

Cove Forest
Southern Blue Ridge Mountains

Montane cove forest occurs in low to mid-elevation sites in moist, protected areas. Coves are generally stable, uneven-aged climax forest, characterized by a dense tree canopy. Other plant community classification systems refer to cove forests as mixed mesophytic hardwoods (SAMAB 1996) or differentiate between acidic coves and rich (circumneutral soils) coves (Schafale and Weakley 1990). Common tree species may include: yellow poplar, sugar maple, yellow buckeye, basswood, beech, black cherry, white ash, red maple, hemlock, black birch, umbrella tree, fraser magnolia, and northern red oak. Generally, rich coves have a relatively open midstory with a dense herb layer of ferns and numerous herbaceous plants, and acidic coves have a dense midstory, often comprised of rhododendron and dog hobble, with a sparse herbaceous layer. Canopy gap dynamics play a large role in regeneration (NCNHP 2001).

Appalachian cove hardwood forests represent some of the most diverse ecosystems in the world outside of tropical zones (Hunter *et al.* 1999). An amazing assortment of trees and herbaceous vegetation, coupled with topographic, microclimatic, and soil characteristics combine to provide an extremely productive habitat for numerous mammals, amphibians, and birds. High numbers of endemic salamanders are present (Petranka 1998), and population densities of these animal groups in cove hardwood forests make these extremely important habitats. Table 1 provides a list of priority species associated with cove forest habitats for which there is conservation concern.

Table 1. Priority species associated with cove forest.

Group	Scientific name	Common name	State status (Federal status)
Birds	<i>Accipiter cooperii</i>	Cooper's Hawk	SC
	<i>Accipiter striatus</i>	Sharp-shinned Hawk	SR
	<i>Certhia americana</i>	Brown Creeper	SC
	<i>Coccyzus americanus</i>	Yellow-billed Cuckoo	
	<i>Coccyzus erythrophthalmus</i>	Black-billed Cuckoo	SR
	<i>Colaptes auratus</i>	Northern Flicker	
	<i>Contopus virens</i>	Eastern Wood-pewee	
	<i>Dendroica cerulea</i>	Cerulean Warbler	SR
	<i>Helmitheros vermivorous</i>	Worm-eating Warbler	
	<i>Hylocichla mustelina</i>	Wood Thrush	
	<i>Limnothlypis swainsonii</i>	Swainson's Warbler	
	<i>Picoides villosus</i>	Hairy Woodpecker	
	<i>Sphyrapicus varius</i>	Yellow-bellied Sapsucker	SC
	<i>Wilsonia citrina</i>	Hooded Warbler	
Mammals	<i>Mustela frenata</i>	Long-tailed Weasel	
	<i>Napaeozapus insignis</i>	Woodland Jumping Mouse	
	<i>Scalopus aquaticus</i>	Eastern Mole	
	<i>Sorex cinereus</i>	Masked Shrew	
	<i>Sorex fumeus</i>	Smoky Shrew	

Table 1. Priority species associated with cove forest.

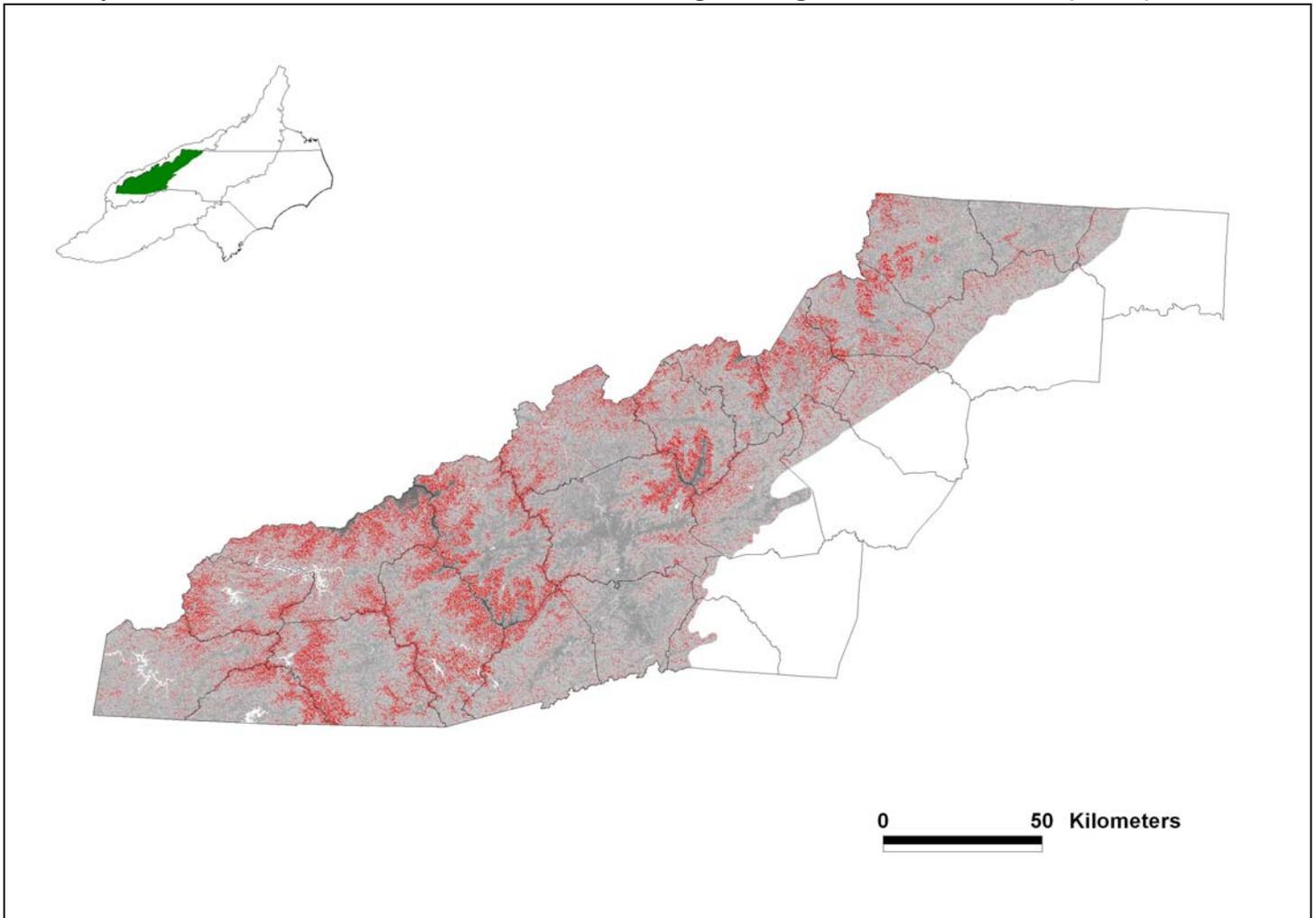
Group	Scientific name	Common name	State status (Federal status)
Amphibians	<i>Ambystoma maculatum</i>	Spotted Salamander	
	<i>Ambystoma opacum</i>	Marbled Salamander	
	<i>Aneides aeneus</i>	Green Salamander	E
	<i>Desmognathus aeneus</i>	Seepage Salamander	SR
	<i>Desmognathus wrighti</i>	Pigmy Salamander	SR
	<i>Plethodon aureolus</i>	Tellico Salamander	SR
	<i>Plethodon chattahoochee</i>	Chattahoochee Slimy Salamander	
	<i>Plethodon glutinosus sensustricto</i>	Northern Slimy Salamander	
	<i>Plethodon longicrus</i>	Crevice Salamander	
	<i>Plethodon richmondi</i>	Southern Ravine Salamander	
Reptiles	<i>Plethodon ventralis</i>	Southern Zigzag Salamander	
	<i>Heterodon platirhinos</i>	Eastern Hog-nosed Snake	
	<i>Virginia valeriae valeriae</i>	Eastern Smooth Earthsnake	
*Abbreviations			
E Endangered			
SC Special Concern			
SR Significantly Rare			

Location and condition of habitat

Cove hardwood habitat is well represented in the mountains of western North Carolina. The Southern Appalachian Assessment (SAMAB 1996) categorized over 3.1 million acres of their study area as mixed mesophytic hardwood forest. Hunter *et al.* (1999) estimated that within that total, the Southern Blue Ridge physiographic province (mostly NC, but with portions of TN, GA, and SC) contributed approximately 1 million acres of cove hardwoods. The US Forest Service (2001) estimated through ecological mapping that there was over 1.8 million acres of cove hardwood forest in the southern Appalachians of TN, NC, GA, and SC and approximately 300,000 acres of cove hardwood forest occurs on its lands in western North Carolina, on the Pisgah and Nantahala National Forests. Of course, direct measurement of the amount of cove hardwood habitat currently in North Carolina is not possible, so depending upon the methods used to estimate, and the data upon which estimates are based, the overall availability of cove hardwoods is, at best a crude estimate.

If estimating the amount of cove hardwood is difficult, defining its condition is impossible. Most would agree that the majority of cove hardwood forest in western North Carolina is currently in mid-late successional stages (SAMAB 1996, Hunter *et al.* 1999). Likewise, over 81% of the cove hardwood forest on the Pisgah and Nantahala National Forests is over 60 years old (USFS 2001).

Map 1. Cove forest habitats in the Southern Blue Ridge ecoregion of North Carolina (in red).



Data source: NC GAP, 1992.

Problems affecting species and habitats:

In general, the most significant problem affecting cove hardwood habitat is its conversion to other uses, primarily in the form of residential development, though estimates of the amount of cove hardwoods lost to development are unavailable. Residential development in mountain coves often differs from development in other habitats of the region, in that homes and associated spaces are often interspersed within the forest. The result may be that direct habitat loss as a result of the houses and associated structures may be more limited than other types of development. However, the reduction in quality of the habitat by virtue of being bisected by roads and driveways can certainly have significant impact upon the wildlife species of the forest (Rosenberg *et al.* 2003).

Another potential problem affecting cove hardwood habitat is the advent of several exotic pest species which could have a significant impact upon the health of the forest, including the hemlock wooly adelgid, gypsy moth, and beech scale, as well as several non-native plants. And

finally, timber harvesting and conversion to other forest types (white pine) or other uses on private lands in certain areas can also decrease the availability of this habitat in the future.

Problems of individual species associated with cove hardwood forests include isolation or extremely limited ranges of populations (e.g. cerulean warbler, crevice salamander). That could lead to increasing chances of genetic depression or stochastic events having negative consequences for the sustainability of populations. Some bird species which require a diverse understory may be impacted by the aging of stands, which can result in decreased plant diversity until the stand reaches age classes sufficient to produce canopy gaps (Hunter *et al.* 2001).

Species And Habitat Conservation Actions And Priorities For Implementation

As with all of our habitats, human population growth and its associated development is consuming or altering cove hardwood habitat rapidly. We must continue to add to our base of conservation ownership for future generations of the wildlife species associated with the habitat, as well as the use and enjoyment of them by future generations of North Carolinians.

Additional conservation measures that need to be considered will grow out of the research, survey, and monitoring mentioned above, however measures can be pursued now to help achieve both research and conservation goals regarding understory development and gap management. With the vast majority of cove hardwood habitat in mid successional stages, efforts should be directed towards increasing older age classes of cove hardwoods by both lengthening harvest rotation recommendations for timberland owners, and exploring whether we can mimic old growth gap dynamic conditions through selective harvesting techniques in mid-late successional cove hardwood stands. These and other measures to promote the development of diverse understory, particularly in acidic coves, should be pursued.

Priority Research, Survey, And Monitoring

- **Surveys**

- Initial efforts need to be directed towards surveys to determine current baseline distribution and status of species associated with cove hardwood forest for which that information is lacking. There are also numerous species associated with cove forests that are believed to be relatively common or have stable populations. However, in truth, we lack baseline information about actual distribution and status for most species that are considered common.
- Focus initial survey efforts on state-listed species, and others that may be declining (e.g. Cooper's hawk, sharp-shinned hawk, brown creeper, black-billed cuckoo, cerulean warbler, yellow-bellied sapsucker, green salamander, seepage salamander, pigmy salamander, Tellico salamander, and zigzag salamander).
- Next, conduct surveys to understand current status of species believed to be more common, from which we can measure future population changes. Examples of such species include: Swainson's warbler, silver-haired bat, long-tailed weasel, woodland

jumping mouse, eastern mole, smoky shrew, masked shrew, spotted salamander, marbled salamander, ravine salamander, eastern hognose snake, and eastern smooth earth snake.

- **Monitoring**

- Protocols and procedures developed during surveys for these various taxa should subsequently provide a means to convert from a baseline survey mode, to a long-term population trend monitoring mode at all times of the year. Long-term population trend monitoring will be critical for planning conservation measures, setting goals, and measuring achievements. In addition, other monitoring systems and protocols for certain taxa (i.e., MAPS or BBS) may need to be enhanced such that species not covered by current efforts receive special attention.

- **Research**

In addition, priority research topics for cove hardwood associated species currently envisioned include:

Genetics

- Green salamander movement/habitat use and genetics studies.

Habitat

- Habitat use studies for certain bird species (especially cerulean warbler and yellow-bellied sapsuckers).
- Studies of bird, amphibian, and vegetation responses to gap management or specific timber harvest regimes (e.g., cerulean warbler, Swainson's warbler, yellow-bellied sapsucker, and various plethodontid salamanders).

Population demographics

- Studies of neotropical migrant birds to get information on demographics through nest searching spot mapping, telemetry.

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.

Hunter, W. C., R. Katz, D. Pashley, and B. Ford. 1999. Partners in Flight bird conservation plan for the Southern Blue Ridge. American Bird Conservancy.

Hunter, W.C. and D.A. Buehler, R.A. Canterbury, J.L. Confer and P.B. Hamel. 2001. Conservation of disturbance-dependent birds in eastern North America. *Wildlife Society Bulletin*, 29(2): 440-455.

Johns, M.E. 2004. North Carolina Bird Species Assessment. N.C. Partners in Flight.

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.

Petranka, James W. 1998. Salamanders of the United States and Canada. Smithsonian Institution Press, Washington, DC.

Rosenberg, K.V., R.S. Hames, R.W. Rohrbaugh, Jr., S.Barker Swarthout, J.D. Lowe and A.A. Dhondt. 2003. A land manager's guide to improving habitat for forest thrushes. The Cornell Lab of Ornithology.

Schafale, M. P., and A. S. Weakley. 1990. Classification of the natural communities of North Carolina, third approximation. N.C. Department of Environment and Natural Resources, Natural Heritage Program, Raleigh, NC.

Southern Appalachian Man and the Biosphere (SAMAB). 1996. The Southern Appalachian Assessment terrestrial technical report. Report 5 of 5. U.S. Department of Agriculture, Forest Service, Southern Region, Atlanta, GA.

U.S. Forest Service (USFS). 2001. Management indicator species habitat and population trends- Nantahala and Pisgah National Forests. Draft internal document. U.S. Department of Agriculture, Forest Service, National Forests in North Carolina, Asheville, NC.