Northern Hardwoods

Southern Blue Ridge Mountains

Northern hardwood forests are found throughout western North Carolina on high elevation sites with abundant rainfall and a cool climate. Generally these conditions occur above 4,000 feet, but more often it is above 4,500 feet. High elevation climate, slope, aspect and past disturbance are critical ecological determinants of the distribution of northern hardwood forests today. This habitat can be quite variable and include several ecological sub-types such as boulderfield forests and beech gaps. Dominant tree species include yellow birch, American beech, yellow buckeye, and sugar maple. Understory vegetation varies considerably from dense rhododendron to open sedge, with numerous potential combinations of herbaceous and shrub components (NCNHP 2001).

This forest is a climax community, with regeneration occurring where disturbance has created a gap in the closed canopy which often creates an uneven aged community. Large areas of natural disturbance are more likely to occur from ice damage rather than from fire, which occurs much less frequently at high elevations. While the northern hardwood habitat can be defined in general terms, ecologically, it should be considered in association with spruce-fir forest for the purposes of maintaining ecological relationships and sustainability. The ecological boundaries of northern hardwood forest are not well defined, therefore the ecotones are wide and contain a diverse mixture of components from the adjoining habitat. Northern hardwood forests share some ecological components with high elevation red oak forests but are more likely to occur on northerly aspects, with more cool moist conditions. This habitat grades to cove hardwoods at lower elevations and the distinction can be difficult to discern, with many species occurring in both types. Often components of spruce-fir habitats are present in sub-dominant numbers within northern hardwood communities, and increase in dominance along the elevation gradient to a point where spruce-fir becomes the dominant community.

Northern hardwood forests provide habitat for numerous wildlife species that also rely heavily on spruce-fir forests. Because of the spatial relationship between them, and the fact that they share many ecological components and plant species, northern hardwood forests are critical to maintaining many species of birds and mammals dependent upon spruce-fir habitats. In addition, northern hardwood plant species may be critical components of spruce-fir habitats even in their sub-dominant role. Consider, for example, the fact that many spruce-fir dependent wildlife species are cavity nesters. Yellow birch, beech, sugar maple, and buckeye often provide more natural cavities and decaying wood than spruce or fir for species such as northern flying squirrels, yellow-bellied sapsuckers, black-capped chickadees, northern saw-whet owls, and other wildlife. A list of priority species that may use northern hardwood forests and for which there is conservation concern is provided in Table 1.

Table 1. Priority species associated with northern hardwoods.

Group	Scientific name	Common name	State status* (Federal status)
Birds	*Accipiter cooperii*	Cooper's Hawk	SC
	Accipiter striatus	Sharp-shinned Hawk	SR
	Aegolius acadicus	Northern Saw-whet Owl	T
	Certhia americana	Brown Creeper	SC
	Coccyzus erythropthalmus	Black-billed Cuckoo	SR
	Dendroica pensylvanica	Chestnut-sided Warbler	
	Pheucticus ludovicianus	Rose-breasted Grosbeak	
	Picoides villosus	Hairy Woodpecker	
	Poecile atricapilla	Black-capped Chickadee	SC
	Sphyrapicus varius	Yellow-bellied Sapsucker	SC
	Vermivora chrysoptera	Golden-winged Warbler	SR
	Wilsonia canadensis	Canada Warbler	
Mammals	*Glaucomys sabrinus*	Northern Flying Squirrel	E (E)
	Lasionycteris noctivagans	Silver-haired Bat	SR
	Mustela frenata	Long-tailed Weasel	
	Napaeozapus insignis	Woodland Jumping Mouse	
	Parascalops breweri	Hairy-tailed Mole	
	Scalopus aquaticus	Eastern Mole	
	Sorex cinereus	Masked Shrew	
	Sorex dispar	Rock Shrew	SC
	Sorex fumeus	Smoky Shrew	
	Sorex hoyi winnemana	Southern Pygmy Shrew	
	Sorex palustris	Water Shrew	SC
	Sylvilagus obscurus	Appalachian Cottontail	SR
Amphibians	*Ambystoma maculatum*	Spotted Salamander	
	Desmognathus wrighti	Pigmy Salamander	SR
	Plethodon aureolus	Tellico Salamander	SR
	Plethodon chattahoochee	Chattahoochee Slimy Salamander	
	Plethodon glutinosus sensustricto	Northern Slimy Salamander	
	Plethodon richmondi	Southern Ravine Salamander	
	Plethodon welleri	Weller's Salamander	SC

*Abbreviations
T Threatened
E Endangered
SC Special Concern
SR Significantly Rare

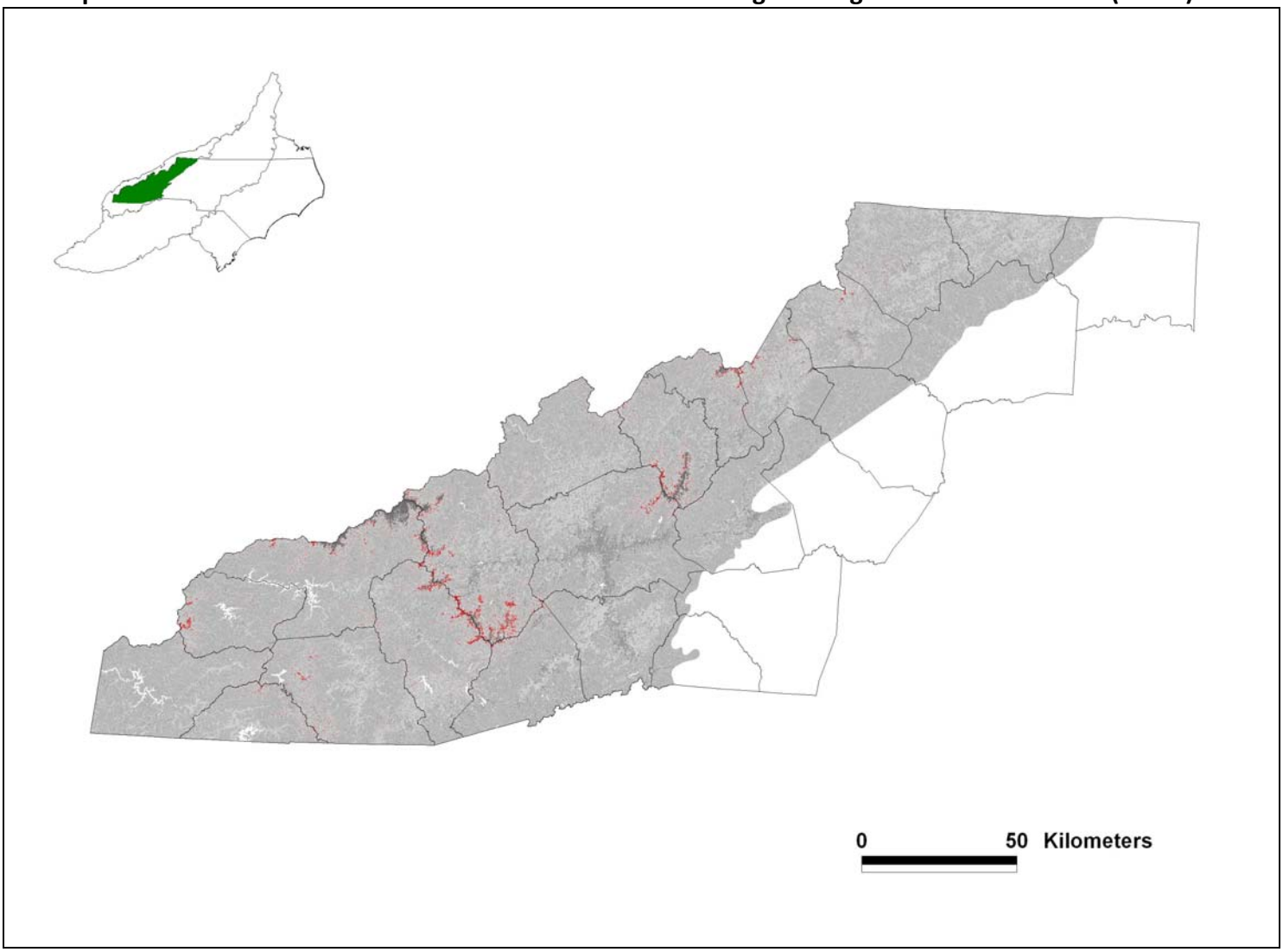
Location And Condition Of Habitat

Northern hardwood forests in western North Carolina are concentrated in many of the same high elevation areas as spruce-fir forests, however they are more widespread throughout the region owing to their respectively lower elevation range. Significant amounts of northern hardwood forest occur in the Great Smoky Mountains, Great Balsams, Plott Balsams, Black/Craggy Mountains, Unicoi Mountains, and in the vicinities of Roan Mountain, and Grandfather Mountain. While most of the available northern hardwood forest is associated with these high elevation mountain ranges, significant amounts are present in other areas of suitable elevation throughout the region, such as in the Amphilobite mountains in Ashe and Watauga counties and in the Nantahala mountains in Macon county. Map 1 depicts locations of northern hardwood forests in the Southern Blue Ridge ecoregion.

In western North Carolina, estimates of the amount of northern hardwood forest have not been definitively made, however the Southern Appalachian Assessment estimated approximately 56,000 acres (SAMAB 1996), and the US Forest Service estimates 46,000-56,000 acres on the Pisgah and Nantahala National Forest (USFS 2001). Estimates range from 68-80% of the acreage of northern hardwood forest in older (60+) age classes (Hunter *et al*. 1999, USFS 2001). Regardless of the estimates used, most of the available northern hardwood forest in North Carolina can be found on federally owned lands including US Forest Service (Pisgah and Nantahala National Forests) and National Park Service (Blue Ridge Parkway and Great Smoky Mountains National Park). A small percentage does occur on state-owned lands, and other conservation ownerships (e.g., The Nature Conservancy, local land trusts, etc.).

Hunter *et al*. (1999) and Schafale and Weakley (1990) suggest that the available acreage of northern hardwood habitat is actually greater now than in the past, primarily due to expansion of northern hardwoods into areas formerly occupied by spruce-fir forests. In fact, there are places which may have been spruce or fir forests where previous disturbances (fires, grazing, etc.) have resulted in northern hardwood stands. It remains to be seen whether these places, under natural regimes will ultimately become mixed northern hardwood/spruce stands or whether spruce will eventually attain dominance. However, it must also be considered that significant development has and continues to occur in northern hardwood habitats on private lands throughout the region. Primarily this has been residential development and the rate of it has likely increased recently, making an estimate of current northern hardwood habitat availability relative to past availability difficult.

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



Data source: NC GAP, 1992.

Problems Affecting Species And Habitats

The aging of many northern hardwood stands has resulted in closed canopy conditions and decreasing habitat for bird species that rely on diverse understory development, such as Canada warbler. Lack of disturbance has reduced available habitat for disturbance-dependent species such as golden-winged warbler and yellow-bellied sapsucker (Hunter *et al*. 2001). In turn, the impacts to other wildlife from stand level disturbance will need to be examined. For example, soricids such as masked and smoky shrews can respond favorably to forest disturbance in northern hardwoods (Ford *et al*. 2002), but this may not be true for other small mammals or salamanders. Many of the former fir forests and logged or grazed areas are regenerating into northern hardwood stands without a conifer component (spruce or fir).

Development pressure includes threats from a large increase in second homes and recreation facilities. Many non-native pathogens are a potential problem for several tree species in this ecosystem including hemlock woolly adelgid, balsam woolly adelgid, gypsy moth, and beech scale. The isolated nature of several populations of wildlife, such as northern flying squirrel, northern saw-whet owl, black-capped chickadee and Weller's salamander, is likely detrimental to the genetic flow and overall long-range health of the species.

Species And Habitat Conservation Actions and Priorities For Implementation

While much of the available northern hardwood forest in North Carolina occurs on conservation lands, that does not ensure the continued existence of many of the species associated with it. Conservation actions necessary to conserve those species and the habitat itself include both protection and management of the community. Given the small proportion of the landscape occupied by northern hardwood forest, it and its associated species need to be protected from significant loss due to development or other factors. The current habitat and connectivity of isolated patches certainly needs to be protected through conservation ownership acquisition or easement.

In addition, management of existing northern hardwood forests and adjacent habitats (particularly spruce-fir forests) needs to be expanded to ensure that we provide the complete mix of age class, composition, and conditions necessary to sustain populations of a wide range of species that utilize this community. The effects of edge and fragmentation need to be considered for forest interior wildlife in northern hardwood habitats (Manolis *et al*. 2000, Rosenberg *et al*. 2003).

Specific actions necessary include:

- Acquire additional acreage of northern hardwoods habitat through purchase, conservation easement, or other perpetual management agreements.
- Increased connectivity among habitat patches, both through acquisition or management of adjacent stands. Preservation of large tracts of minimally disturbed older forests may be key to maintaining forest litter amphibian populations.
- Consider and implement strategies to enhance the greater high elevation communities (particularly the spruce-fir/northern hardwood forest complex) by expanding the current distribution of mixed spruce/northern hardwood forest through appropriate means and at appropriate locations (e.g. establishing a subdominant spruce component in pure northern hardwood stands)
- Consider and implement silvicultural management at appropriate locations to enhance understory development, provide regeneration and habitat for disturbance dependent species or early successional species, and enhance mature forest conditions in young to middle-aged pure stands.

Priority Research, Survey, And Monitoring

The following are examples of the priority research, survey, and monitoring efforts needed to Identify factors to assist In the restoration and conservation of wildlife species.

- **Surveys**
  - Initiate surveys for rare salamanders like Weller's, pygmy, seepage, and Tellico, as well as more common species such as ravine salamanders, to determine their actual distribution and better define their habitat associations.
  - Continue survey work on northern flying squirrel distributions within and between known populations. Questions remain, such as: *Are there additional populations? Within populations how much suitable habitat occurs? What are the spatial relationships between patches of suitable habitat?*
  - Conduct shrew surveys to determine the distribution of long-tailed, pygmy and water shrews and surveys to document the response of shrews to disturbance/management.
  - Conduct surveys for more common mammals such as Appalachian cottontails, bats (particularly silver-haired and hoary bats), woodland jumping mice.
  - Conduct bird surveys to document breeding distribution (e.g., black-billed cuckoo).
  - Conduct bird surveys for golden winged warbler, black-capped chickadees, brown creeper, yellow-bellied sapsucker, and other high elevation birds.
- **Monitoring**
  - Monitoring of population trends for all high elevation species, including those associated with northern hardwood forest, needs to be developed and implemented with top priority towards rare species and secondary priority towards all species occurring in this relatively rare community of the North Carolina landscape.
  - Establish more Monitoring Avian Productivity and Survivorship (MAPS) stations, point counts, and migration banding stations; montane birds are not adequately picked up in breeding bird survey (BBS) routes.
  - Continue montane bird population monitoring (e.g., northern saw-whet owl, brown creeper, black-billed cuckoo, yellow-bellied sapsucker, rose-breasted grosbeak, and others that may be found at the upper or lower ranges of this habitat).
  - Establish monitoring systems and protocols for small mammal population status and trends including northern flying squirrel, rock shrew, water shrew.
  - Establish monitoring systems and protocols for bats (e.g. hoary, silver-haired and other bats) and other mammals (e.g. Appalachian cottontails) associated with northern hardwood communities.
  - Establish monitoring systems and protocols for northern hardwood associated amphibians such as Weller's and pigmy salamanders.

- **Research**

  Genetics

  - Conduct genetic studies across taxonomic groups to assess degree of population isolation/gene flow, and determine taxonomic status (primarily bird taxa thought to be southern Appalachian endemics).

  Habitat

  - Conduct species specific research needed for northern saw-whet owls, yellow-bellied sapsuckers, black-capped chickadees, golden-winged warbler to answer the question: *how are they using the available habitat*?
  - Initiate habitat use studies for many species to assess use of microhabitats, forest age classes and habitat spatial relationships.
  - Conduct research on habitat management techniques to successfully establish mixed spruce-northern hardwood stands in non-forested areas or appropriate pure/young northern hardwood stands.
  - Conduct research on habitat management techniques to maintain suitable habitat for disturbance tolerant species such as golden-winged warbler and yellow-bellied sapsucker.

  Population demographics

  - Initiate demographic studies of neotropical migrants through nest searching, spot mapping, telemetry.

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