and Maintain the South Carolina Bat Conservation Plan

Monitoring and mitigation efforts for WNS are needed in the state to help prevent or slow the spread of the disease. Efforts that seek to protect and manage bat roosting and foraging habitat are another primary concern. Habitats of high priority have been delineated in the SWAP, and the greatest number of threatened and endangered species fall under four habitat types in the Blue Ridge ecoregion (Appalachian oak forest, high elevation forest, low elevation acidic mesic forest, and low elevation basic mesic forest) and one in the Coastal Plain (mesic forest). Other habitats utilized by over half of the state's highest priority bat species include bottomlands and riparian zones, depressions, hardwood slopes and stream bottoms, maritime forest, pine woodland, river bottoms, upland mixed forest, blackwater stream systems, rock outcrops and sandhill pine woodland.

For South Carolina's bat conservation plan to be successful, complete and reliable information on abundance, distribution, demography, life history, and habitat needs for most of South Carolina's bat species still needs to be determined. Without this basic ecological data, habitat protection plans and land management strategies cannot be fully informed, and therefore may contribute no or very limited benefits toward bat conservation. In addition, partnerships and cooperation between government agencies, private landowners, non-governmental organizations, and the general public are essential if the state is to accomplish its conservation objectives for South Carolina's bat species.



## Introduction

Bats are one of the most diverse mammalian orders and compose approximately 25% of all mammals (Neuweiler 2000). With over 1,110 species in the world and 47 resident to the US, bats represent a wide range of morphological and behavioral traits. Worldwide, bats are known to consume fruit, nectar, fish, frogs, birds, mice, and the blood of livestock and wildlife. Though vampire bats tend to give other bats a bad reputation, only three vampire bat species exist in the world and none live in the US. Ecological services provided by bats in the tropics through seed dispersal and pollination are known to be vital to the survival of rainforests (Cox et al. 1991, Hodgkison et al. 2003, Kelm et al. 2008), and a popular alcoholic drink, Tequila, comes from the *Agave tequilana* plant that depends completely on bats for pollination. If that's not persuasive enough information to make one appreciate bats, consider that 70% of all bat species in the world feed exclusively on insects (Neuweiler 2000), and the amount consumed provides a substantial pest control service that would otherwise require costly pesticides. For example, in an eight county region in south-central Texas, this value was estimated at \$741,000 annually for cotton producers (Cleveland et al. 2006). In the southwestern U.S. and northern Mexico, the Mexican free-tailed bat (a subspecies of the Brazilian free-tailed bat) provides a total annual cotton pest-suppression service of \$11.67 million (López-Hoffman et al. 2014). The estimated annual value of bats in pest suppression services to the US agricultural industry is an estimated \$22.9 billion, and is nearly \$115 million in South Carolina alone (Boyles et al. 2011). The beneficial ecological effects of bats extend past insect consumption as they also indirectly suppress pest-associated fungus and the toxic compounds they produce in corn, a major worldwide crop (Maine and Boyles 2015). In addition to significant economic advantages, the presence of healthy bat populations and the reduced need for pesticides helps prevent negative effects to many other wildlife species substantially impacted by these chemicals (Pimentel 2009).

Bats have been seen as gods by the Mayans, and are highly regarded in countries like China. For example, the popular Chinese *wufu* symbol of five bats surrounding a stylized tree represents health, wealth, long life, good luck, and tranquility. Through education and outreach, as well as notoriety from WNS that has brought declining bat populations into the public spotlight, bats are beginning to be appreciated by the public and recognized for the major role they play in our ecosystem.

There is great diversity in bat populations across the state due to various roosting habits of South Carolina bats. The state itself consists of a wide variety of habitats, categorized into five distinct ecoregions: The mountainous Blue Ridge near the Appalachians, the Piedmont composed of foothills and midlands, the Sandhills composed of sandy soils and rolling hills along the Fall Line, the Coastal Plain composed of swamps and marshes with rolling hills in the innermost portion and flat plains in the outermost portion, and the Coastal Zone, a warmer, seaward extension of the Coastal Plain composed of sand flats, pine hardwood, swamps, and emergent saltwater marshes (Figure 1). South Carolina commonly harbors 14 bat species, the diversity of which vary geographically across the state (Table 1). Eight bat species occur statewide, and these are also the only bats present in the Piedmont. Incidental records exist of the big free-tailed bat (*Nyctinomops macrotis*) and the federally endangered Indiana bat (*Myotis sodalis*): however, these species are not addressed in this document due to their rarity in the state.

Of the bat species occurring in South Carolina, five are considered foliage roosting bats and nine are considered colonial roosting bats. As the names suggest, colonial roosting bats roost in colonies in winter hibernacula in caves and mines, and foliage roosting bats typically roost solitarily in the foliage of trees. The foliage roosting bats of South Carolina include all of the species in the *Lasiurus* genus and *Lasionycteris* genus and are the eastern red bat, hoary bat, northern yellow bat, Seminole bat, and silver-haired bat. The colonial roosting species include all the species in the *Myotis* genus and the rest of the bats in the state. These are the eastern small-footed bat, little brown bat, northern long-eared bat, southeastern bat, big brown bat, Brazilian free-tailed bat, evening bat, Rafinesque's bat, and tricolored bat.

Like many bat species across the US, the population status and ecology of most bats in South Carolina remain unknown (M. A. Menzel et al. 2003). We seek to summarize available information on legal status, public health, conservation issues, natural history, habitat requirements, species-specific accounts, threats and conservation strategies in 4 chapters: 1. Status and Conservation Issues, 2. Natural History and Habitat Requirements, 3. Species Accounts, and 4. Conservation Actions and Strategies. Chapter 1 is an overview of the legal and conservation status of bats in the state, relationships to public health, and conservation threats and management activities. Chapter 2 summarizes the natural history and habitat requirement of South Carolina's bats. Chapter 3 provides informational accounts of all 14 species on identification, status, life history traits, and specific conservation threats and measures. Chapter 4 is a strategic outline of conservation tasks that could help protect South Carolina's bat populations.

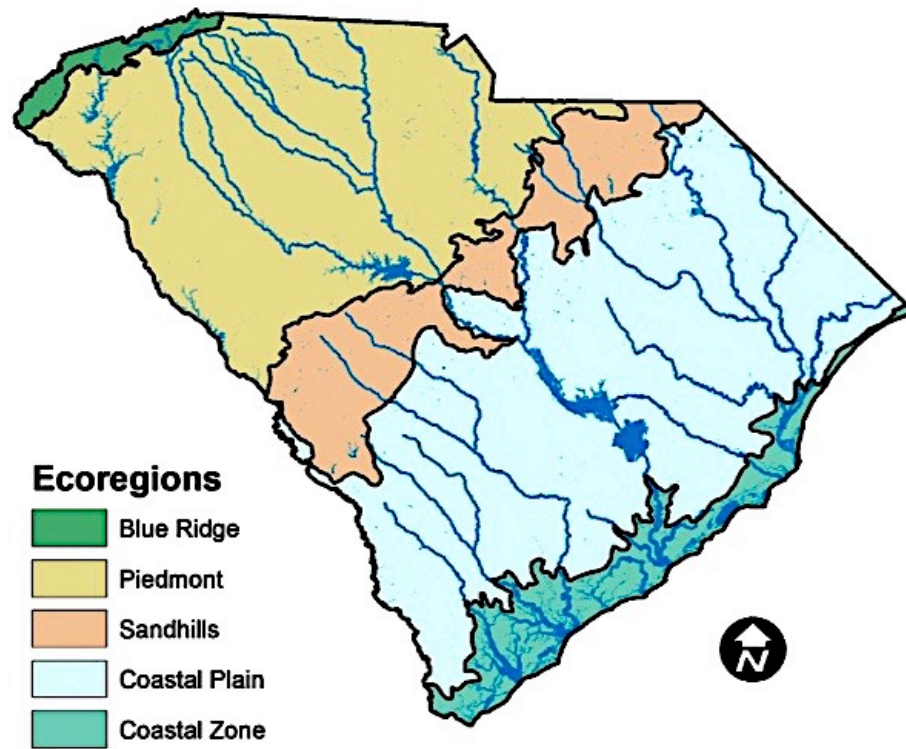


Figure 1: The five ecoregions of South Carolina. Modified from Griffith et al. (2002) for the South Carolina State Wildlife Action Plan (SCDNR 2015). The Coastal Plain-Coastal Zone boundary is modified to conform to the legal delineation of the boundary between freshwater and saltwater zones for fisheries management purposes.

Table 1: Bat species and their associated ecoregions documented in South Carolina. Presence in parentheses (X) indicates that the species is not often found in that ecoregion.

Common Name	Scientific Name	Ecoregion				
		Blue Ridge	Piedmont	Sandhills	Coastal Plain	Coastal Zone
Big Brown Bat	<i>Eptesicus fuscus</i>	(X)	X	X	X	X
Brazilian Free-tailed Bat	<i>Tadarida brasiliensis</i>	X	X	X	X	X
Eastern Red Bat	<i>Lasiurus borealis</i>	X	X	X	X	X
Eastern Small-footed Bat	<i>Myotis leibii</i>	X				
Evening Bat	<i>Nycticeius humeralis</i>	X	X	X	X	X
Hoary Bat	<i>Lasiurus cinereus</i>	X	X	X	X	X
Little Brown Bat	<i>Myotis lucifugus</i>	X	(X)	(X)	(X)	(X)
Northern Long-eared Bat	<i>Myotis septentrionalis</i>	X			(X)	(X)
Northern Yellow Bat	<i>Lasiurus intermedius</i>			X	X	X
Rafinesque's Big-eared Bat	<i>Corynorhinus rafinesquii</i>	X		X	X	X
Seminole Bat	<i>Lasiurus seminolus</i>	(X)	X	X	X	X
Silver-haired Bat	<i>Lasionycteris</i>	X	X	X	X	X
Southeastern Bat	<i>Myotis austroriparius</i>			X	X	X
Tricolored Bat	<i>Perimyotis subflavus</i>	X	X	X	X	X
		12	8	12	13	13