Conservation Strategy and Conservation Focus Areas for Priority Bats in Georgia

Gray Bat
Photo credit: Adam Mann

Indiana Bat
Photo credit: Ann Froschauer
USFWS

Northern Long-eared Bat
Photo credit: Al Hicks NYDEC

Prepared By:
U.S. Fish and Wildlife Service
Georgia Ecological Services Field Office
Athens, Georgia

Version 1.1: March 2018

Table of Contents

Introduction 1
Purpose and Need 2
Versions 2
Definitions / Glossary 2
Background 4
- Bats of Georgia 4
- Reproductive Biology Overview 4
- Regions of Georgia and Distribution of Georgia's Bats 4

Threats to Bats in Georgia 4
- White-Nose Syndrome 4
- Wind Energy 5
- Habitat Disturbance / Loss 6
- Hibernacula Disturbance / Loss 6
- Maternity Roost Disturbance / Loss 6
- Water Quality / Pesticides / Air Quality 7
- Natural Hazards 7
- Other Human-induced Threats 7

Conservation Focus Areas 8
- Framework for Identification of Conservation Focus Areas 8
- Focus Areas 8

Summary of Species Specific Conservation Needs and Research Needs 8
Application of the Strategy 13
Conservation, Avoidance, Minimization, Mitigation, and ESA Options 13
- Best Management Practices / Avoidance and Minimization 13
  - All Projects 13
  - Tree Removal (Habitat Removal) 14
  - Man-made Structures 14
  - Cave or Cave-like Habitats / Hibernacula 14
  - Lighting 14
  - Blasting 14

Solar / Wind 15
Surveys to Inform Assessment of Impacts 15
Consultation for Species Protected Under the Endangered Species Act 15
Technical Assistance / Informal Consultation 15
Final 4(d) Rule for the Northern Long-eared Bat 16
Conservation Goals 16
Summary of Regional Conservation Focus Areas 16
Mitigation Implementation for the Conservation Strategy 17
Compensatory Mitigation Measures 17
Strategy Modification 17
Summary 17
Literature Cited 18
Tables 19
Figures 23
Appendix A 29
Appendix A1 30
Appendix A2 31
Appendix A3 32
Appendix A4 33
Appendix A5 34
Appendix A6 35
Appendix A7 36
Appendix A8 37
Appendix A9 38
Appendix B 39
Appendix B1 40
Appendix B2 41
Supplemental Material 42

List of Tables

Table 1 Bat species occurring in Georgia, their conservation status, and regions where they were designated a priority according to the 2015 State Wildlife Action Plan (SWAP; GDNR 2015). 19
Table 2 Georgia's priority bat species and their general natural history classifications 20
Table 3 Matrix of major threats to or presumed causes of decline of high priority bat species in Georgia. 21
Table 4 Native bat species and documented or likely impacts from White-Nose Syndrome (WNS) in Georgia. 22

List of Figures

Figure 1 Counties and dates for the non-volant period (pup season) for bats in north and south Georgia. 23
Figure 2 Strategic regions of Georgia based on the Level IV Ecoregions (SA/RV: Southeastern Appalachians / Ridge and Valley; BR: Blue Ridge; PD: Piedmont; SP: Southeastern Plains: SCP: Southern Coastal Plain) 24
Figure 3 Distribution of White-Nose Syndrome-affected areas as of June 19, 2017. 25
Figure 4 Overview of Conservation Focus Areas for Georgia's priority bat species. 26
Figure 5 Conservation Focus Areas for Georgia's priority bat species in north Georgia. 27
Figure 6 Conservation Focus Areas for Georgia's priority bat species in south Georgia. 28

Introduction

The U.S. Fish and Wildlife Service (Service), Georgia Ecological Services (GAES) developed this Conservation Strategy (Strategy) to address conservation needs of several listed and non-listed bat species in the state. This Strategy formalizes goals and priorities of the office and provides a framework for federal, state, and private partners to participate in a statewide conservation effort for priority bat species. This document uses several sources of documentation to help prioritize Conservation Focus Areas (CFAs) within the state and is regionalized to align with Georgia Department of Natural Resources' (GDNR) State Wildlife Action Plan (SWAP; GDNR 2015).

Georgia hosts 16 species of bats (Table 1). Of these 16 species, three are federally listed species, endangered Gray Bat (*Myotis grisescens*), endangered Indiana Bat (*Myotis sodalis*), and threatened Northern Long-eared Bat (*Myotis septentrionalis*). In addition to these three bats, the Rafinesque's Big-eared Bat (*Corynorhinus rafinesquii*) is state listed as rare. The Georgia SWAP also identifies five additional species as high priority for conservation in Georgia, Northern Yellow Bat (*Lasiurus intermedius),* Southeastern Myotis (*Myotis austroriparius*), Eastern Small-footed Bat (*Myotis leibii*), Little Brown Myotis (*Myotis lucifugus*), and Tri-colored Bat (*Perimyotis subflavus*). This document will outline a conservation strategy for the nine listed and high priority bats identified above.

The conservation of many of Georgia's priority bat species relies on understanding general life history requirements of each species and how those species can be impacted by changes to the landscape. This document is not intended to be an exhaustive accounting of the natural history of bats in Georgia, but will address measures to minimize impacts to the species and identify CFAs for each species. As new information relevant to the conservation of these species becomes available GFO will modify the strategy and provide an updated version to our partners.

A portion of the Strategy relates to avoidance, minimization, mitigation, and compliance under the Endangered Species Act (ESA). The ESA (16 U.S.C. 1531 *et seq*.), Fish and Wildlife Act of 1956 (16 U.S.C. 742a. *et seq*.), and the Fish and Wildlife Coordination Act (FWCA; 16 U.S.C. 661 *et seq*.). Section 5 of the ESA provides that, "The Secretary…shall establish and implement a program to conserve fish, wildlife, and plants, including those which are listed as endangered species or threatened species…" and "shall utilize land acquisition and other authority under the Fish and Wildlife Act, as amended, and the Migratory Bird Conservation Act, as appropriate". Section 7(a)(1) of the ESA further directs Federal agencies to "utilize their authorities in furtherance of the purposes of this Act [ESA] by carrying out programs for the conservation of endangered species and threatened species." Additionally, section 7(a)(2) of the ESA directs Federal agencies to "insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered species or threatened species. The Fish and Wildlife Act of 1956 provides that the Secretary shall "...take such steps as may be required for the development, advancement, management, conservation, and protection of fish and wildlife resources." The FWCA states that the Secretary and the head of the state fish and wildlife agency are authorized "to provide assistance to, and cooperate with, Federal, State, and public or private agencies and organizations in the development, protection, rearing, and stocking of all species of wildlife, resources thereof, and their habitat…" In Georgia, all bats are also protected under Georgia state

law (Official Code of Georgia § 27-1-28). The following document will provide guidance relating to impacts to Georgia's priority bat species.

Purpose and Need

The purpose of this strategy is to assess threats to and conservation needs for priority bat species in Georgia. Additionally, this strategy will provide best management practices and avoidance and minimization measures to reduce impacts to bats related to transportation, utility, energy and other development projects. The primary focus of this document will be for federally listed bat species, although many conservation, avoidance, and minimization efforts will be beneficial to other bat species found in Georgia. This document focuses on describing the species habitat requirements and threats to their persistence in Georgia.

Versions

The initial version (1.0) of this strategy was released in May 2017. This version (1.1) was released in March 2018 to update the document to ensure the document complies with Section 508 if the Rehabilitation Act of 1973, as amended (29 U.S.C. § 794 (d)). No substantive content changes occurred with this revision.

Definitions / Glossary

For the purpose of this strategy, we define the following terms:

Active Season: The period between April 1 and October 15 when most federally listed *Myotis* species are expected to be on the landscape.

Conservation Focus Area (CFA): Key habitats or areas identified for the focus of conservation efforts. By focusing conservation into specific areas, this should provide greater ecological benefits to the species.

Flyway habitat: Travel corridors used by bats to move between roosting and foraging habitats and during migration. For Indiana, Northern Long-eared, and Gray Bats flyway habitats can include waterways, forest roads, and along other cleared areas adjacent to forests such as fencerows.

Foraging habitat: Foraging habitats include areas of riparian forests, small openings or clearings, forests with relatively open understory, and over water. Gray Bat foraging areas are commonly associated with clean, fresh water.

Hibernate: To pass the winter in torpor. Hibernation can include periods of arousal and activity.

Hibernacula: Caves, cave-like structures (e.g. mines, tunnels, culverts, bridges) or other features where bats spend some or all of the winter torpor/hibernation period.

Maternity habitat: Suitable summer habitat used by juveniles and reproductive (pregnant, lactating, or post-lactating) females, pups, and recently volant juveniles.

Maternity roost: A location or place for female bats to give birth and rear their young. For Indiana Bats, roosts are typically found in dead or partially dead tree that is at least 9 inches diameter at

breast height (DBH) and has cracks, crevices, and/or loose or exfoliating bark. For Northern Long-eared Bats, maternity roost trees include trees that are at least 3 inches DBH and have cracks, crevices, and/or loose or exfoliating bark. Gray Bat roosts are typically located in caves or cave-like structures. Each of these species may also roost in man-made structures such as bridges, houses, and other structures.

Migration corridor: Habitats between hibernacula locations and maternity roosts or habitats between roosting and foraging areas. These habitats are typically forested with corridors providing flyway habitat.

Non-volant: Young bats that have are not capable of flight (Figure 1). In Georgia, we consider the non-volant pup season for federally listed bats and northern counties to span May 15 to July 31 and the non-volant pup season for southern counties to span April 1 to July 31.

Pup: A young bat that is dependent on its mother to nurse and provide nutrition, see non-volant and volant.

Roost: A location where a single bat or group of bats rests, hibernates, enters torpor, raises young, or spends time. For bats in Georgia, roosts can consist of a variety of natural or man-made structures.

Staging: Suitable roosting, foraging and travel habitat within a determined distance of a known hibernaculum in the spring. In Georgia, we use a five mile distance as the primary staging area.

Summer habitat: A variety of habitats that incorporate a species' needs for roosting, foraging, and flyways. For Indiana, Gray and Northern Long-eared Bats, this typically includes intact forest habitats with access to sources of clean water and prey resources. For Gray Bats this also includes caves or cave-like habitats.

Swarming: Suitable roosting, foraging and travel habitat within a determined distance of a known hibernaculum in the fall. The swarming period is the primary time for mating for bats that hibernate. In Georgia, we use a five mile distance as the primary swarming area.

Torpor: A state of lowered physiological activity typically characterized by reduced metabolism, heart rate, respiration, and body temperature. In Georgia, bats in this state have been documented to occur when temperatures are below 50°F; however, in the winter and spring bats may remain in torpor when temperatures are above this threshold.

Volant: Young bats that have become capable of flight, see non-volant and pup season (Figure 1). In Georgia, we consider the non-volant pup season for federally listed bats and northern counties to span May 15 to July 31 and the non-volant pup season for southern counties to span April 1 to July 31.

Winter Season: The period between October 16 and March 31 when most federally listed *Myotis* species are expected to be in hibernation or associated with hibernacula.

Background

Bats of Georgia

During the development of the State Wildlife Action Plan (SWAP; GDNR 2015), GDNR identified nine species of bats that were considered priority and a high priority for conservation (hereafter referred to priority bat species). Many of these bat species depend on caves (cave-like) and forested habitats for their survival (Table 2). These species have been identified as priority species and may be at-risk from one or more of the following threats:

- destruction/ degradation of hibernation habitat,
- loss and degradation of summer habitat, migration habitat, and swarming habitat (especially forested habitats),
- disturbance of hibernating individuals,
- predation,
- competition,
- natural catastrophes in hibernacula, such as flooding, environmental contaminants, altered food and habitat through climate change, and
- mortalities from collisions with wind energy facilities.

Reproductive Biology Overview

Mating for most species of bats in Georgia is assumed to occur in the fall prior to the typical hibernation period. Most bats in Georgia give birth to one to two young in the spring (Table 2). Most species, including the federally listed species, form maternity colonies of several to 1,000 bats or more. Females care for their non-volant young for three to six weeks after which they become capable of flight. During the non-volant period, the females leave the young at the roost while they forage at night. This is likely a very critical time in the life cycle of a bat where disturbance, changes in food abundance, changes in microclimate, or water contamination could prohibit or cause failure of reproduction for the year.

Regions of Georgia and Distribution of Georgia's Bats

The predicted ranges of each of our high priority bat species can be found in Appendix A. The GDNR and their partners identified regions of the state that were deemed important for each of the high priority species in Georgia in the 2015 SWAP (GDNR 2015; Table 1; Figure 2).

Threats to Bats in Georgia

A matrix of major threats to Georgia's priority bats can be found in Table 3. A brief description of these threats can be found below. Many of these threats can be additive, increasing risk of specific threats and compounding impacts to individuals and/or populations.

White-Nose Syndrome

White-nose Syndrome (WNS) is a fungal disease affecting hibernating bats. The first documented occurrence of this fungus occurred in New York during the winter of 2006-2007. Since 2006, the WNS has been detected in most eastern states and eastern Canadian Provinces and evidence of the fungus (*Pseudogymnoascus destructans; Pd*) has been found in additional states (Figure 3). As fungal

levels increase on hibernating bats, bats have an increased chance to be disturbed. This disturbance interrupts hibernation patterns and results in losses of fat reserves. The fungus can also result in structural damage to wing membranes. It is estimated that WNS has resulted in the mortality of millions of bats in the United States and Canada. Population modeling indicates a 99% chance of regional extinction of the Little Brown Bat in the Northeast within the next 16 years due to WNS (Frick *et al*. 2010). Up-to-date range, spread, and other information on WNS can be found online at http://whitenosesyndrome.org/.

Along with direct tissue damage from the fungus, WNS can also decrease the ability of individual bats to survive other sources of stressors. These compounded stressors may impact long-term fitness of individuals as they adapt to changes in food resource, climate, hibernacula, habitat, flyways, and roost availability. Bats affected but not killed by WNS during hibernation may be weakened by the effects of the disease and may have extremely reduced fat reserves and damaged wing membranes. These effects may decrease survival rates through reducing their capability to fly, reducing foraging success, making them vulnerable to predation events, and potentially reducing survival of pups through reduced fat reserves, reduced foraging ability, and other disruptions to maternity colonies. Increases in mortality and reductions in fitness will make it more difficult for the species to recover from stressors and more prone to extirpation events. Due to a low reproductive potential, any threats that increase mortality or decrease recruitment are of particular concern. While reducing threats can yield population increases, these increases will be gradual because of low reproductive rates.

Although WNS is widespread in Georgia, it appears not to impact all species and all individuals in the same way. Species or individuals that do not use caves for hibernacula have less risk than species that hibernate in caves. Cave microclimates are productive environments for *Pd*. Even within a particular cave, individuals may be differentially impacted. The *Pseudogymnoascus* fungus responsible for WNS grows most readily in regions of the cave that have low temperatures (5-10°C; 40-50°F), and high humidity (>90%; Verant et al. 2012; Blehert et al. 2009). Species that hibernate in cooler temperatures may not be impacted by WNS as much as others. Georgia's native bats have varied population impacts likely resulting from WNS (Table 4). Population reductions of Tri-colored Bats, Northern Long-eared Bats, and Little Brown Bats in Georgia have likely resulted from impacts of WNS. However, several species of bats have tested positive for *Pd*, but no individuals have exhibited signs of WNS. These *Pd* positive individuals or individuals/species that have shown signs of WNS may have limited impacts because of their distribution and/or behavior.

Wind Energy

Wind energy development is a relatively new threat to bats. In Georgia, much of this development is likely to occur along the coast and in the Ridge and Valley and Blue Ridge regions of the state. Mortalities from wind turbine strikes are difficult to assess, but will likely have an additional impact to already declining species. Wind turbine strikes appear to impact highly migratory species more than those that are not migratory (i.e. Eastern Red Bats, *Lasiurus borealis*, Hoary Bats, *Lasiurus cinereus*, and Silver-haired Bats, *Lasionycteris noctivagans*; Kunz et al. 2007). Although not currently a priority species, Hoary Bats appear to be particularly vulnerable to this threat, with models estimating a major species decline in the next 50 years (Baerwald 2016).

Habitat Disturbance / Loss

Changes in habitat and land use has likely influenced populations of bats through time. Prior to colonial development, Georgia was covered in pine and hardwood forests. By the early 1920's only about one-twentieth of Georgia's virgin timber remained (Georgia State Board of Forestry 1922). This change in Georgia's landscape likely had profound influences on the distribution and abundance of bats in Georgia. Since this time, forested acre in Georgia have increased. Much of Georgia's new forest habitats consist of planted pines. The loss of forest stands that have mixed age classes and diversity of species will likely continue to impact our native bat species by limiting roosting sites. The following is a list of threats to bats through disturbance or loss of habitat:

- Loss of habitat for foraging / roosting
- Fragmentation of habitat – disturbance of natural movement pathways / flyways.
- Light Contamination – changes in night-time light through tree removal or additional man-made lights can impact foraging behavior and activities.
- Changes in behavior resulting in reduced fecundity and survival.

Hibernacula Disturbance / Loss

Winter hibernacula can include cave and other cave-like habitats (e.g. mines, railroad tunnels, some bridge structures). Priority bats including Rafinesque's Big-eared Bat, Southeastern Myotis, Gray Bat, Eastern Small-footed Bat, Little Brown Bat, Northern Long-eared Bat, Indiana Bat, and Tri-colored Bat, all use hibernation as a life history strategy. Individuals in the southern part of the state may show varying degrees of hibernation. Captures of Northern Long-eared Bat on the Southern Coastal Plain of North and South Carolina in winter suggests that individuals of this species in these areas may forego hibernation (Grider 2014; D. Brown personal communication). The following is a list of threats to bats through disturbance or loss of hibernacula:

- Human disturbance (e.g. cave commercialization, recreational caving, research-related activities, vandalism, vibrations from human-induced activities) – interrupting hibernation, transferring WNS, alteration of habitat.
- Improper cave gating – preventing access to the cave by bats, creating a flying hazard.
- Human-caused changes in cave microclimate through improper gating, filling, blocking cave entrances – causing improper climates for hibernation, creating better climates for WNS.
- Flooding of hibernacula caused by dam / reservoir developments – loss of hibernacula or access to hibernacula.
- Destruction of man-made hibernacula through demolition, alteration of structures to limit access or remove protected areas.

Maternity Roost Disturbance / Loss

Because of the limited reproductive capabilities of Georgia's bats, interruptions to reproduction can be a significant threat to species during the summer season. The maternity season is a critical life history time when females are caring for young and the non-volant young are vulnerable to threats. The following is a list of threats to bats through disturbance or loss of maternity roosts:

- Human disturbance (e.g. cave commercialization, recreational caving, research-related activities, vandalism, vibrations from human-induced activities) – interrupting feeding/resting of females and pups, extensive disturbance could cause roost abandonment.
- Improper cave gating – preventing access to the cave by bats, creating a flying hazard.
- Human-caused changes in roost microclimate through improper gating, filling, blocking cave entrances, tree clearing (changes in sunlight, wind, humidity).
- Flooding of roost habitats caused by dam / reservoir developments.
- Destruction of man-made roosts through demolition, alteration of structures to limit access or remove protected areas.
- Tree removal through various land use / management activities – elimination of roost trees resulting in added energy expenditure finding alternative roosts and increased risks associated with search / travel to new habitats.

Water Quality / Pesticides / Air Quality

Contaminants in water sources, pesticides, and air quality contamination can cause direct impacts through acute or chronic exposure resulting in death or compromised health and indirect impacts through changes in food resources and potential roost abandonment. All of Georgia's bats are insect eaters and rely on timely abundance of prey for the maternity season, and pre- and post-hibernation. Air quality can be compromised through auto/industry releases, dust, and / or smoke. The following is a list of threats to bats through changes in water quality, air quality, and pesticide use:

- Direct impacts – acute and chronic impacts of contaminants and pesticides.
- Indirect impacts – changes in food types and availability, compromised health, roost abandonment.

Natural Hazards

Natural hazards will continue to be a threat to Georgia's native bat species. These natural hazards can be compounded by other natural threats and/or human-induced threats. The following is a list of threats to bats through natural hazards:

- Disease / parasites
- Predation –changes in natural faunal communities can result in changes in predator behaviors and abundance.
- Flooding
- Mine ceiling collapse
- Climate change – changes in weather patterns, rainfall, temperatures, food resources
- Competition with other bat species – reductions in habitat used for roosting and hibernation along with changes in ranges of native bat species could both result in higher rates of competition for prime roosting areas or habitats that become limited.

Other Human-induced Threats

- Collisions with man-made objects (i.e. communications towers, airstrikes, vehicle strikes)
- Forest management through fire or tree removal activities

Conservation Focus Areas

Framework for Identification of Conservation Focus Areas

Conservation Focus Areas were identified to help enhance the conservation of the listed species where they are likely to occur in Georgia. As new information on priority bat species becomes available, GAES will maintain an updated list of CFAs and update the strategy as needed. These areas were Tiered according to guidance from the national Federal Highway Administration (FHWA) / Federal Rail Administration (FRA) and Service programmatic biological opinion for Indiana and Northern Long-eared Bats.

Focus Areas

An overview of focus areas for Georgia can be found in Figure 4. Conservation Focus Areas are prioritized into three tiers. Below are descriptions of the three tiers and guidelines for areas that fall into each category.

Tier 1: Areas with known, extant **maternity** colonies including a 2.5 mi buffer;

Tier 2: Areas with known **hibernacula** including a 5 mi staging/swarming buffer;

Tier 3: **Other** priority mitigation areas, including:

- Suitable habitat for target species
- Migratory pathways between known hibernacula and maternity areas
- Suitable habitat to allow for shifting of known maternity roosts (a 5 mi buffer of maternity roosting area or an additional 2.5 mi buffer around buffered maternity areas)
- Habitat documented as bachelor or other migratory habitat (supported by captures, telemetry, or acoustic data)
- Areas of habitat suitable for the target species and adjacent to existing conservation lands or important landscape features.

For reference, two maps are provided in Appendix B1 and B2 showing regional prioritizations of habitat. The CFAs have also included portions of these prioritizations for defining focus areas. Many regions or species do not have identified Tier 1 CFAs, as maternity roosts / colonies are identified, they will be added to any future modifications of this document.

Summary of Species Specific Conservation Needs and Research Needs

A matrix of major threats to each of the priority bat species can be found in Table 3. Below is a list of research and conservation needs specific to each species. Although specific caves are described in supplemental materials, new caves or cave-like habitat may be identified as a hibernaculum or maternity roost and added to the CFAs. If vandalism and / or human disturbance is deemed a problem to any hibernacula or maternity cave, cave gating or fencing could be considered to be protective of bats.

Rafinesque's Big-eared Bat

<u>Research Needs</u>:

- Inventory of existing populations.
- Refinement of species range.
- Assessment of seasonal differences in habitat use and range.
- Assessment of impacts to the species caused by changes in land use.
- Evaluation and documentation of bridge and culvert structure use.

Conservation Needs: Conservation for this species should focus on preservation of existing floodplain and bottomland hardwood forests and preservation or replacement of any known man-made or natural roosting structures. The habitat identified in the Georgia SWAP as priority for this species is habitat along the Altamaha River floodplain. Areas with good quality foraging habitat but lack high quality maternity roosts may benefit from the construction of man-made roosting structures. If project development results in the loss of known maternity roosts, the species would benefit from replacement of lost roosts in nearby or connected patches of appropriate habitat. The CFAs identified for this species are classified as Tier 3.

Northern Yellow Bat

Research Needs:

- Assessment of habitat use.
- Refinement of species range.
- Assessment of seasonal distribution and potential migratory patterns.
- Evaluation of the threat of coastal wind energy would provide valuable information related to impacts of energy projects on the species. The development of best management practices is needed for coastal wind energy related to impacts to this and other coastal bat species.

Conservation Needs: The main habitat where this species is found is within Spanish moss in old hardwoods on Georgia's barrier islands. This species also requires access to fresh water sources. Preservation of old hardwood trees and fresh waters are the primary conservation need for the species. The CFAs identified for this species are classified as Tier 3.

Southeastern Myotis

Research Needs:

- Inventory of existing populations.
- Refinement of species range.
- Assessment of seasonal differences in habitat use and range.
- Assessment of impacts to the species caused by changes in land use.
- Evaluation and documentation of man-made structure and caves use.

Conservation Needs: Conservation for this species should focus on preservation of existing floodplain and bottomland hardwood forests and known man-made or natural roosting habitat. The priority habitat identified for this species includes the same Altamaha floodplain forest areas that are identified for Rafinesque's Big-eared Bat. Although not mapped, Tier 1 habitats (known maternity roosts and their surround habitat) should be prioritized for preservation. Please coordinate with GAES to determine if a potential project falls within a Tier 1 CFA. This

species also relies on caves. Priority caves (ordered according to priority) identified for this species can be found in the supplemental materials.

Caves used as hibernacula and the surrounding swarming / staging habitat (5 mi radius of cave entrance) should be preserved and/or restored. If vandalism and / or human disturbance is deemed a problem, cave gating could be considered. Additionally, for caves not known to have *Pd*, protections and conservation measures to minimize introduction of *Pd* to these structures should be considered. The CFAs identified for this species are classified as Tier 2 (hibernacula) and Tier 3 (other bottomland hardwood habitats).

Gray Bat

Research Needs:

- Identification of maternity roost locations could provide important information for consultation and assessing impacts to this species. We have documented captures of female gray bats across the species' defined range in the summer. This data along with a limited number of identified maternity roosts, indicate there are many undetected maternity roosts in Georgia.
- Refinement of species range.
- Assessment of the temporal variation in cave usage.
- Evaluation and documentation of man-made structure and caves use.

Conservation Needs: Because this species relies on caves or cave-like habitat for both maternity and hibernacula, protection of cave habitat is a priority. Priority caves (ordered according to priority) identified for this species can be found in the supplemental materials. If future evidence suggests that WNS has a large negative impact on this species in Georgia, treatment of hibernacula could considered to reduce those impacts.

Caves used as maternity roosts (Tier 1 CFAs) and/or hibernacula (Tier 2 CFAs) and the surrounding swarming / staging habitat (5 mi radius of cave entrance) should be preserved and/or restored. Because the main prey for Gray Bats are adult forms of aquatic invertebrates, a priority for conservation of this species is tied to preserving water quality that supports food resources for this species.

Eastern Small-footed Bat

Research Needs:

- Refinement of species range.
- Assessment of habitat use and any seasonal variation of habitat use. Slab rock and scree have been used by this species in northeastern Georgia. These habitats are available in central portions of Georgia but limited efforts have been placed on assessing species use in this region of the state.
- Evaluation and documentation of man-made structure.

Conservation Needs: In Georgia, this species uses primarily exposed rock cliffs and rocky balds, and likely uses cave habitats. Because of the small spaces this species can enter and their small

size, this species is difficult to detect during surveys. Preservation of rock cliff and other identified roosting habitats are a priority for this species.

Little Brown Bat

Research Needs:

- Determine if WNS resilient individuals occur in the southern portions of its range (Piedmont region). Understanding the impacts of WNS in more southerly populations could provide insight to population survival in light of declines in most other portions of its range.
- Identification of maternity roosts. If surveys capture females during the maternity season, researchers should consider tracking individual bats to identify maternity roosts. There are currently no known maternity roosts for this species in Georgia.
- Evaluation and documentation of bridge and culvert structure use.
- Refinement of species range.
- Evaluation of the impacts of wind energy development.

Conservation Needs: This species is one of many that is susceptible and has shown declines caused by WNS. Because of the limited number of known maternity roosts, if any activity is expected to destroy a known maternity roost, replacement of the roost should be a priority.

Northern Long-eared Bat

Research Needs:

- Determine if WNS resilient individuals occur in the southern portions of its range (Piedmont region). Additional surveys assessing if this species also uses southern / Coastal Plain counties in Georgia would provide insight into the long-term persistence of this species in the state.
- Refinement of species range.
- Assessment of winter habitat use. Radio tracking individuals during fall migration would also help determine other potential wintering sites.

Conservation Needs: Northern Long-eared Bats are one of the most severely affected bat species from WNS. Treatment of hibernacula could reduce declines of this species in the state. Priority hibernacula identified for this species can be found in the supplemental materials. Caves used as hibernacula and the surrounding swarming / staging habitat (5 mi radius of cave entrance) should be preserved and/or restored (Tier 2 CFAs).

Protection of migratory routes between hibernacula and roosting habitats is also a priority (Tier 3 CFAs). Although not mapped, Tier 1 habitats (known maternity roosts and their surrounding habitat) should be prioritized for preservation. Please coordinate with GAES to determine if a potential project falls within a Tier 1 CFA.

Priorities of preserving or restoring appropriate summer roosting habitat (Tier 3 CFAs) include adding to existing tracts of preserved, older-aged hardwood or mixed hardwood/pine forests including:

1. Paulding Forest

2. Dawson Forest
3. Little Sand Mountain
4. Other large forested tracts capable of supporting (or documented to support) maternity colonies.

Indiana Bat

Research Needs:

- Identify additional migration routes into and through Georgia.
- Refinement of species range.
- Assess the potential impacts of wind energy development along the ridges in the northwest portion of the state.
- Assess potential for any additional maternity roosts in Dade, Walker, Chattooga, Murray, and Catoosa Counties.

Conservation Needs: There are no known primary hibernacula in Georgia. However, there is one known cave that an individual Indiana Bat was recorded using for the winter. (Tier 2 CFA). This cave is also used by other species of bat as a hibernaculum. This hibernaculum is identified in the supplemental materials.

Priorities for conservation should focus on preservation of known roosting areas (Tier 1 CFA), tracts of appropriate habitat (Tier 3 CFAs), and protection of migratory routes between known hibernacula in Tennessee to maternity roosts in Alabama and Georgia along the ridges of Dade, Walker, Catoosa, and Chattooga Counties and from Whitfield/Murray Counties to Gilmer County (Tier 3 CFAs). Priorities also include preserving or restoring appropriate maternity roosting habitat (Tier 3 CFAs), and could also include adding to existing tracts of preserved, older-aged hardwood or mixed hardwood/pine forests including:

1. Rich Mountain WMA
2. Paulding Forest
3. Dawson Forest
4. Crockford-Pigeon WMA
5. Little Sand Mountain (included in the migratory ridges of northwest Georgia)
6. Cumberland Plateau forests (included in the migratory ridges of northwest Georgia)
7. Other large forested tracts capable of supporting (or documented to support) maternity colonies.

Tri-colored Bat

Research Needs:

- Identification of any large wintering roosts in the southern portion of the state. These roosts may be less impacted by WNS and may identify populations that could persist into the future.
- Assessment of hibernacula in north Georgia for individuals that are surviving impacts of WNS. Identification of these individuals may prove to be important for the long-term survival of the species.

- Refinement of species range.

Conservation Needs: Tri-colored Bats are one of the most severely-affected bat species from WNS, with approximately 90 percent reduction of populations in northern Georgia. Treatment of hibernacula could reduce declines of this species in the state. Tri-colored Bats occur in caves throughout the state. Priority hibernacula (Tier 2 CFAs) identified for this species can be found in the supplemental materials. Caves used as hibernacula and the surrounding swarming / staging habitat (5 mi radius of cave entrance) should be preserved and/or restored. For caves not known to have *Pd*, protections and conservation measures to minimize introduction of *Pd* to these habitats should be considered.

Application of the Strategy

This strategy is intended to apply to all areas of Georgia where priority bat species occur. For species protected under the ESA, this strategy applies to all projects within the state boundary or where GAES is the lead Field Office for a project for consultation.

Conservation, Avoidance, Minimization, Mitigation, and ESA Options

Best Management Practices / Avoidance and Minimization

The best option for the conservation of bat species is to avoid disturbance of habitats and environments that priority species use. With a growing population and changing landscape, the complete avoidance of these habitats for project proponents will not always be possible. The next option is to limit or avoid disturbance to the species during critical life-history stages by preserving maternity roosting habitat and wintering habitat. Because of low reproductive capacity of many bat species, protecting maternity habitat during the pup season (non-volant period) is critical (Figure 1). Below is a list of avoidance, minimization, and other Best Management Practices related to conservation of priority bats on the landscape. Please use this list to employ Avoidance and Minimization Measures (AMMs) that could be applicable to a project. Please consult with the Georgia Ecological Field Office, FWS, and GDNR to assess potential project impacts related to known roosts and potential cave habitats.

All Projects

- Avoid disturbance of known maternity roosts and the surrounding habitat during the non-volant pup season (north GA: May 15 to July 31; south GA: April 1 to July 31).
- All personnel surveying or monitoring bat populations should implement appropriate WNS decontamination protocols.
- Wetland avoidance/minimization/compensation.
- Dust control.
- Protections of water quality through erosion and sediment control, spill control, runoff detention, and post-construction water quality treatment.
- Consider conducting any disturbance activities at night when bats are feeding, starting one hour after sunset, and ending one hour before daylight excluding the hours between 10 p.m. and midnight, and keeping the light localized.

Tree Removal (Habitat Removal)

- High priority should be given to preserve any maternity roosts and nearby habitat. If preservation of a roosting site is not possible, impacts should be minimized to all extent possible and replacement of any lost maternity habitat/roosts should be prioritized.
- If suitable habitat requires removal, use timing restrictions to conduct work when bats are not likely to be using the habitat (winter season: April 1 to October 15) or when there pups are non-volant (north GA: May 15 to July 31; south GA: April 1 to July 31).
- Ensure any habitat to be cleared is clearly marked to ensure contractors stay within the planned clearing limits.

Man-made Structures

- Ensure each structure is surveyed to assess whether it is being used as a roost by bats.
- Avoid impacts that could disturb roosting bats by performing any maintenance or modifications to structures when bats are not present.
- If structure modification / repair / maintenance is required when bats are present, minimize impacts to roosts when pups are non-volant (north GA: May 15 – July 31; south GA: April 1 – July 31).
- Perform activities in a way that minimizes disturbance to roosting bats.
- Replace any lost or modified roosting habitat. If artificial roosting structures are used, ensure that the designs adhere to dimensions of those that have been approved by Bat Conservation International (www.batcon.org).
- Ensure that any exclusionary barriers are placed outside of the non-volant pup season to ensure that helpless pups are not entrapped inside exclusion areas.

Cave or Cave-like Habitats / Hibernacula

- For projects within karst areas, priority should be given to preservation of forested habitat within 0.5 mi of known hibernacula or named caves. This area likely provides microclimate controls for the cave and protected cover for individuals moving to and from the cave.
- Projects located within karst areas should establish a natural area/buffer of 300 ft. or greater around any cave, sinkhole, losing stream, or spring found within the action area.
- Project drainage plans should ensure that karst areas and ground water sources are not degraded through untreated runoff or that significant runoff does not modify cave entrances or flood cave habitats.

Lighting

- Direct temporary lighting away from suitable habitat during the active season.
- Use downward-facing, full cut-off lens lights, and direct lighting away from suitable habitat when installing new or replacing existing permanent lights.

Blasting

- All blasting activities should assess impacts to karst habitat, groundwater sources, and nearby caves or cave-like habitats that could serve as hibernacula or maternity roosts.
- Explosive blasting activities must be designed and conducted to face away from identified bat habitat.

Solar / Wind

- Siting locations of solar or wind facilities should avoid physiographic features that are commonly used by migratory bat species.

Surveys to Inform Assessment of Impacts

Surveys of habitat, structures, bridges/culverts, caves, and cave-like habitats can provide additional information needed for consultation. Please ensure that any mist-net and hibernacula surveyors have appropriate state and federal permits to conduct these activities and permission of property owners. If bats are using man-made structures or cave habitats, and counts cannot be directly made, emergence counts and/or acoustic surveys could provide valuable information for species use of specific habitats. Surveys within hibernacula should be avoided unless coordinated with the GDNR. Any man-made structures (bridges, culverts, buildings) that will be impacted by projects should be surveyed to assess if the structure is being used by bats as a maternity roost. If bats are using a structure, efforts should be made to identify what species are using the habitat and efforts made to preserve the maternity habitat, if possible.

Consultation for Species Protected Under the Endangered Species Act

Technical Assistance / Informal Consultation

For any project that has a potential to impact listed or priority species, technical assistance can be provided by GAES and GDNR. Georgia Ecological Services is planning on developing programmatic agreements with several federal agencies (FHWA, U.S. Army Corps of Engineers, and Rural Utilities Service) to streamline consultation with our office under the ESA. These programmatic agreements will define specific guidance related to impacts and avoidance, minimization, and mitigation options for specific project types. Additional information can be found on our website: https://www.fws.gov/athens/ . Or contact our office at the following address:

Carrie Straight
Georgia Ecological Services
Fish and Wildlife Service
105 Westpark Drive, Suite D
Athens, Georgia 30606
Phone: 706-913-9493
carrie_straight@fws.gov

Consultation is required for species listed under the ESA. Our office requests that coordination occur early in the project planning process. Early coordination decreases the likelihood of project delay and allows project proponents to include any avoidance and minimization efforts in project plans.

Consultation under the ESA is not required for species proposed to be listed. However, depending on projected timelines of a project, coordination for proposed species may be beneficial to minimize project delays in the future. If a proposed action is likely to adversely affect a proposed species or proposed critical habitat, the action agency may request a conference with the Service to ensure that the proposed action will not result in jeopardy to the species or the destruction or

adverse modification of designated critical habitat. The results of this conference are documented in a conference opinion. Once a species becomes listed, conference opinions can be converted to biological opinions.

Final 4(d) Rule for the Northern Long-eared Bat

On January 14, 2016, the Service published a 4(d) rule for the Northern Long-eared Bat. Section 4(d) of the ESA is the section that relates to protective regulations the Secretary of Interior deems necessary and advisable to provide for the conservation of species listed as threatened. This rule identifies types of take that are prohibited for the species and activities that would not result in prohibited take. Additional information on the final 4(d) rule is available at: http://www.fws.gov/midwest/endangered/mammals/nleb/.

Although the final 4(d) rule does not prohibit most incidental take of the Northern Long-eared Bat in Georgia, it does not eliminate the requirement for federal action agencies to consult with the Service. The Service developed a Programmatic Biological Opinion to streamline consultation under the 4(d) rule. Project proponents and federal agencies should assess project impacts and assess whether the use of the streamlined consultation for this species is appropriate http://www.fws.gov/midwest/endangered/mammals/nleb/S7.html.

Conservation Goals

This strategy is intended to provide guidance to project proponents, federal agencies, state partners, and private entities. The main goal is to provide measures to minimize impacts to priority bat species and compensate for unavoidable impacts. These goals include:

1. Minimizing and avoiding impacts to a priority species during project implementation
2. Protection of known maternity roosts
3. Protection of known hibernacula
4. Protection of staging/swarming habitats surrounding known hibernacula
5. Protection of migratory routes bats use to move between hibernacula and maternity habitat.
6. Treatments, if available, for WNS

Summary of Regional Conservation Focus Areas

Southwestern Appalachians/ Ridge & Valley. In this region, Tier 3CFAs should include preservation of older-aged mixed or hardwood forest habitat in the migratory ridges of the northwestern part of the state. Other Tier 3 SFAs include adding to existing protected habitat patches surrounding Cloudland Canyon State Park and Crockford-Pigeon Mountain WMA. Tier 1 and Tier 2 CFAs include preservation of hibernacula, staging and swarming habitat for priority hibernacula and maternity caves (Figure5).

Blue Ridge. In this region, Tier 3CFAs should include preservation of older-aged mixed or hardwood forest habitat to increase habitat patches associated with Dawson Forest WMA and Rich Mountain WMA. Tier 2 CFAs include preservation of hibernacula, staging and swarming habitat for priority hibernacula (Figure 5). Although not mapped, Tier 1 habitats for Northern Long-eared Bats have been identified in this region. Please consult with GAES to assess conservation efforts related to these habitats.

Piedmont. In this region, Tier 3CFAs should include preservation of older-aged mixed or hardwood forest habitat to increase habitat patches associated with Paulding Forest WMA and Dawson Forest WMA (Figure 5).

Southeastern Plains. In this region, Tier 3CFAs should include preservation of older-aged mixed or hardwood floodplain or bottomland forest in the Altamaha River corridor. Tier 1 and Tier 2 CFAss should include preservation of hibernacula, staging and swarming habitat for priority hibernacula and maternity caves (Figure 6).

Southern Coastal Plain. In this region, Tier 3CFAs should include preservation of older-aged mixed or hardwood floodplain or bottomland forest in the Altamaha River corridor (Figure 6).

Mitigation Implementation for the Conservation Strategy

Compensatory Mitigation Measures

Mitigation should be considered to account for unavoidable impacts on listed bats and their habitats. Mitigation options could include in-lieu fee mitigation, conservation banking, and/or permittee responsible mitigation. Permittee responsible mitigation measures may include replacing lost roosts or roosting habitat and/or cave gating. In-lieu fee mitigation methodology was defined in the national programmatic agreement between FHWA/FRA and the Service. The fee amount will be based on acres of land classified as habitat for the species that is expected to be directly impacted by the project which is multiplied by the current agricultural real estate value. Additionally, this cost will be multiplied by a ratio defined by the season that habitat is expected to be cleared. These ratios will be defined and updated in programmatic agreements with our office. Our office will maintain an up-to-date coverage of known roosts and hibernacula to use for assisting consultation under the ESA.

Strategy Modification

This strategy will be modified if new information becomes available related to priority bats in Georgia and their conservation status, natural history, threats, conservation measures, and recovery. Additionally, this strategy may be modified if new hibernacula or habitats are identified or prioritizations of the CFAs change. Modifications may be needed if new bat species is proposed or becomes listed under the ESA. As the strategy is updated, new versions will be posted on the GAES website and provided to appropriate federal, state, and private partners.

Summary

This conservation strategy was developed by GAES to assist project proponents, federal agencies, state agencies, and private entities assess threats, understand limits in our knowledge, and prioritize conservation needs of priority bat species in Georgia. This strategy will be updated and disseminated to partners as new information becomes available. By providing research needs, this document has identified limitations in our knowledge of these species in Georgia and could provide valuable information related to the natural history, threats, and conservation need of Georgia's priority species.

Conservation priorities listed herein should help support recovery of listed species and help support more viable populations of priority bat species in Georgia. The protection of hibernacula and maternity habitat is vital for sustaining populations of priority bat species in Georgia. The avoidance and minimization measures provided herein should provide guidance to minimize harm to priority bat species and mitigation options for unavoidable impacts should help support listed species into the future.

Literature Cited

Baerwald, E. F. 2016. Do fatalities at wind energy facilities threaten North American populations of Hoary Bats? The Wildlife Society 2016 Annual Conference, October 15-19, 2016, Raleigh, NC.

Blehert D. S., A. C. Hicks, M. J. Behr, C. U. Meteyer, B. M. Berlowski-Zier, E. L. Buckles, J. T. H. Coleman, S. R. Darling, A. Gargas, R. Niver, J. C. Okoniewski, R. J. Rudd, and W. B. Stone. 2009. Bat white-nose syndrome: an emerging fungal pathogen? Science. 323: 227.

Frick, W. F., J. F. Pollock, A. C. Hicks, K. E. Langwig, D. S. Reynolds, G. G. Turner, C. M. Butchkoski, and T. H. Kunz. 2010. An emerging disease causes regional population collapse of a common North American bat species. Science 329: 679-682.

Georgia Department of Natural Resources (GDNR) 2015. Georgia State Wildlife Action Plan. Social Circle, GA: Georgia Department of Natural Resources.

Georgia State Board of Forestry. 1922. Report of the Georgia State Board of Forestry to the Georgia General Assembly of 1922. Atlanta, GA.

Grider, J. F. 2014. Year-Round Activity of Peripheral Bat Populations in the North Carolina Coastal Plain. M.S. Thesis. University of North Carolina at Greensboro, Greensboro, NC. 50 pp.

Kunz, T. H., E. B. Arnett, W. P. Erickson, A. R. Hoar, G. D. Johnson, R. P. Larkin, M. D. Strickland, R. W. Thresher, and M. D. Tuttle. 2007. Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses. Frontiers in Ecology and the Environment 5: 315-324.

Verant, M. L., J. G. Boyles, W. Waldrep Jr., G. Wibbelt, and D. S. Blehert. 2012. Temperature-dependent growth of *Geomyces destructans*, the fungus that causes bat White-Nose Syndrome. PLoS ONE 7(9): e46280.

Tables

Table 1 Bat species occurring in Georgia, their conservation status, and regions where they were designated a priority according to the 2015 State Wildlife Action Plan (SWAP; GDNR 2015). All federally listed species and state listed species are SWAP priority species.

Scientific Name	Common Name	Federal / Georgia Status	Southwestern Appalachians/ Ridge & Valley (SA/RV)	Blue Ridge (BR)	Piedmont (PD)	Southeastern Plains (SP)	Southern Coastal Plain (SCP)
Corynorhinus rafinesquii	Rafinesque's Big-eared Bat	State Rare	X	X		X	X
Eptesicus fuscus	Big Brown Bat	None					
Lasionycteris noctivagans	Silver-haired Bat	None					
Lasiurus borealis	Eastern Red Bat	None					
Lasiurus cinereus	Hoary Bat	None					
Lasiurus intermedius	Northern Yellow Bat	SWAP Priority Species				X	X
Lasiurus seminolus	Seminole Bat	None					
Myotis austroriparius	Southeastern Myotis	SWAP Priority Species			X	X	X
Myotis grisescens	Gray Bat	US Endangered / GA Endangered	X	X	X		
Myotis leibii	Eastern Small-footed Bat	SWAP Priority Species	X	X			
Myotis lucifugus	Little Brown Bat	SWAP Priority Species	X	X			
Myotis septentrionalis	Northern Long-eared Bat	US Threatened / GA Threatened	X	X	X		
Myotis sodalis	Indiana Bat	US Endangered / GA Endangered	X	X			
Nycticeius humeralis	Evening Bat	None					
Perimyotis subflavus	Tri-colored Bat	SWAP Priority Species	X	X	X	X	X
Tadarida brasiliensis	Mexican Free-tailed Bat	None					

Table 2 Georgia's priority bat species and their general natural history classifications.

Common Name	Pups	Cave Use?	Primary Known Summer / Roost Types	Primary Known Hibernacula / Winter Roost Types	General Habitat in Georgia
Rafinesque's Big-eared Bat	1	Yes	Trees, some use of man-made structures	Caves, trees	Pine forests; hardwood forests; caves; abandoned buildings; bridges; bottomland hardwood forests and cypress-gum swamps.
Northern Yellow Bat	2-4	Unknown	Trees (palm/Spanish moss)	Likely active all year, same roost types as summer	Wooded areas near open water or fields; large trees, live oaks preferred.
Southeastern Myotis	2	Yes	Caves, trees, man-made structures	Likely active all year, same roost types as summer	Caves; buildings; bridges; large hollow trees in bottomland hardwood swamps; typically associated with water.
Gray Bat	1	Yes	Caves, uncommon use of other cave-like habitats	Caves	Caves or cave-like structures associated with flowing water, large creeks, or bodies of water
Eastern Small-footed Bat	1	Yes	Cliff fissures/ rock shelters	Caves, fissures in rocks/cliffs/caves	Caves; mines; abandoned buildings; bridges; rock shelters; high elevation talus fields.
Little Brown Bat	1	Yes	Trees, man-made structures	Caves/mines	Caves; mines; mixed forests; man-made structures; bat houses.
Northern Long-eared Bat	1	Yes	Trees, some use of man-made structures	Caves/mines	Caves and mines in winter; riparian areas, upland forests, cracks and crevices in dead and live trees in summer.
Indiana Bat	1	Yes	Trees, some use of man-made structures	Caves/mines (no priority hibernacula in Georgia)	Wooded areas near streams; upland forests; large snags in open areas.
Tri-colored Bat	2	Yes	Trees, man-made structures	Caves/mines	Open forests with large trees and woodland edges; roosts in tree foliage; hibernates in caves or mines with high humidity.

Table 3 Matrix of major threats to or presumed causes of decline of high priority bat species in Georgia.

Threats	Rafinesque's Big-eared Bat	Northern Yellow Bat	Southeastern Myotis	Gray Bat	Eastern Small-footed Bat	Little Brown Bat	Northern Long-eared Bat	Indiana Bat*	Tri-colored Bat
White-nose Syndrome				X	X	X	X	X	X
Wind Energy		X				X	X	X	
Habitat									
Habitat Loss	X	X	X	X	X	X	X	X	X
Habitat Fragmentation	X	X	X	X	X	X	X	X	X
Light Contamination	X	X	X	X	X	X	X	X	X
Hibernacula									
Human Disturbance	X		X	X	X	X	X	NA	X
Improper Cave Gating	X		X	X	X	X	X	NA	X
Changes in Cave Microclimate	X		X	X	X	X	X	NA	X
Flooding of Hibernacula	X		X	X	X	X	X	NA	X
Destruction of Man-Made Hibernacula	X		X	X	X	X	X	NA	X
Maternity Roost									
Human Disturbance	X	X	X	X	X	X	X	X	X
Improper Cave Gating			X	X					
Changes in Cave Microclimate			X	X					
Flooding of Roost Habitat	X	X	X	X	X	X	X	X	X
Destruction of Man-Made Roosts	X		X	X		X	X	X	X
Tree Removal	X	X	X			X	X	X	X
Water Quality / Pesticides / Air Quality									
Direct and Indirect Impacts	X	X	X	X	X	X	X	X	X
Natural Hazards									
Disease / Parasites	X	X	X	X	X	X	X	X	X
Predation	X	X	X	X	X	X	X	X	X
Flooding	X	X	X	X	X	X	X	X	X
Mine Ceiling Collapse	X			X	X	X	X	X	X
Climate Change	X	X	X	X	X	X	X	X	X
Competition with Other Bat Species	X	X	X	X	X	X	X	X	X
Other Threats									
Collisions with Man-made Objects	X	X	X	X	X	X	X	X	X
Forest Management	X	X	X	X	X	X	X	X	X

* There are no known primary hibernacula for Indiana Bats in Georgia.

Table 4 Native bat species and documented or likely impacts from White-Nose Syndrome (WNS) in Georgia.

Common Name	WNS vulnerability
Rafinesque's Big-eared Bat	Low*
Big Brown Bat	Low**
Silver-haired Bat	Low*
Eastern Red Bat	Low*
Hoary Bat	Low
Northern Yellow Bat	Low
Seminole Bat	Low
Southeastern Myotis	Unknown***
Gray Bat	Low**
Eastern Small-footed Bat	Moderate*
Little Brown Bat	High
Northern Long-eared Bat	High
Indiana Bat	High
Evening Bat	Low
Tri-colored Bat	High
Mexican Free-tailed Bat	Low

* Individuals testing positive for *Pseudogymnoascus destructans*, but without signs of WNS.
** Individuals documented with WNS, but likely WNS has minimal impacts to the species in Georgia because of limited reliance on caves and/or behaviors minimizing impacts.
*** Individuals documented with WNS, impacts to the species currently unknown.

Figures

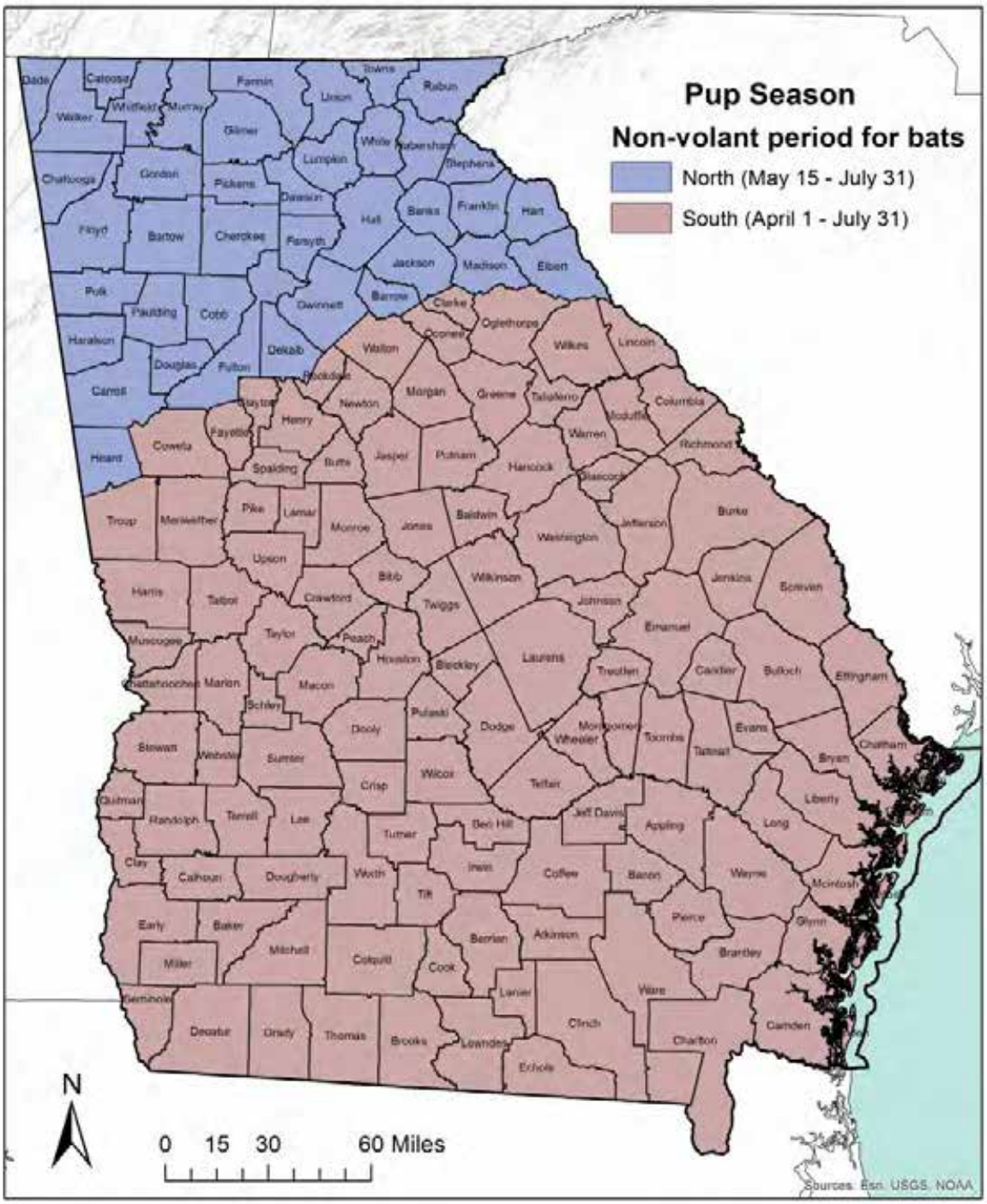


Figure 1 Counties and dates for the non-volant period (pup season) for bats in north and south Georgia.

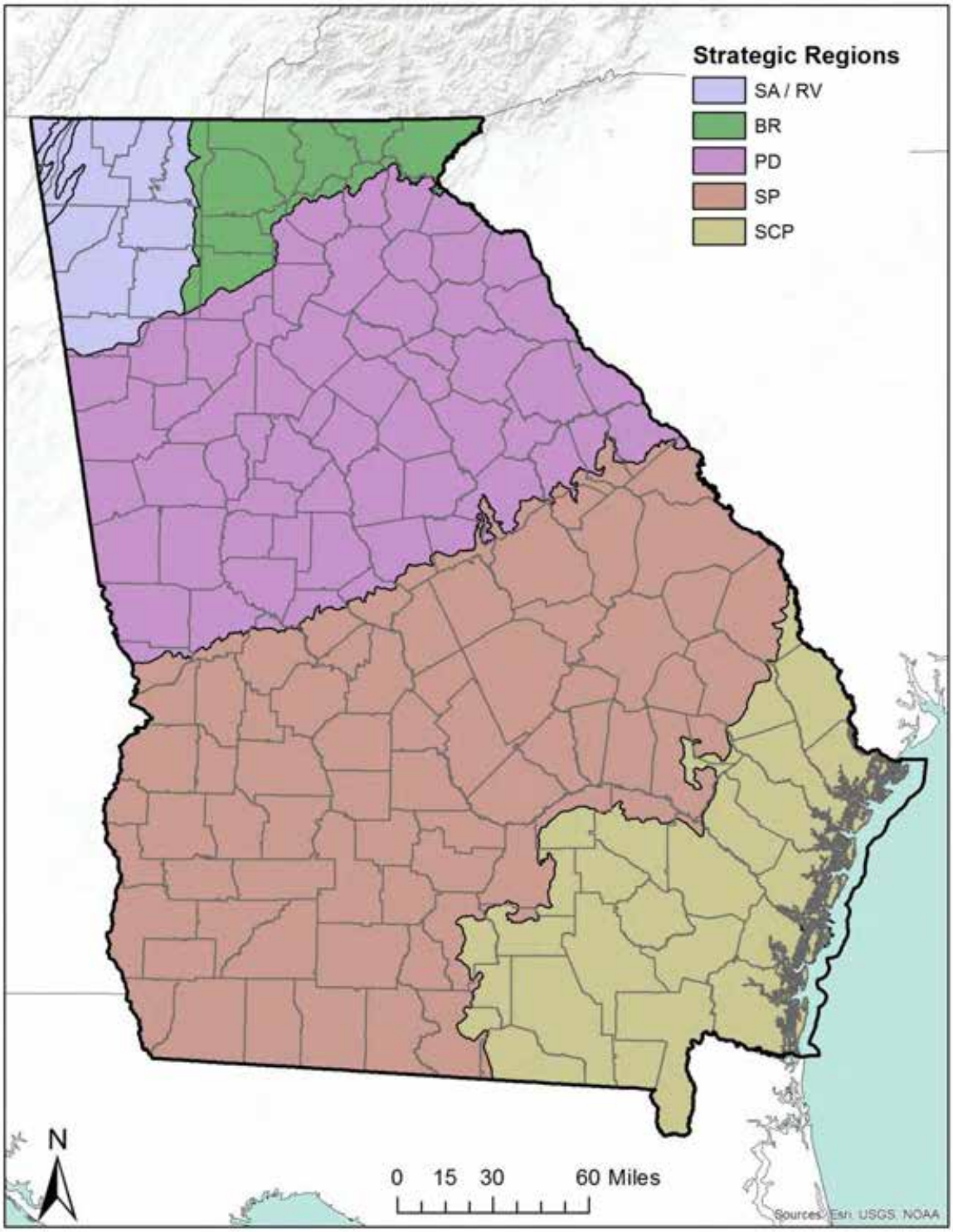


Figure 2 Strategic regions of Georgia based on the Level IV Ecoregions (SA/RV: Southeastern Appalachians / Ridge and Valley; BR: Blue Ridge; PD: Piedmont; SP: Southeastern Plains: SCP: Southern Coastal Plain).

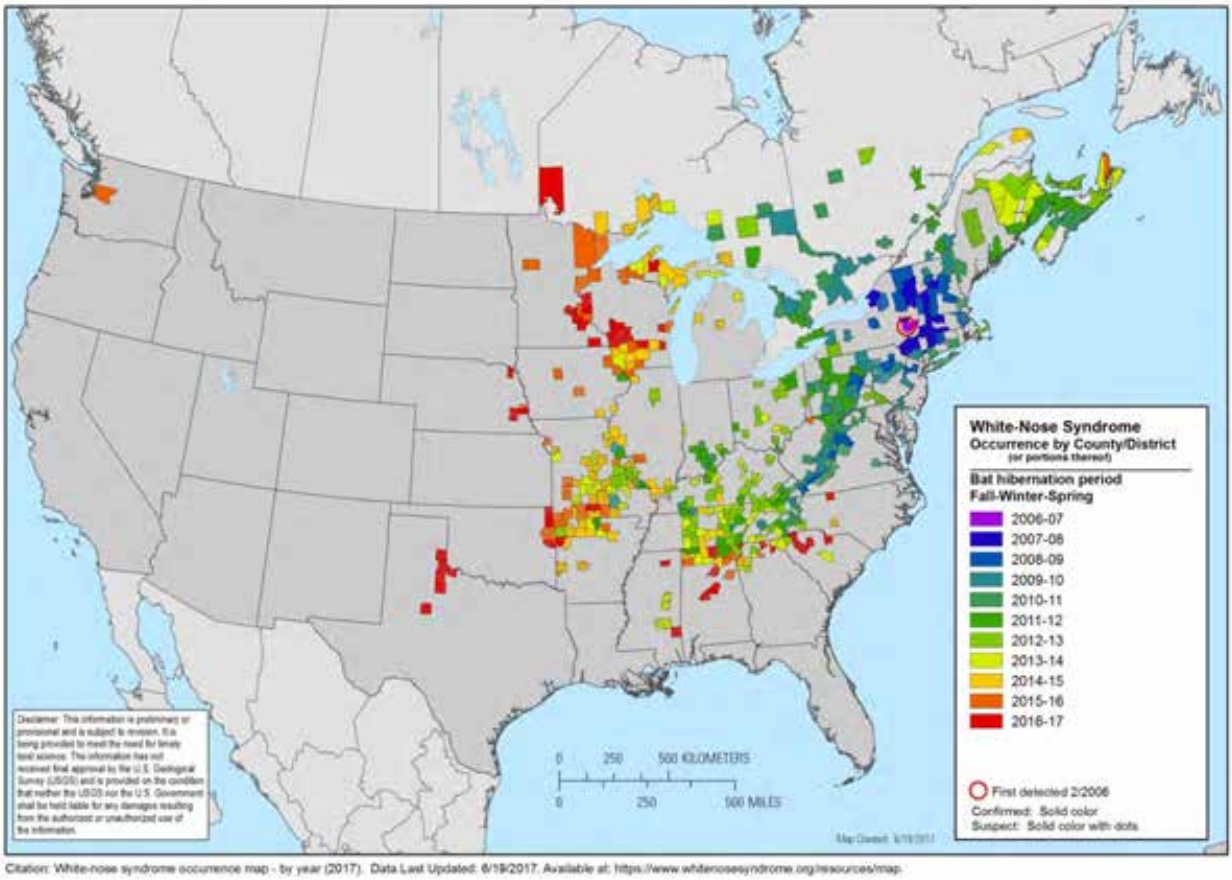


Figure 3 Distribution of White-Nose Syndrome-affected areas as of June 19, 2017.

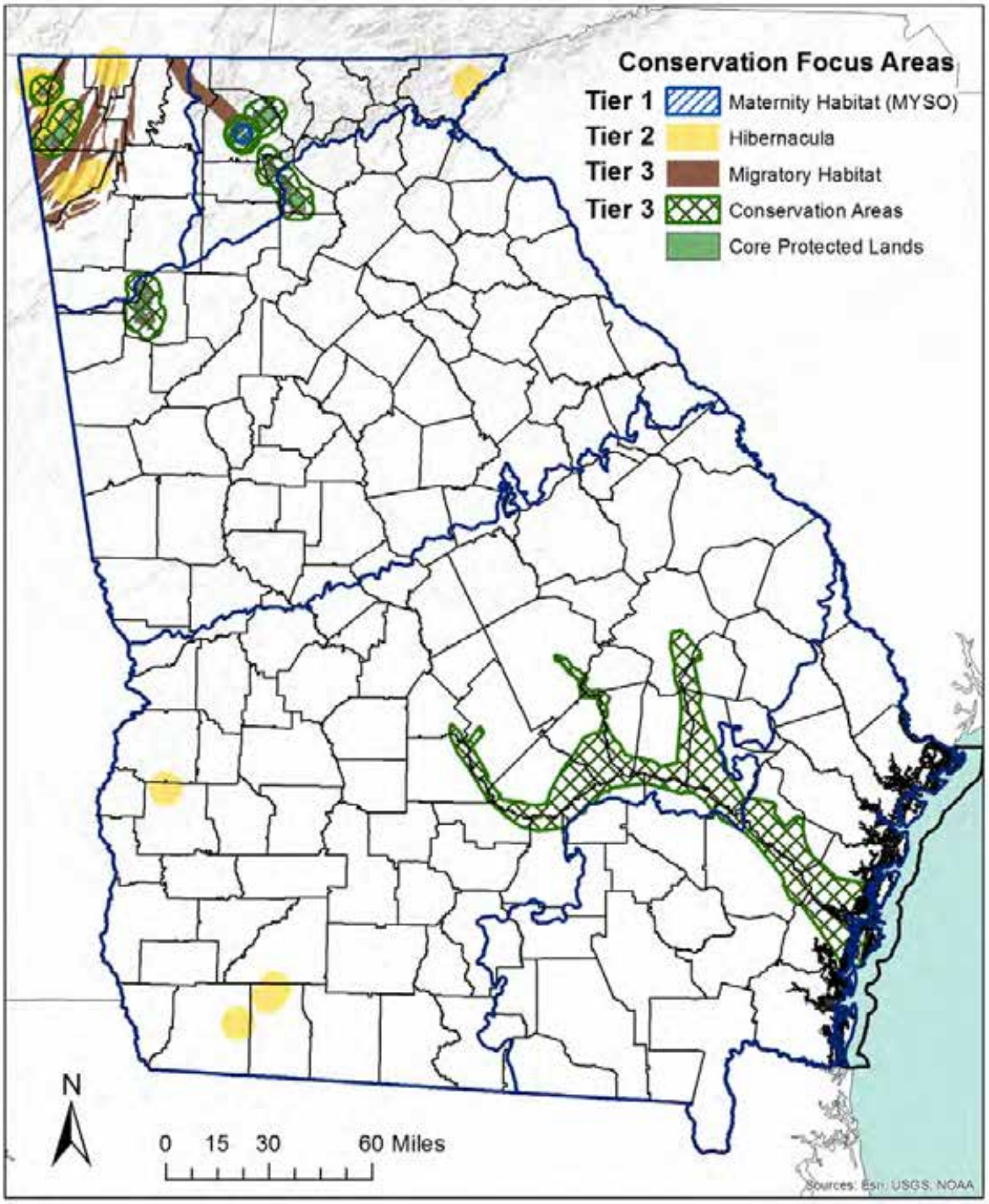


Figure 4 Overview of Conservation Focus Areas for Georgia's priority bat species.

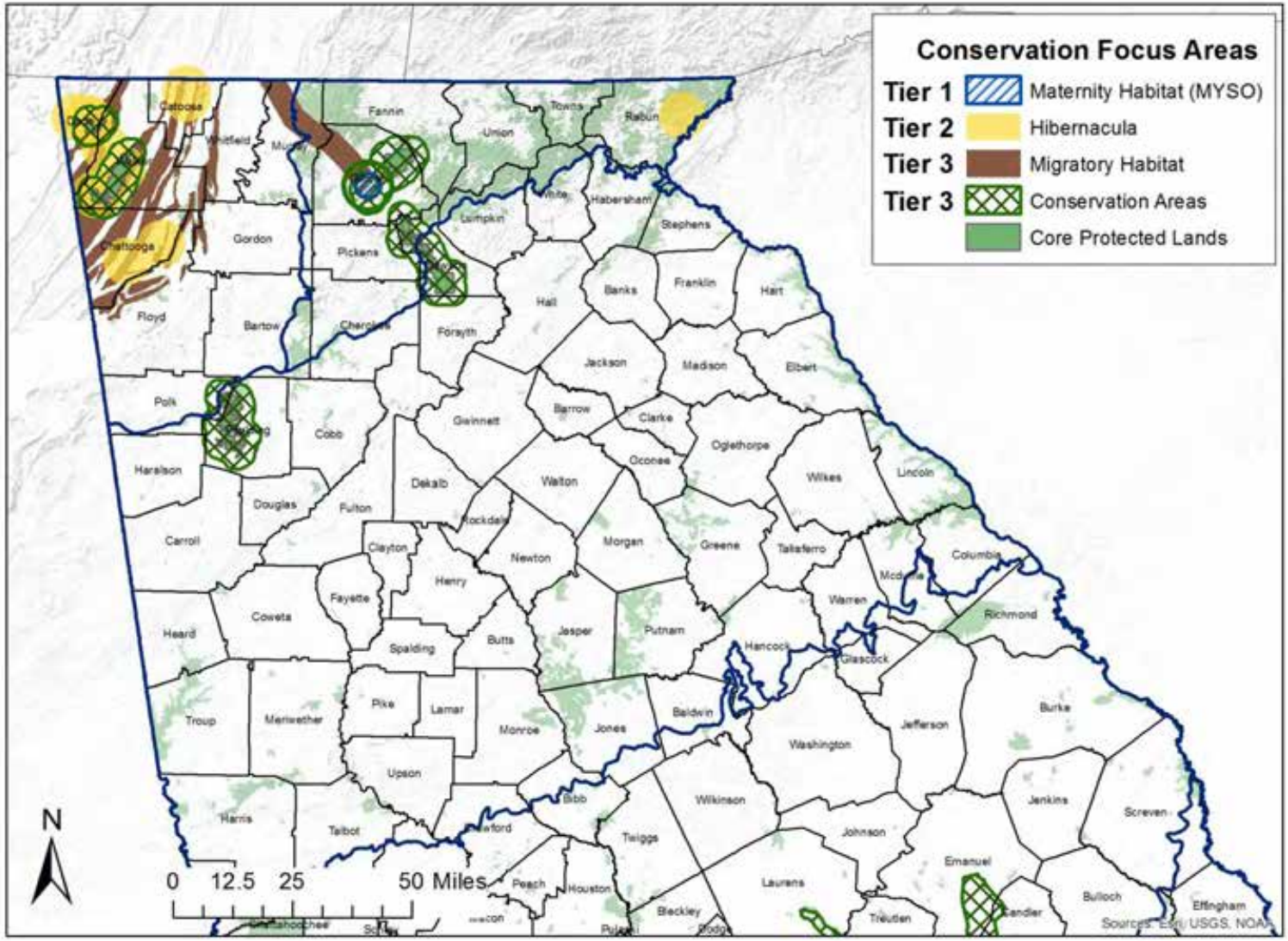


Figure 5 Conservation Focus Areas for Georgia's priority bat species in north Georgia.

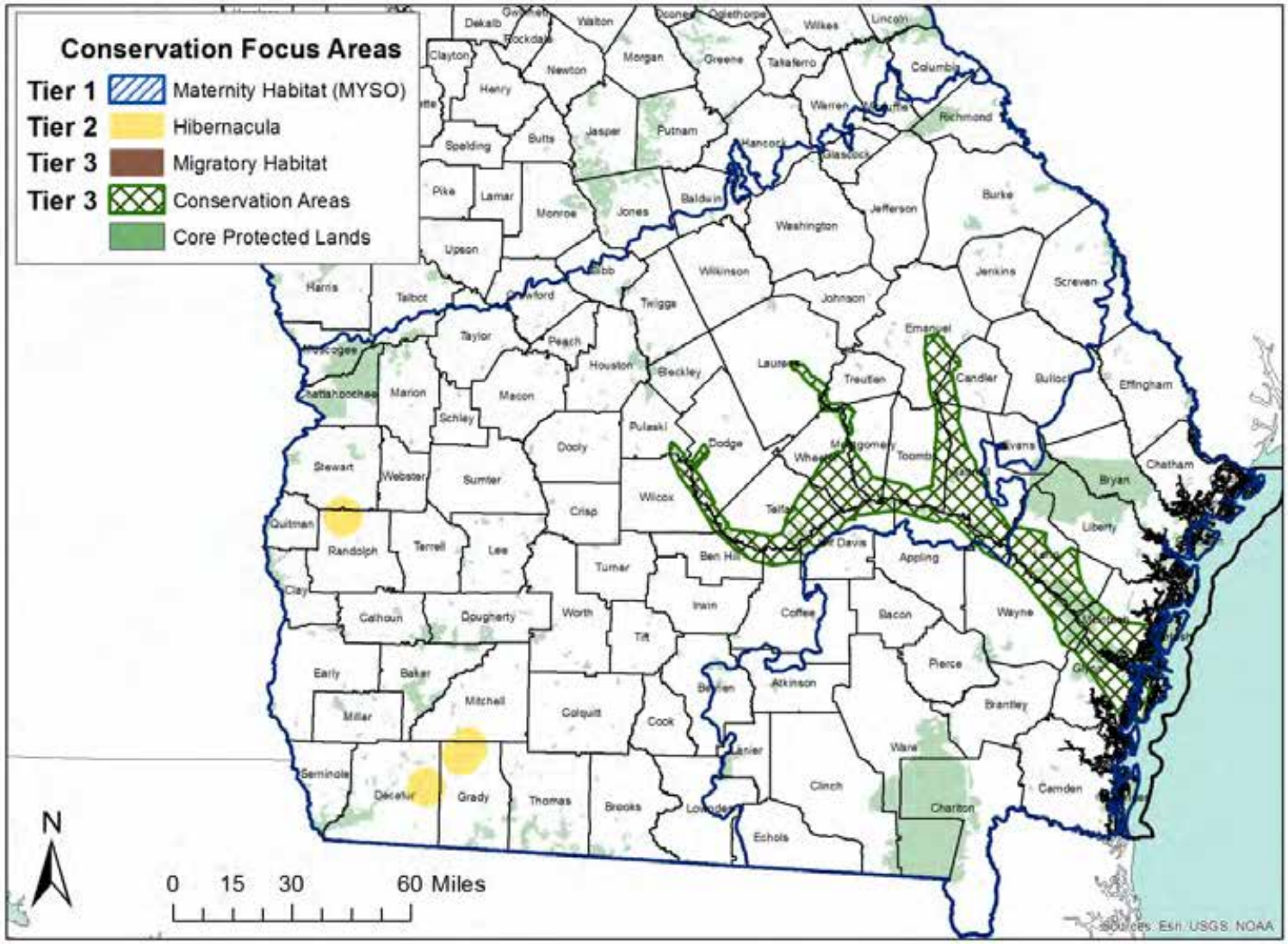


Figure 6 Conservation Focus Areas for Georgia's priority bat species in south Georgia.

Appendix A

Distributions of the nine priority bat species in Georgia. Distributions were developed using occurrence records, species habitat assessment, and expert opinion of Georgia Department of Natural Resources and Service employees.

Appendix A1. Distribution of Rafinesque's Big-eared Bat (*Corynorhinus rafinesquii*).

Appendix A2. Distribution of Northern Yellow Bat (*Lasiurus intermedius*).

Appendix A3. Distribution of Southeastern Myotis (*Myotis austroriparius*).

Appendix A4. Distribution of Gray Bat (*Myotis grisescens*).

Appendix A5. Distribution of Eastern Small-footed Bat (*Myotis leibii*).

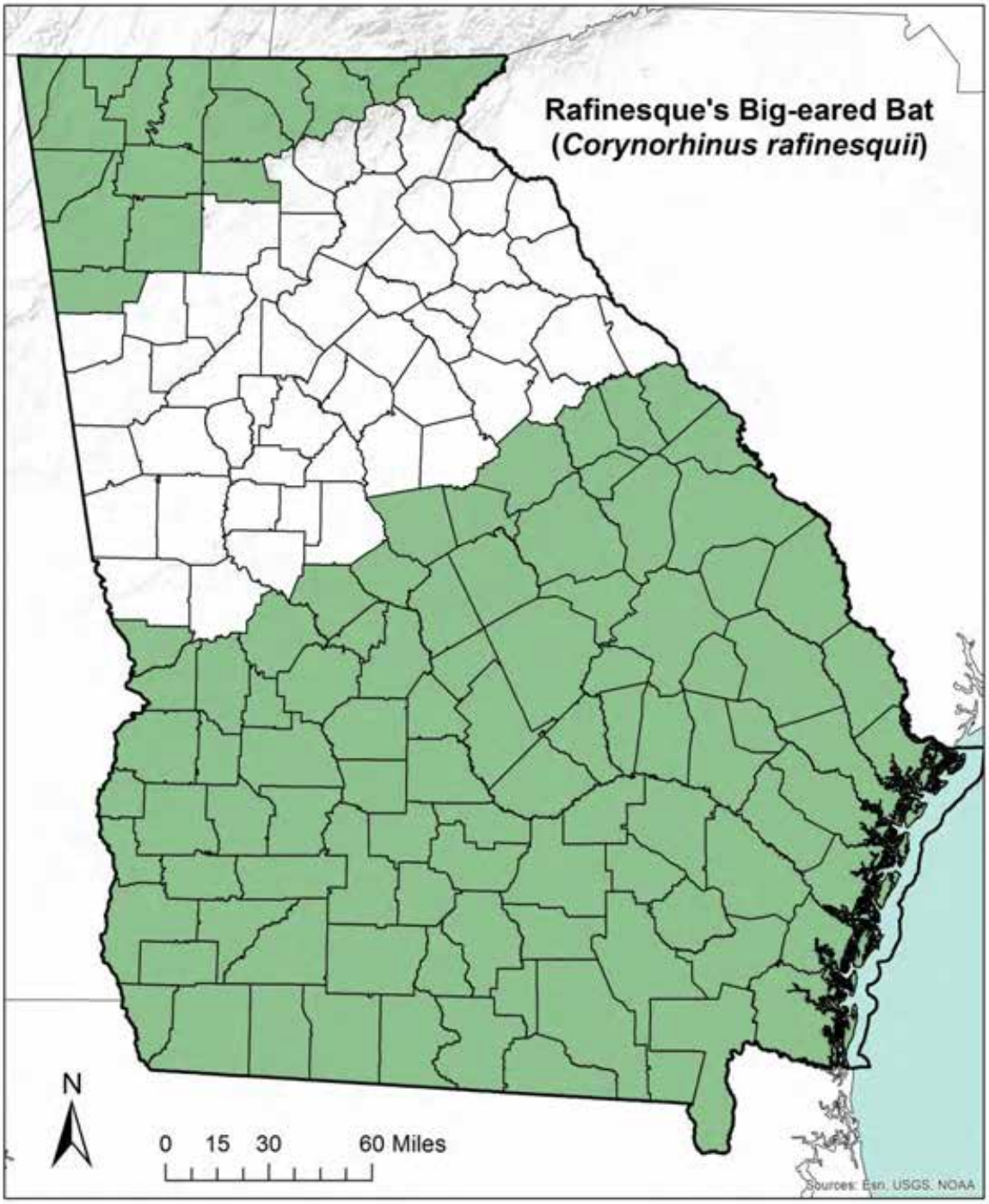
Appendix A6. Distribution of Little Brown Bat (*Myotis lucifugus*).

Appendix A7. Distribution of Northern Long-eared Bat (*Myotis septentrionalis*).

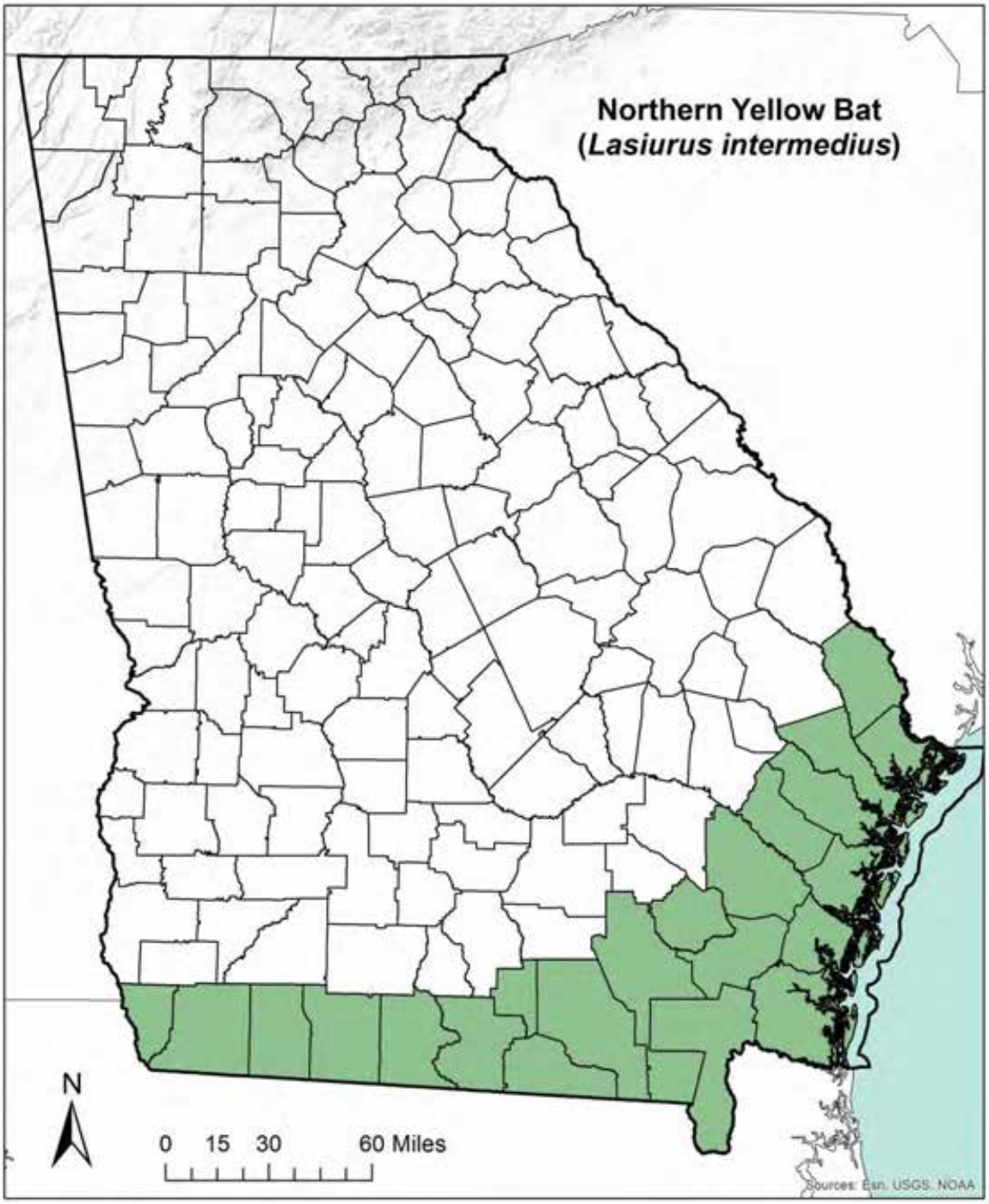
Appendix A8. Distribution of Indiana Bat (*Myotis sodalis*).

Appendix A9. Distribution of Tri-colored Bat (*Perimyotis subflavus*).

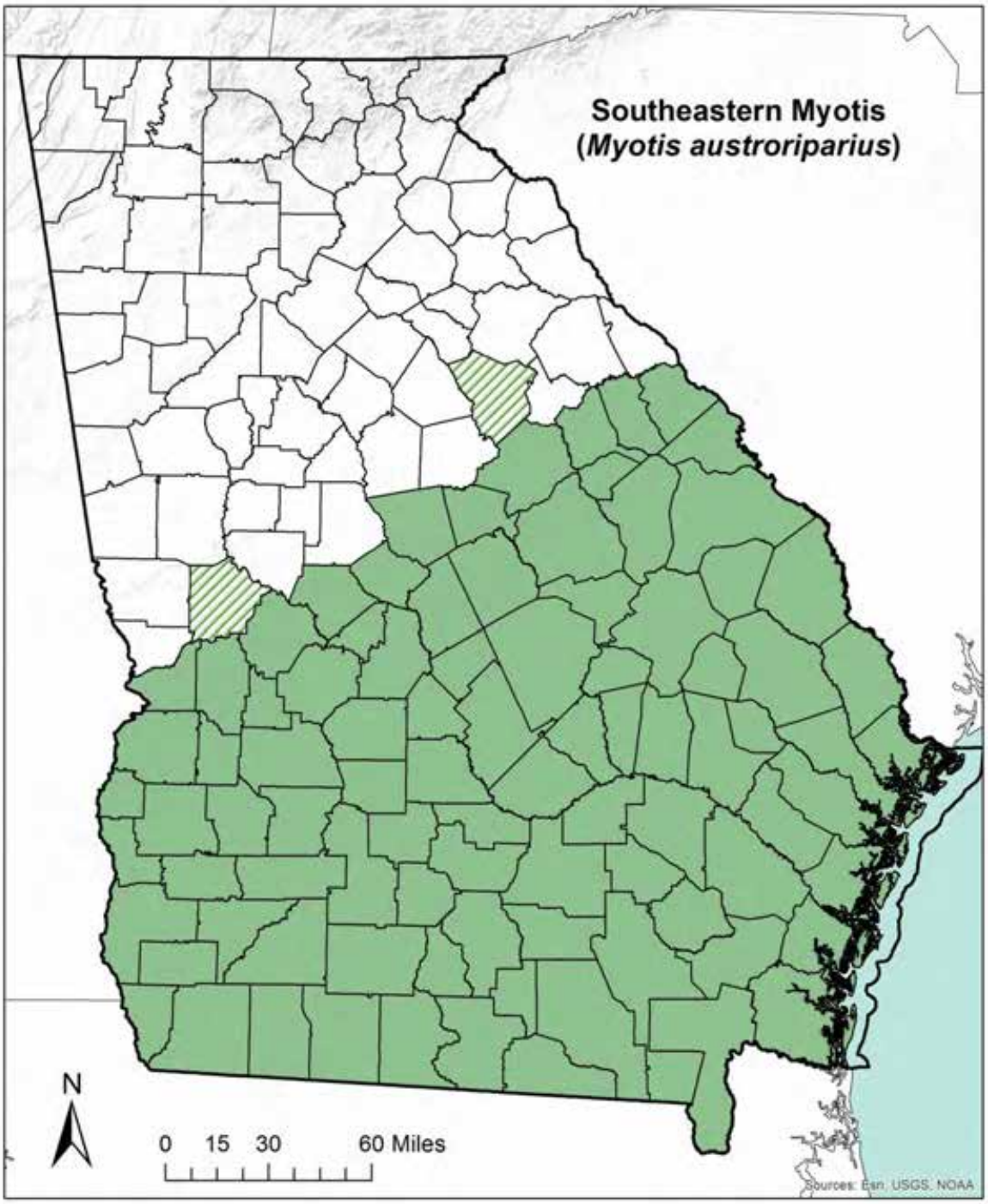
Appendix A1. Distribution of Rafinesque's Big-eared Bat (*Corynorhinus rafinesquii*).



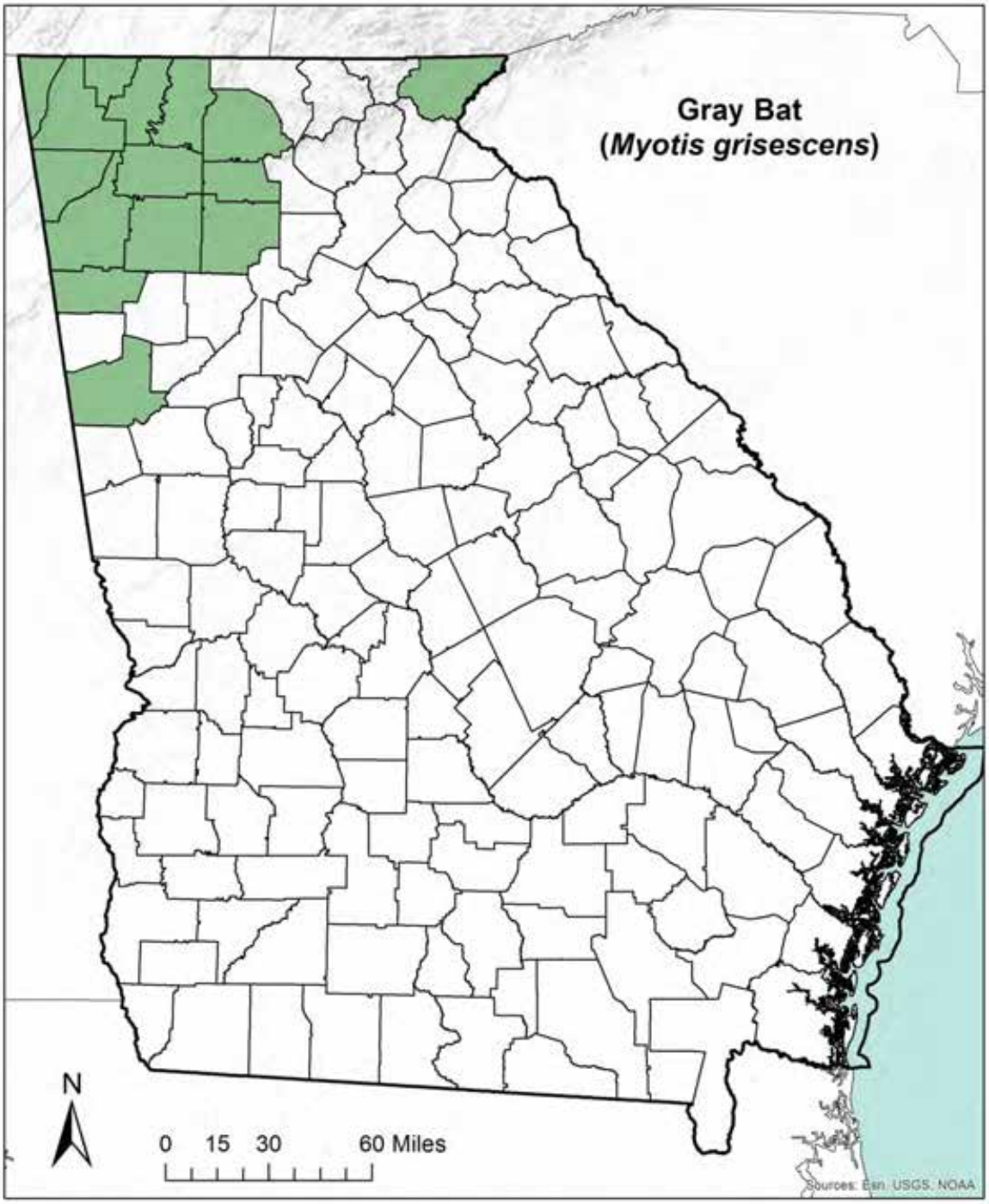
Appendix A2. Distribution of Northern Yellow Bat (*Lasiurus intermedius*).



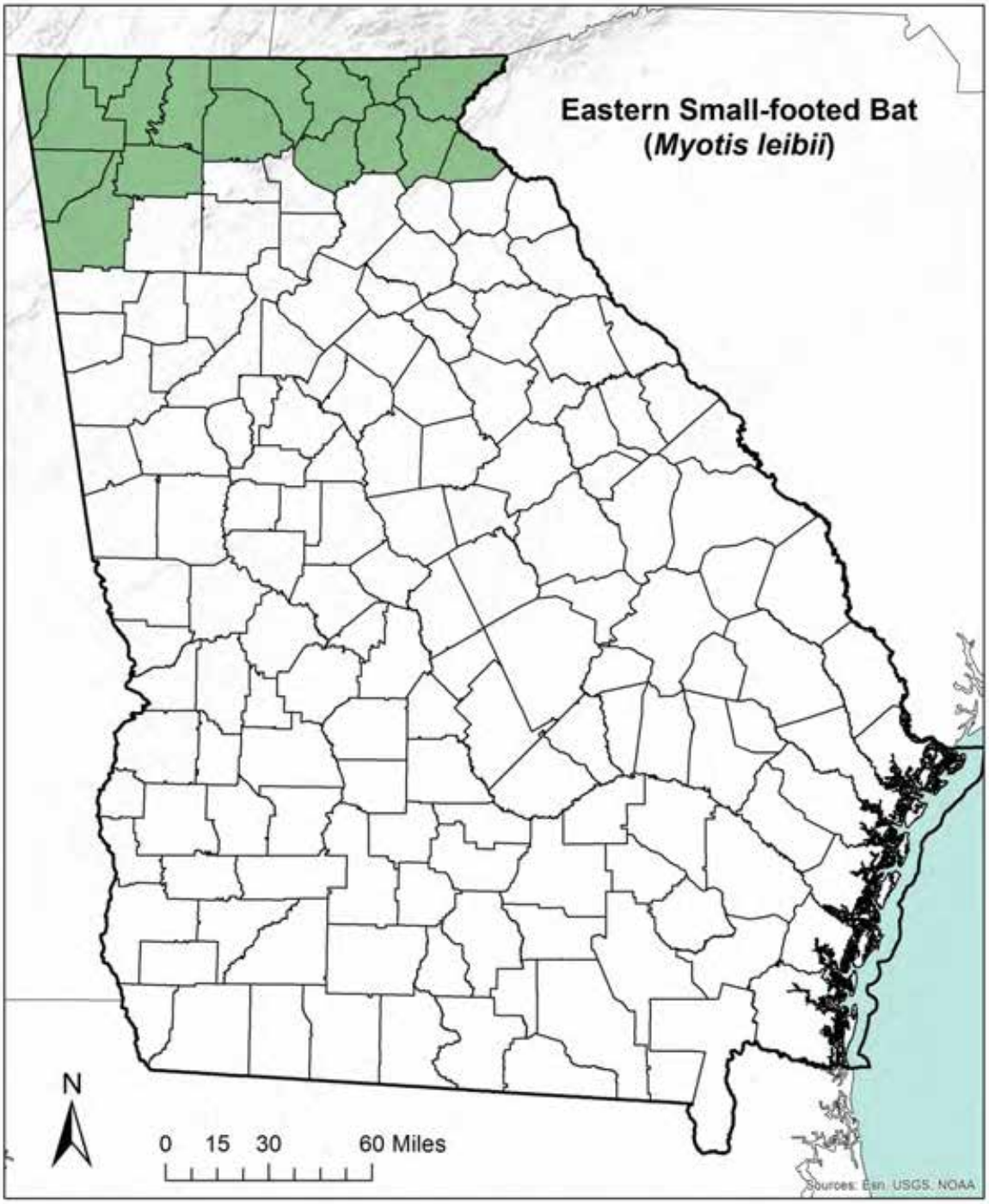
Appendix A3. Distribution of Southeastern Myotis (*Myotis austroriparius*). Hashed counties represent past, documented occurrences, but may not be part of the current range.



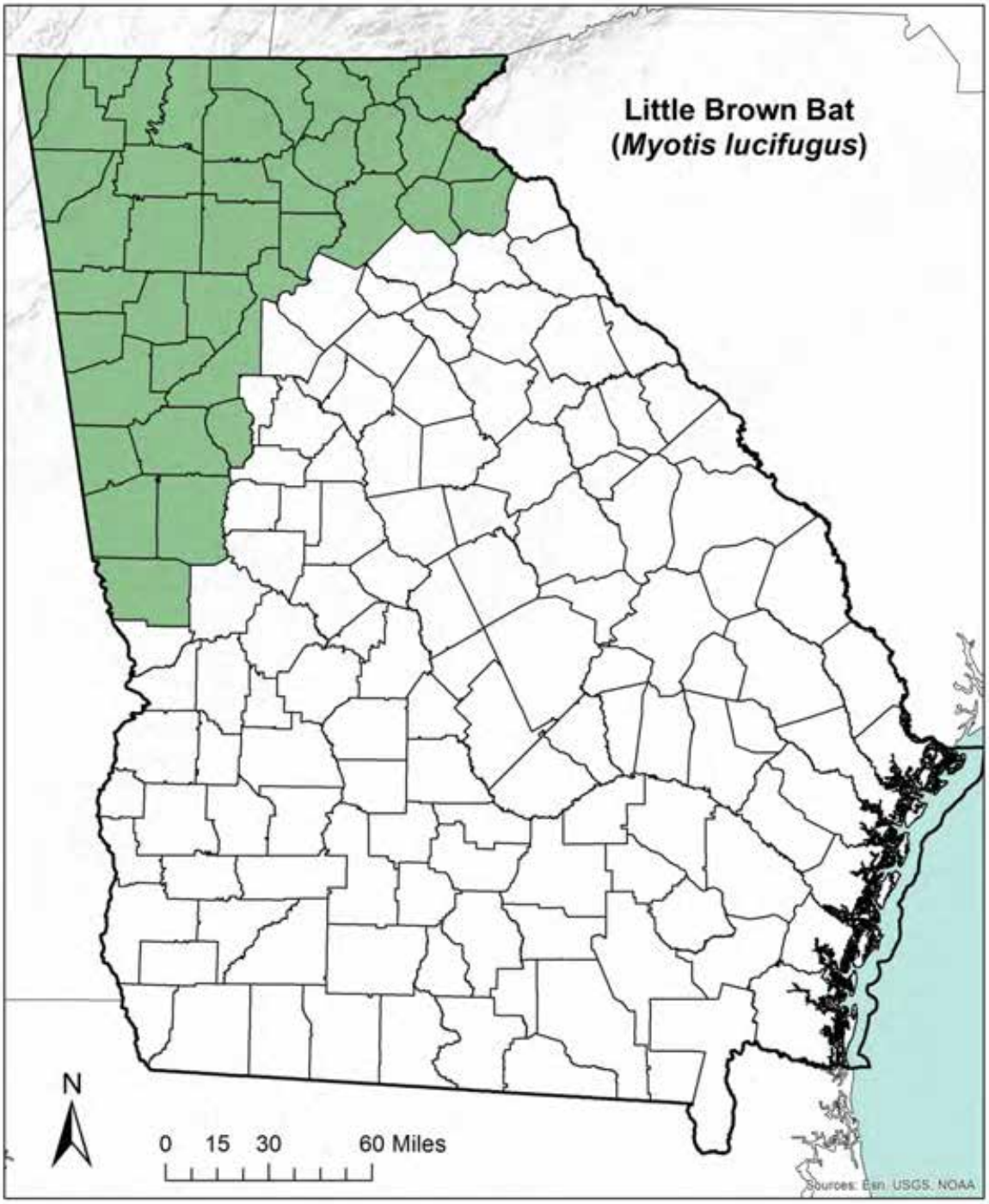
Appendix A4. Distribution of Gray Bat (*Myotis grisescens*).



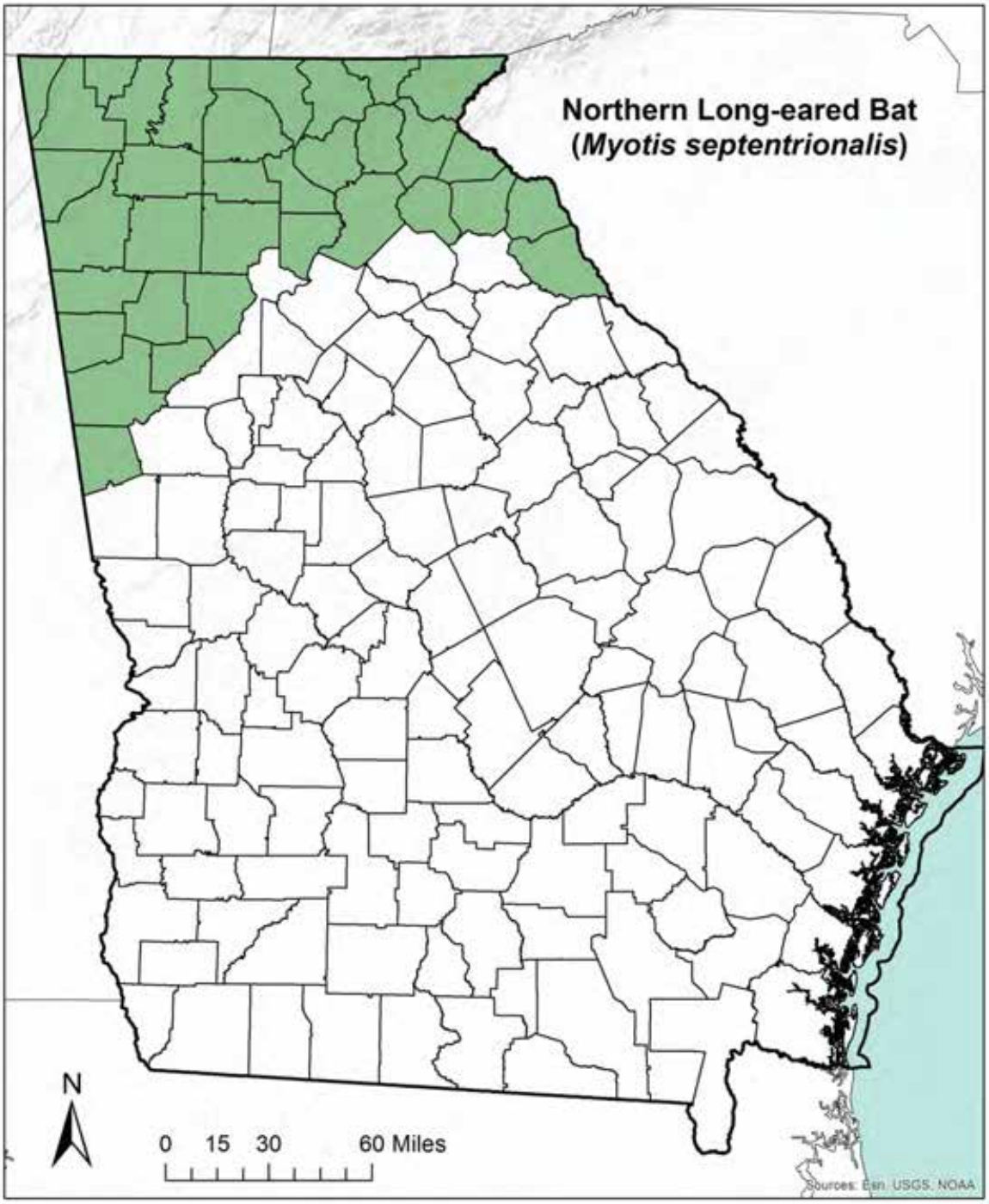
Appendix A5. Distribution of Eastern Small-footed Bat (*Myotis leibii*).



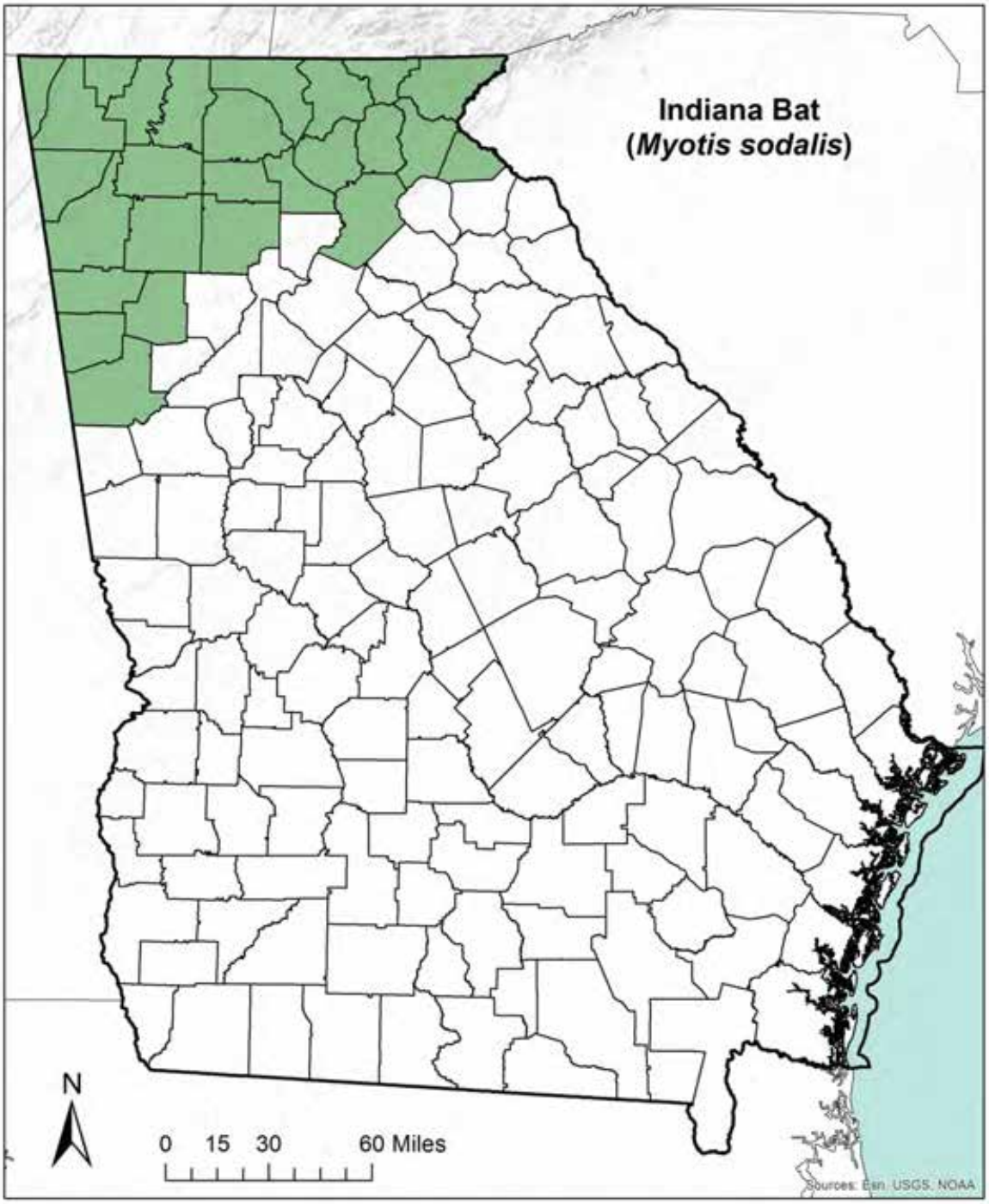
Appendix A6. Distribution of Little Brown Bat (*Myotis lucifugus*).



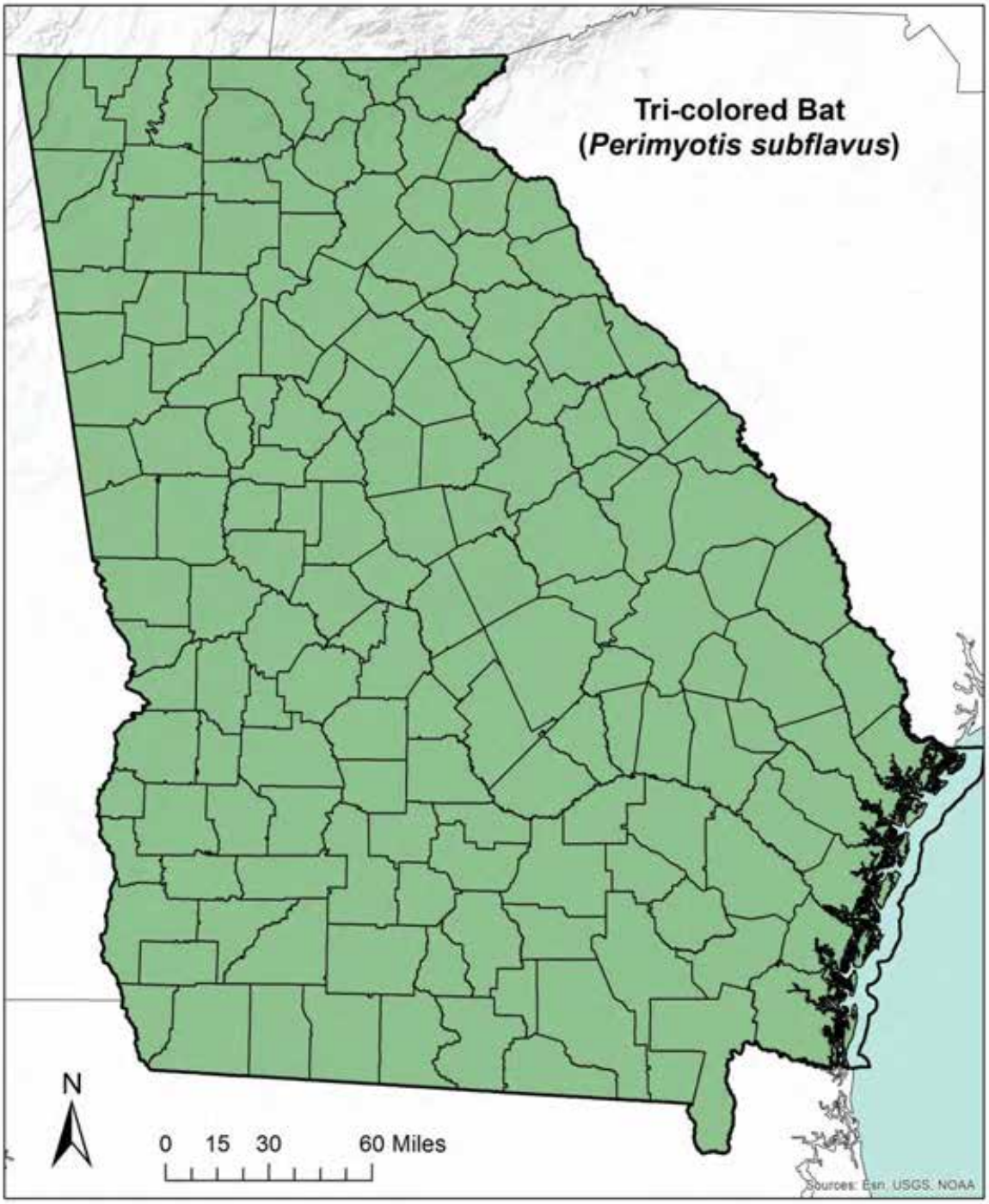
Appendix A7. Distribution of Northern Long-eared Bat (*Myotis septentrionalis*).



Appendix A8. Distribution of Indiana Bat (*Myotis sodalis*).



Appendix A9. Distribution of Tri-colored Bat (*Perimyotis subflavus*).



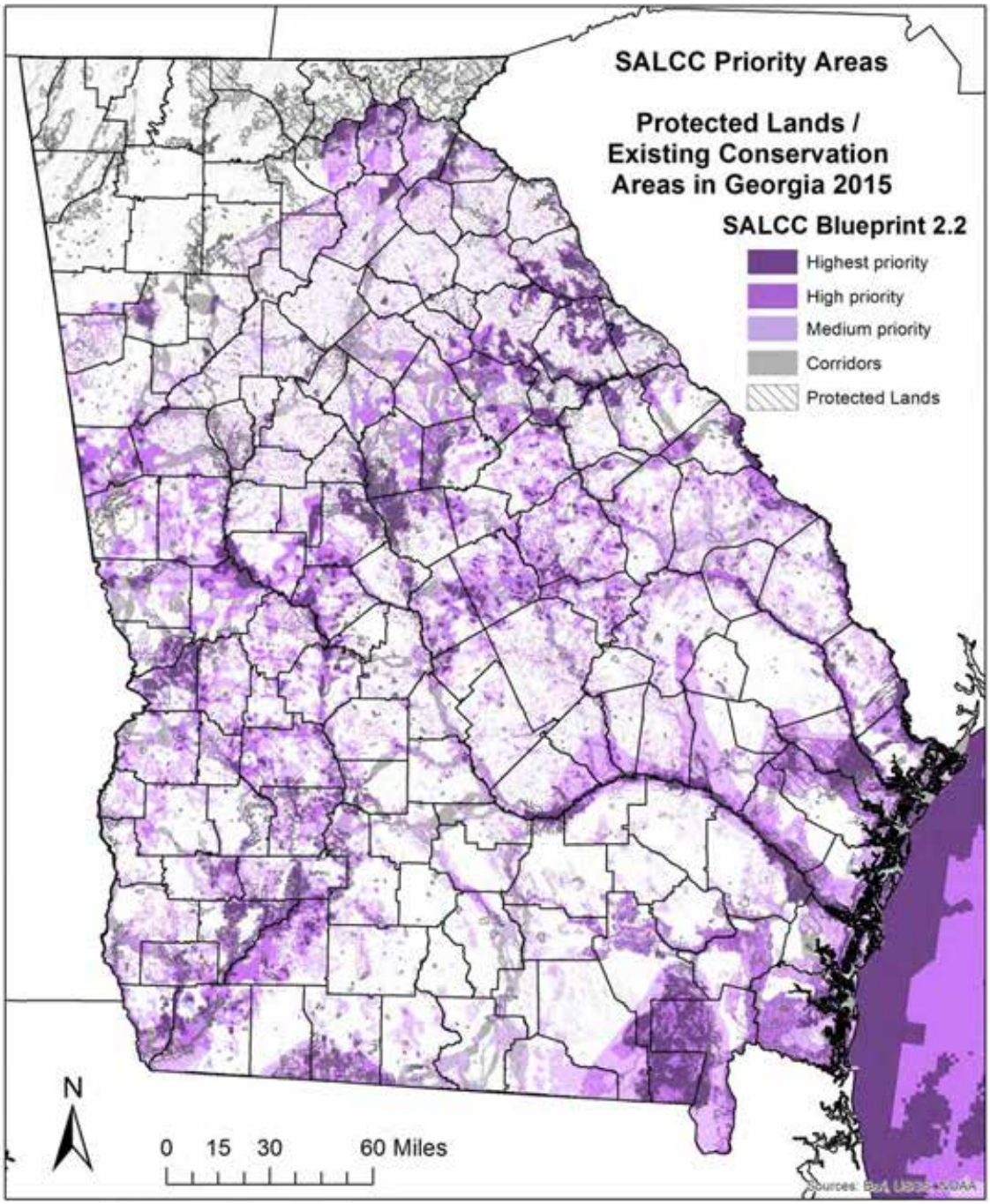
Appendix B

Areas in Georgia identified as priorities by regional strategic planning efforts.

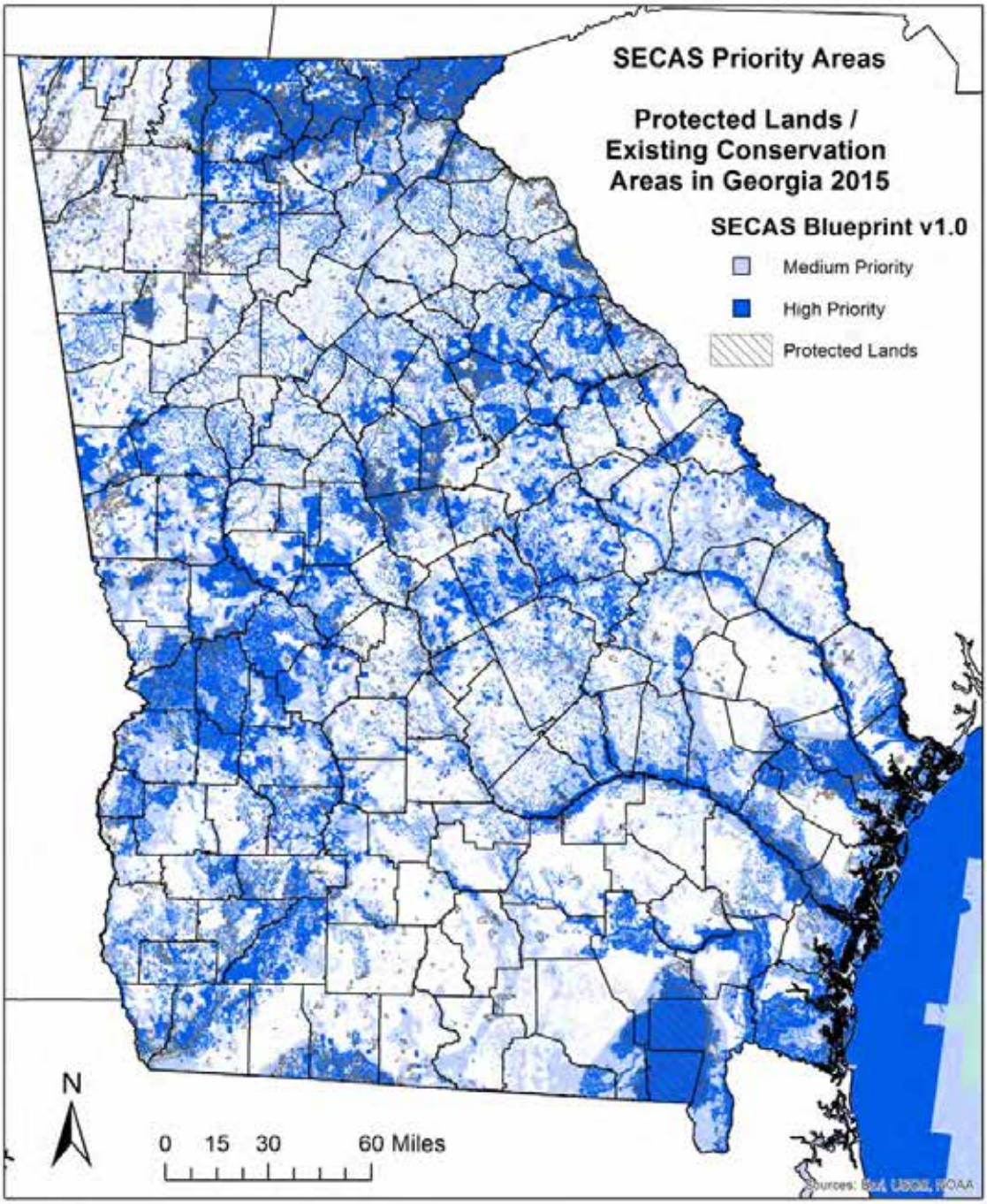
Appendix B1. Conservation areas of the South Atlantic Landscape Conservation Cooperative's Blueprint v2.2.

Appendix B2. Conservation areas of the Southeast Conservation Adaptive Strategy Blueprint v1.0.

Appendix B1. Conservation areas in Georgia defined by the South Atlantic Landscape Conservation Cooperative's Blueprint v2.2. These priorities do not include the portions of counties in northern Georgia.



Appendix B2. Conservation areas in Georgia defined by the Southeast Conservation Adaptive Strategy Blueprint v1.0.



Supplemental Material

For privacy purposes, the names of caves/mines identified in the document as priorities for conservation are included in this section of supplemental materials and not in the text of the main document. By request, this portion of the strategy may be provided. The Service does not maintain or own rights to cave locality data; therefore it cannot be provided without permissions of the Georgia Speleological Survey or land owner.