4.4.4 Cove Forests

4.4.4.1 Ecosystem Description

Cove forests are some of the most well-known and recognized community types in the Mountains, occurring on sheltered, moist, low to moderate elevation sites. They are characterized by a dense forest canopy of moisture-loving trees. There are three community types in this ecosystem: rich cove forest, acidic cove forest, and basic mesic forest (montane calcareous subtype).

- The rich cove forest type, occurring in the most fertile sites, has a lush herb layer and relatively few shrubs. The high diversity in all vegetation layers makes this forest of great interest to botanists and ecologists.

- The acidic cove forest, which occurs in less fertile but otherwise similar sites to those occupied by rich cove forests, is dominated by the more acid tolerant species, and has undergrowth dominated by ericaceous shrubs such as rhododendron, rather than by herbs. Canada Hemlock forests have similarly dense shrub layers and relatively few herbs.

- The basic mesic forest (montane calcareous subtype) is a geologically restricted com- munity that occurs on rare outcrops of limestone, marble, or dolomite, and is dominated by trees that favor high pH soils. These communities are naturally relatively stable, uneven-aged climax forests, with trees up to several centuries old.

The 2005 WAP describes Southern Blue Ridge Mountains Cove Forest as a priority habitat (see Chapter 5) (NCWRC 2005).

4.4.4.2 Location of Habitat

Cove hardwood habitat is well represented in the Mountain ecoregion of western North Carolina, including in the Pisgah and Nantahala National Forests. According to the most recent Southeast Gap Analysis Project (GAP), cove forests comprise a little over 558 thousand acres (nearly 226 thousand hectares) of land cover in North Carolina (SEGAP 2007; NatureServe 2007). This represents slightly more than 1.6% of all land cover in the state.

4.4.4.3 Problems Affecting Habitats

The most pressing problem affecting the 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 nonnative plants. Evans and Gregoire (2007) that aldelgid infestation can move across the landscape at 15 km (about 9 miles) per year or faster and can kill trees in two to three years (Trotter and Shields 2009). In fact, the adelgid has already devastated most of the Canada Hemlock stands in the state, such that former mixed hemlock–hardwood

stands are now mostly hardwoods, with much lessened evergreen cover available for wildlife during the cooler months.

Though estimates of the amount of cove hardwoods lost to development are unavailable, the most significant problem affecting this community type is its conversion to other uses. Residential development in mountain coves often differs from development in other habitats of the region because the homes and associated open spaces are often interspersed within the forest. The result may be that direct habitat loss because of the houses and associated structures may be more limited than other types of development.

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. The reduction in quality of the habitat through fragmentation by roads and driveways and human intrusion can have significant impact upon the wildlife species of the forest (Rosenberg et al. 2003).

4.4.4.4 Climate Change Compared to Other Threats

Comparing climate change to other ecosystem threats can help define short- and long-term conservation actions and recommendations. The effect of a changed climate is likely to vary widely among examples of these communities, depending on topographic sheltering, configuration of rocks, soil depth, and amount of overland runoff. Unprotected examples of these forests are most threatened by development and logging. Table 4.29 summarizes the comparison of climate change with other existing threats.

TABLE 4. 29 Comparison of climate change with other threats to cove forests

Threat	Rank Order	Comments
Invasive Species	1	Exotic species represent a growing threat, including the hemlock wooly adelgid, Gypsy Moth, and beech scale, as well as several nonnative plants. The Hemlock Wooly Adelgid has already caused widespread devastation in hemlock forests. Emerald Ash Borer and several other destructive insects represent large potential threats. Invasive plants are a serious and growing problem in lower elevation examples, particularly in those that are disturbed by logging or that occur near developed areas. Invasive plants, such as Garlic Mustard and Oriental Bittersweet, are likely to increase regardless of climate change. Oriental Bittersweet is already a significant problem in some cove forests in the Mountains and has greatly altered vegetation composition and structure.
Logging/ Exploitation	2	Logging causes more drastic alterations to structure and composition than expected from climate change. 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.

Threat	Rank Order	Comments
Development	2	Development can cause indirect effects as well as outright destruction of these communities, creating an edge effect and developing seed sources for invasive species. 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 because of the houses and associated structures may be more limited than other types of development. However, the reduction in quality of the habitat by being bisected by roads and driveways, other infrastructure, and domesticated plants and animals can certainly have significant impact upon the wildlife species of the forest (Rosenberg et al. 2003).
Climate Change	3	Climate change poses several threats, including loss of area in more marginal sites, alteration by increased wind, flood, and fire disturbance, and increased problems with invasive plants. For some protected examples, this is the most severe threat.

4.4.4.5 Impacts to Wildlife

Appendix G provides a list of SGCN and other priority species for which there are knowledge gaps and management concerns. Appendix H identifies SGCN that depend on or are associated with this habitat type.

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.

Problems of individual species associated with cove hardwood forests include isolation or extremely limited ranges of populations (e.g., Cerulean Warblers, Crevice Salamanders, Green Salamanders). 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. 2001a).

Junaluska and Tellico salamanders are highly restricted to habitats within this ecosystem group. Both occupy extremely small global ranges and are likely to be strongly affected by increased drought-, fire-, or storm-created openings in the canopy. Several other salamanders with extremely limited global ranges also have significant amounts of habitat within this community and are also likely to be threatened by the same set of climate change factors. The same is true for several species of Lepidoptera (such as the Dusky Azure) that are associated with mesic habitats and occur in the southern Appalachians as major disjuncts from the north.

Some high-elevation cove forests now serve as refugia for species for which the current climate in lower areas in North Carolina is not suitable. They are likely to continue to do so, but warming temperature and changed moisture regimes may make some of them less hospitable to some of these species. At the same time, these communities may become refugia for additional species that are currently common, if the regional climate becomes unsuitable for them. They may be crucial for the survival of some species in the state.

4.4.4.6 Recommendations

Rich cove forests host a great diversity of trees and herbs, and provide habitat for many rare plant species in North Carolina. Climate change is not expected to be a major threat to these species overall. While many examples of cove forests are protected from development and logging, protecting more examples would help these communities weather climate change. It would reduce the loss of acreage as protected examples shrink, and would allow larger, more robust populations of their species to survive. Landscape connectivity will become more important as individual patches become smaller.

Surveys. Distributional and status surveys need to focus on species believed to be declining or mainly dependent on at-risk or sensitive natural communities.

- Direct initial efforts toward surveys to determine current baseline distribution and status of species associated with cove hardwood forest for which that information is lacking.

- Focus initial survey efforts on state-listed species and others that may be declining, such as the Cooper's Hawk, Sharp-shinned Hawk, Brown Creeper, Black-billed Cuckoo, Cerulean Warbler, Yellow-bellied Sapsucker, Green Salamander, Seepage Salamander, Pigmy Salamanders, Tellico Salamander, and Southern Zigzag Salamander.

- Conduct surveys to understand current status of species believed to be more common, from which we can measure future population changes (e.g., the 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, Eastern Box Turtle, and Eastern Smooth Earth Snake).

Monitoring. Long-term monitoring is critical to assessing species and ecosystem health over time and gauging the resilience of organisms to a changing climate. These efforts will inform future decisions on how to manage species and their habitats. Studies should include identification of population trends, as well as assessment of impacts from conservation or development activities. Long-term monitoring sites need to be identified and monitoring protocols developed for all priority species. Monitoring plans should be coordinated with other existing monitoring programs where feasible. 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 throughout the year.

- The health of Canada Hemlocks needs to be monitored, and efforts to halt the spread of the Hemlock Woolly Adelgid needs to be pursued.

- An integrated pest management strategy is needed; detection and monitoring of plant pest infestations needs to be an integral part of the strategy.

- Investigate treatment options (e.g., foliar sprays, systemic soil treatments, aerial fungal pathogens, biological controls) and monitor applications to determine best method for stand-level treatments (Onken and Reardon 2005; MDA 2010).

Research. Research topics that facilitate appropriate conservation actions include habitat use and preferences, reproductive behavior, fecundity, population dynamics and genetics, feeding, competition, and food web dynamics. Increased understanding of life histories and status helps determine the vulnerability of priority species to further imperilment, in addition to identifying possibilities for improved management and conservation. All studies should provide recommendations for mitigation and restoration. Formal descriptions for known or putative undescribed species and investigations aimed at resolving taxonomic status are needed.

- Conduct studies of bird, amphibian, reptile, and vegetation responses to gap management or specific timber harvest regimes (e.g., the Cerulean Warbler, Swainson's Warbler, Yellow-bellied Sapsucker, and various reptiles and plethodontid salamanders).

Management Practices. Management practices that reduce impacts and work synergistically with other conservation actions are needed to enhance the resilience of natural resources. Particular needs include preserving biodiversity, protecting native populations and their habitats, and improving degraded habitats.

- With the vast majority of cove hardwood habitat in mid-successional stages, efforts should be directed toward 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- to late-successional cove hardwood stands.

- Protect riparian areas and control impervious surfaces and stormwater runoff to reduce flood damage to cove forests in altered watersheds, as well as protect the aquatic systems.

- Protect cove forests from severe wildfire during drought periods to prevent catastrophic disturbance. In more favorable periods, prescribed burning of surrounding landscapes would help reduce the risk of controllable wildfire, as well as benefitting the upland communities.

Conservation Programs and Partnerships. Conservation programs, incentives, and partnerships should be utilized fully to preserve high-quality resources and protect important natural communities. Protective measures that utilize existing regulatory frameworks to protect habitats and species should

be incorporated where applicable. Land conservation or preservation can serve numerous purposes in the face of anticipated climate change, but above all, it promotes ecosystem resilience.

- 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.

- Protect examples in the most sheltered sites, and those that serve as landscape connections to other patches.

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