

Caves and mines
Southern Blue Ridge Mountains

Caves are found scattered across the Southern Blue Ridge physiographic province, and some do occur in other regions of the state as well. There are several different types of caves, however the most common types of caves are solution caves, fissure caves, and rock shelter/boulder caves. These types differ primarily in the way they are formed. Solution caves are created by the action of water, dissolving the underlying rock to form tunnels. Over time, solution caves get larger and larger and are generally the most extensive (size and length of passage). There are a few areas of North Carolina with underlying limestone geology which lend themselves to solution cave formations. Most notably the Nantahala Gorge and North Fork Catawba River/Linville Mountain area of western North Carolina and parts of the coastal plain are underlain with limestone (marble, dolomite, and marl respectively).

Fissure caves are formed by movement of the earth’s surface which results in cracks of the rock layers. Depending upon the actual events which spawn the development, fissure caves have varying sizes and configuration. Fissure caves occur in many places in North Carolina, though one of the most well known (in fact one of the largest known fissure cave systems in the world) occurs in Hickorynut Gorge in Rutherford County (Cato Holler, pers. comm.).

Rock shelter/boulder caves are formed by erosive forces, weather events, earth surface movements and other factors, which essentially leave spaces underneath/behind surface rock. The vast majority of caves in North Carolina are rock shelter/boulder caves. Owing to their diversity of formation, differing geology, and range in the state, caves in North Carolina are quite variable in terms of both the plant and animal communities adapted to, and found in them.

In addition, an extensive mining history in North Carolina has provided numerous subterranean excavations which can and do mimic environmental conditions of natural caves. Like caves, mines come in many shapes and forms, depending upon numerous factors. There are many mines which do not provide conditions similar to those found in caves such as open pit mines, strip mines, and quarries. Our definition of the caves and mines habitat type is intended to include only mines which include subterranean excavations such that conditions inside the mine shafts and tunnels resemble conditions in caves. That being said, the range of variability of those conditions is extensive. Table 1 provides a list of species of conservation concerns which are associated with cave and mine habitats.

Table 1. Priority species associated with caves and mines.

Group	Scientific name	Common name	State status* (Federal status)
Mammals	<i>Corynorhinus rafinesquii</i>	Rafinesque’s Big-eared Bat	T
	<i>Corynorhinus townsendii virginianus</i>	Virginia Big-eared Bat	E (E)
	<i>Myotis grisescens</i>	Gray Bat	E (E)

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Group	Scientific name	Common name	State status* (Federal status)
	<i>Myotis leibii</i>	Small-footed Bat	SC
	<i>Myotis septentrionalis</i>	Northern Long-eared Bat	SC
	<i>Myotis sodalis</i>	Indiana Bat	E (E)
	<i>Neotoma magister</i>	Allegheny Woodrat	SC
Amphibians	<i>Eurycea longicauda</i>	Longtail salamander	SC
*Abbreviations			
T	Threatened		
E	Endangered		
SC	Special Concern		

Location And Condition Of Habitat

As mentioned previously, caves and mines are found throughout North Carolina. The majority of documented caves occur understandably in the mountain region of western North Carolina, though there are some caves present in all regions of the state, including the coastal plain. The North Carolina Cave Survey has documented over 1,300 caves in the state (Cato Holler, pers. comm.). We have no accurate assessment of the availability of abandoned mines in North Carolina, and certainly have no idea as to their individual suitability for use by cave dwelling animals or plants. Certainly, some portion of the mines do function similarly to caves in providing the range of microhabitat conditions which cave obligate species need. Usually, the larger the mine excavations and the air volume within are important correlates of use by cave dwelling animals. Many smaller mines do support minor levels of use, or use by small numbers of individuals, however the bigger the mine, the bigger the chances for it to be used by wildlife (particularly bats of various species). A map of this habitat is not provided, due to scale and sensitivity issues.

Given the variability in cave types, mine types, and a host of different substrates, orientations, positions on the landscape, etc., the condition of caves and mines in North Carolina is quite variable. Caves and mines occur across all land ownership types. Several of the most significant sites have received attention in the past to protect resources (wildlife or geological in most cases). At least three caves and two mine complexes currently have bat friendly gates installed to prohibit or regulate human entry and subsequent impacts upon cave resources. Various surveys and investigations have been conducted in many caves and mines in attempts to document significant wildlife or geological resources, though no comprehensive evaluation has ever occurred. Certain wildlife groups (i.e. bats) have been surveyed in a portion of the caves on an irregular schedule over the past couple of decades. Therefore, not only is the condition of caves and mines quite variable in North Carolina, but our state of knowledge about the use of caves and mines by plants and animals is extremely variable.

Problems Affecting Species And Habitats

In many states, and throughout the world, many caves have been developed into tourist attractions, often with lighting, tours, gates, etc. All of these activities have resulted in both habitat conditions for cave dwelling animals, as well as disrupted normal behavior patterns, effectively eliminating habitat for many cave animals. In the Southern Blue Ridge Ecoregional Conservation Plan, recreation is the greatest threat to cave and cave species conservation (TNC and SAFC 2000). That would include both developed tourist caves, as well as recreational caving/exploration. Thus far, only one cave complex has been developed as a recreational destination in North Carolina, however you would be hard-pressed to find a cave or mine that doesn't experience some level of human visitation.

Many of the wildlife species that use caves, if not the caves themselves, have been and continue to be impacted by human activities including both direct impacts (e.g., repeated disturbance during bat hibernation), as well as indirect impacts (e.g., habitat changes that make microhabitat conditions inside the cave or mine unsuitable). In addition to the recreational impacts, certainly many smaller caves and mines have most assuredly been impacted by development. However, there is little to no documentation of this actually having occurred. Nonetheless, given the amount of development that has occurred in North Carolina over the last century, it seems very likely that at least some cave habitat has been impacted.

Species And Habitat Conservation Actions and Priorities For Implementation

We must develop a comprehensive, prioritized list of significant caves, including the factors which add significance (e.g., roost of endangered bats, rare geologic formations, other rare plants or animal use). We must also acquire additional cave habitat through purchase, conservation easement, or other perpetual management agreements (potential for partnerships with NC Natural Heritage Program, The Nature Conservancy). Lastly, we must pursue the development of plans for protection of caves where necessary to protect roosting bats or other cave resources, where feasible, and where cost effective (e.g., gating like at Cranberry Mine, limiting access).

Priority Research, Survey, And Monitoring

- **Surveys**
 - Conduct bat surveys in caves and mines that have not been previously evaluated.
 - Survey for potential nesting birds in caves such as turkey vulture, black vulture and common raven.
- **Monitoring**
 - Establish and implement long term monitoring protocol to document bat use of significant cave/mine roosts.
 - Develop protocols and procedures for long-term bat banding study and data storage throughout the state.

- Establish protocol for periodic monitoring and assessment of Allegheny woodrat populations.
- **Research**
 - Longtail salamander research: in some areas of its range, the longtail salamander occurs often associated with caves, or portions of caves. No investigation of its habitat use has ever occurred in North Carolina, and could be undertaken in conjunction with more generalized research on this species distribution, status and habitat in the state.
 - Consider studies to document maternity sites used by bats from specific hibernacula (e.g., find maternity colonies utilizing radio telemetry of individual Virginia big-eared bats that hibernate in known caves/mines, or track any Indiana or gray bats captured to their maternity sites or hibernacula).

Supporting References

Bailey, M. A., J. N. Holmes, and K. A. Buhlmann. 2004. Habitat management guidelines for amphibians and reptiles of the southeastern United States (DRAFT). Partners in Amphibian and Reptile Conservation.

N.C. Natural Heritage Program (NCNHP). 2001. Descriptions of the biological themes of North Carolina, 2nd edition. N.C. Department of Environment and Natural Resources, Natural Heritage Program, Raleigh, NC.

The Nature Conservancy and Southern Appalachian Forest Coalition (TNC and SAFC). 2000. Southern Blue Ridge ecoregion conservation plan. The Nature Conservancy, Durham, NC.