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DRAFT – Piedmont and Coastal Plain Oak Forests

Ecosystem Description

Oak forests were once the most common natural community type in the Piedmont, occurring over most of the uplands. In the Coastal Plain they were much more limited, occurring primarily in dissected areas near streams. Although traditionally called oak-hickory forests, oaks are by far the predominant genus. Five community types occur in the Piedmont and Coastal Plain ecoregions: dry-mesic oak-hickory forest, dry oak-hickory forest, Piedmont monadnock forest, basic oak-hickory forest, and xeric hardpan forest. High quality examples of oak forests in the central Piedmont can be found on public lands such as Caswell Game Land, Umstead State Park, and Uwharrie National Forest. Examples of large size and good quality oak dominated communities are now lacking in the Coastal Plain

Dry-mesic oak-hickory forest and dry oak-hickory forest are the most typical of the five community types, occurring on upland slopes and ridgetops on acidic soils. white oak is usually the most abundant tree in both. post oak and southern red oak are the primary associates in dry oak-hickory forests and red oak and black oak in dry-mesic oak-hickory forests.

Piedmont monadnock forests, typically dominated by chestnut oak and scarlet oak, occur on scattered hills, which are resistant to the erosion affecting the surrounding land.

Basic oak-hickory forests occur on upland flats and slopes in sites similar to dry and dry-mesic oak-hickory forests, but with soils that are not acidic. Most of the soils are apparently near neutral pH rather than truly basic and usually occur over mafic rocks such as gabbro and diabase. They are dominated by white oak in combination with post, red, or black oak and a number of understory, shrub, and herb species that are scarce or absent on acidic soils are present.

Xeric hardpan forests are the most distinctive of the Piedmont and Coastal Plain oak forests. They occur on flat to gently sloping uplands with clay hardpans that restrict water and root penetration. This situation is most common on mafic rocks, but it also occurs on acidic shales. These sites may have shallow standing water in wet seasons, but are extremely dry in dry seasons. The canopy is dominated by some of the most drought tolerant species in the state, post oak and blackjack oak, and is often somewhat open. While dense brush often occurs beneath the open canopy, these communities were likely once open and grassy beneath. A number of plants that need full sunlight are present in openings and along adjacent roadsides. The interaction of the unusual soils with fire was almost certainly what produced the open aspect.

The Mid-Atlantic Coastal Plain ecoregion and Piedmont ecoregion Oak Forest (including Mixed Hardwoods and Pine), another description for this community, is described in the 2005 Wildlife Action Plan as a priority habitat (see Chapter 5A) (NCWRC 2005).

Table 1 at the end of this report provides of summary of expected climate change impacts to these natural communities.

Predicted Effects to Wildlife Species

Tables 2 through 6 at the end of this report identify the species of conservation concern and priority species that use habitats in this ecosystem.

Rare invertebrate species associated with this ecosystem group occupy habitats at the dry to xeric extreme, with some occurring only on a few isolated monadnocks in the Piedmont. These include *Acronicta albarufa* (associated with post oak), *Catocala herodias* and *Stenoporpia polygrammaria* (associated with bear oak), *Fixsenia ontario* (associated with dry oaks in general), *Heliomata infulata* and *Hemeroplanis* n. sp. (associated with dwarf locusts), *Erynnis martialis* (associated with Ceanothus), *Callophyrs augustinus* (associated with upland heaths), *Callophyrs irus* (associated with Baptisia and lupines), and *Ptichodis bistrigata* (a barrens species of unknown host plants).

Habitat for these species is likely to expand with increased frequency of drought and fires, both of which favor development of open woodlands and barrens. However, species that are confined to monadnocks or other small patches of habitat may be vulnerable to increased perturbations, such as fire, if their entire block of habitat is affected by any one event. Many of the problems impacting oak and mixed hardwood/pine forests, including fire suppression and even-aged forest management, result in a loss of habitat complexity and associated wildlife niches (Hunter *et al.* 2001).

Vertebrate species associated with oak forests are less specialized and many can be found in all sub-types. Few, if any, of the vertebrates are restricted only to this habitat type. Native forest stands replaced by even-aged pine plantations result in decreased habitat value for forest species that rely on diverse forest composition and structure, such as Kentucky warbler and wood thrush. Pine plantations do, however, provide increased opportunity to provide habitat for brown-headed nuthatch and bobwhite quail, with proper management (NCWRC 2005).

Cavity nesting birds, arboreal mammals, and some frogs, lizards and snakes are impacted by the lack of snags, while reptiles, amphibians and small mammals are impacted by lack of woody debris. Many bird species, such as hooded warbler, red-headed woodpecker, eastern wood-pewee, northern flicker, nightjars, and many post-fledging juvenile birds utilize canopy gaps for cover, or for foraging habitat, as do some bat species. Lack of fire has also allowed some fire-intolerant mesophytic plant species to become quite common in oak dominated communities

including American beech (Franklin and Kupfer 2004). The resulting loss of acorn production may be limiting for some wildlife in the future (NCWRC 2005).

Microhabitat loss, lack of woody debris, and roads have impacted amphibians, reptiles and small mammals in oak/mixed hardwood stands in the Coastal Plain. Development and roads have caused habitat fragmentation, and amphibian species have been impacted by a loss of ephemeral pond habitats found within the matrix habitat of oak/mixed hardwoods (NCWRC 2005).

Climate Change Compared to Other Threats

While climate change is a significant concern for these communities, several other threats are more severe. Both the extensive examples in the Piedmont and the more limited range in the Coastal Plain continue to be rapidly destroyed by ongoing urban, suburban, rural, residential and commercial development. Continued population growth makes this the most severe threat, in the current and the future climate. However, the fragmentation and loss of extent caused by it will increase the alteration caused by climate change, as isolated communities are unable to migrate and species are unable to move to more favorable sites.

Table 7 compares climate change with other existing threats.

Table 7. Comparison Of Climate Change With Other Threats

Threat	Rank Order	Comments
Development	1	Land use conversions in the Piedmont (primarily to suburban and exurban development) contribute significantly to the reduced condition of some tracts. Includes both direct and secondary impacts of development.
Logging/Exploitation	2	Of greatest concern when accompanied by conversion to pine plantation or severe shifts in composition. Logged forests may be converted to successional pine forests or become dominated by maple or other hardwoods. Demand for biofuels may increase the risk of damage by logging or biomass harvest. However, logging remains an important source of income for many landowners and plays a role in helping to keep forested tracts from being sold for development.
Invasive Species	3	Exotic diseases and pests have the potential to induce a large magnitude compositional change, as was seen with American chestnut in the last century. Primarily Elaeagnus, Baccharis, Ailanthus, and Paulownia. Increased canopy disturbance by wind, drought mortality, or severe fire will hasten invasion. Gypsy moths are the most destructive defoliating insect attacking northern red oak, chestnut oak, and white oak. The Asiatic oak weevil (*Cyrtepistomus castaneus*) attacks northern red oak seedlings and has the potential to seriously affect seedling growth because the larvae feed on the fine roots while the adults feed on the foliage (NCWRC 2005).

Table 7. Comparison Of Climate Change With Other Threats		
Threat	**Rank Order**	**Comments**
Fire	4	Low intensity fires would be beneficial, but intense wild fires would be destructive. Increased prescribed burning, it will produce a more open canopy, reduced understory, increased herb cover with more grasses, and longer lasting canopy gaps. There may be an increase in natural fires (due to increased drought and higher average temperatures), but landscape fragmentation and fire suppression practices likely will continue to prevent most fires from spreading very far in the Piedmont and in the dissected lands where oak forests occur in the Coastal Plain. Most oak forests are expected to benefit from increased fire frequency, as long as the fire intensity is not too high. Lack of fire is leading to slow changes in composition, including reduced oak regeneration. In spite of benefits from fire, there is a need to control wild fires in drought conditions, to prevent intense fires, and to prevent whole patches of fragmented forest from being burned at the same time.
Climate Change	5	Piedmont and Coastal Plain Oak Forests are likely to be relatively resilient to the effects of climate change. These communities are tolerant of severe droughts, hot spells, and fires of low intensity. Development, logging, and invasive species are much more of a threat to these communities than climate change.

Summary and Recommendations

These communities occur in a fragmented landscape and migration may be problematic. Protection of remaining examples and restoration of degraded sites and landscape-level connections would allow for adaptation in the future, as well as provide protection and promote the ecosystem viability under the current climate.

Recommended Actions

Surveys

- Conduct surveys to document priority and common species in areas poised for development (edge of urban expansion) to establish baseline populations and identify problems before development expands.
- Determine the current baseline distribution and status of species mainly associated with oak and mixed hardwood/pine forests (especially those that are state-listed or believed to be declining) for which that information is lacking (NCWRC 2005).
- Conduct surveys to understand current status from which we can then measure future population changes over time (NCWRC 2005).
- Protocols and procedures developed from baseline surveys should then

provide a means to convert from a baseline survey mode to a long-term population monitoring mode (NCWRC 2005).

Monitoring

- Monitor non-native invasive species, analyze population trends, or assesses their effect on native priority species populations.
- Initiate long-term monitoring for breeding neotropical migrants (especially ground-nesters and cavity nesters), bats and small mammals (*e.g.* moles, shrews, rodents), amphibians that use woody debris as a microhabitat, and canebrake rattlesnakes and other secretive reptiles (NCWRC 2005).
- Monitor tree infestations and diseases to document potentially destructive organisms shortly after they show up, while there is still a chance to contain or eradicate the pest (NCWRC 2005).
- Develop standardized monitoring programs analogous to the Breeding Bird Survey for reptiles, amphibians and small mammals. Of particular interest is trend information for those species dependent upon snags and woody debris (NCWRC 2005).

Research

- Research and identify important wildlife crossing areas; evaluate connectivity issues between intact and fragmented habitats used by priority species; work with partners to improve crossing and connectivity.
- Long-term and large-scale, replicated studies that have controlled experimental approaches and focus on population demographics and the response of species to habitat manipulations, where appropriate, for oak/mixed hardwoods forest taxa including birds, bats, small mammals, amphibians and reptiles (NCWRC 2005).

Management Practices

- Transportation facilities that utilize longer bridges at streams and wetlands not only minimize impacts (and thereby reduce mitigation requirements) but also provide crossing options for wildlife that often travel these riparian corridors and disperse to upland communities.
- Work with adjacent states on mutual planning and protection for regional species concerns, especially since some priority species are likely to expand their range due to climate change impacts.
- Control of invasive species in the short run, while populations are relatively limited and small, will prevent greater damage by them in the future.
- Use of infrequent prescribed fire and canopy gap management may be needed to improve forest structural heterogeneity (frequent fire will limit shrub and understory development necessary to breeding bird species) (NCWRC 2005).
- Management and protection of mixed hardwoods/pine to promote future large, unfragmented tracts is especially important for amphibians, reptiles, small mammals and bats (NCWRC 2005).

- Landowner incentives to promote extending rotation lengths may be another management option (NCWRC 2005).
- Invasive and exotic species control should be targeted at ecologically sensitive areas and at new and potentially manageable outbreaks (NCWRC 2005).

Land Protection

- Maintaining and restoring connections between habitat blocks is critical, not only for allowing adjustments in range in response to climate change, but to maintain population resilience and adaptability more generally.
- A high priority should be given to protecting movement corridors that allow dispersal between habitat blocks, especially as development and roadways fragment the few remaining large tracts of habitat.
- Priority should be given to restoring connections that are lost due to construction of four-lane highways and other roads that create near-impassible barriers for all animals except those capable of flight.
- County and state-level land use planning is needed to minimize development within large, unfragmented tracts of forests. This would be most appropriate and effective in the regions that are, as yet, not heavily developed, including Montgomery, Stanly, Randolph and Richmond counties in the southern Piedmont, and the northern tier counties of Surry, Stokes, Rockingham, Caswell, Person, and Granville (NCWRC 2005).
- Planning for future infrastructure (roads, water lines, etc.) should be concentrated closer to existing development and should avoid dissecting larger tracks of unfragmented forest (NCWRC 2005).
- Attempts should be made to provide large core areas of forest and to connect isolated patches of forests. Cooper and Demarest (1999) recommend that core areas be at least 16,000 acres in size to produce viable populations of forest-interior birds, like scarlet tanager. Large core areas will be important for reptiles like box turtle and timber rattlesnake, which suffer high mortality when crossing roads (NCWRC 2005).

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Table 1. Predicted Impacts of Climate Change	
Climate Change Factor	**Comments**
Storms	An increase in hurricanes or other severe storms may increase wind damage in forests. These effects are likely to be localized. Small scale wind disturbances can create canopy gaps, downed woody debris, and patches of early successional habitat which can be beneficial to both early successional and mature forest species. Large scale wind disturbances will benefit early successional species but will harm mature forest species.
Temperature	Direct effects of the warmer climate on these communities are likely to be limited. Similar oak forests range well to the south of North Carolina where normal temperatures are higher.
Drought	The most severe droughts and hot spells of recent record have had only limited effects on them. They can occupy some of the driest places on the Piedmont landscape. Increased drought may possibly favor oaks, but increased wind damage favors the understory species. If drought leads to severe wildfires, it would be harmful to oak forests, but the ease with which fires may usually be controlled in them makes this unlikely.

Table 2. Bird Species Utilizing Piedmont and Coastal Plain Oak Forests							
Species	**Common Name**	**Element Rank**	**Endemic**	**Major Disjunct**	**Extinction/ Extirpation Prone**	**US/ NC/ WAP***	**Comments**
BIRDS							
Accipiter cooperii	Cooper's Hawk					/SC/P	
Caprimulgus carolinensis	Chuck-will's-widow	G5/S5B				/ /P	
*Caprimulgus carolinensis**	Chuck-wills-widow						
Caprimulgus vociferus	Whip-poor-will	G5/S5B				/ /P	
Coccyzus americanus	Yellow-billed cuckoo	G5/S5B				/ /P	
Colaptes auratus	Northern Flicker					/ /P	
Contopus virens	Eastern Wood-pewee					/ /P	
Helmitheros vermivorous	Worm-eating Warbler					/ /P	
Hylocichla mustelina	Wood thrush	G5/S5B				/ /P	
Melanerpes erythrocephalus	Red-headed Woodpecker					/ /P	
Picoides villosus	Hairy woodpecker	G5/S4				/ /P	
*Sitta pusilla**	Brown-headed nuthatch						
Wilsonia citrina	Hooded warbler	G5/S5B				/ /P	

* In pine-dominated systems of this community type.

Table 3. Mammal Species Utilizing Piedmont and Coastal Plain Oak Forests							
Species	**Common Name**	**Element Rank:**	**Endemic**	**Major Disjunct**	**Extinction/ Extirpation Prone**	**US/ NC/ WAP***	**Comments**
MAMMALS							
Mustela frenata	Long-tailed Weasel		YES			/ /P	
Scalopus aquaticus	Eastern Mole					/ /P	
Sciurus niger	Eastern Fox Squirrel					/SR/P	

Table 4. Reptile Species Utilizing Piedmont and Coastal Plain Oak Forests							
Species	**Common Name**	**Element Rank**	**Endemic**	**Major Disjunct**	**Extinction/ Extirpation Prone**	**US/ NC/ WAP***	**Comments**
REPTILES							
Cemophora coccinea	Scarlet snake	G5/S3				/W1,W5 /P	
Cemophora coccinea copei	Northern Scarletsnake					/ /P	
Crotalus horridus	Timber (Canebrake) Rattlesnake					/SC/P	
Elaphe guttata	Corn Snake					/ /P	
Eumeces laticeps	Broad-headed Skink					/ /P	
Heterodon platirhinos	Eastern Hog-nosed Snake					/ /P	
Lampropeltis calligaster rhombomaculata	Mole Kingsnake					/ /P	
Lampropeltis triangulum elapsoides	Scarlet Kingsnake					/ /P	
Ophisaurus attenuatus longicaudus	Eastern Slender Glass Lizard					/ /P	
Sistrurus miliarius	Pigmy Rattlesnake					/SC/P	
Tantilla coronata	Southeastern crowned snake	G5/S3S4				/ /P	
Terrapene carolina	Eastern box turtle	G5/S5				/ /P	
Virginia valeriae valeriae	Eastern Smooth Earthsnake					/ /P	

Table 5. Amphibian Species Utilizing Piedmont and Coastal Plain Oak Forests							
Species	**Common Name**	**Element Rank:**	**Endemic**	**Major Disjunct**	**Extinction/ Extirpation Prone**	**US/ NC/ WAP***	**Comments**
AMPHIBIANS							
Ambystoma maculatum	Spotted salamander	G5/S5				/ /P	
Ambystoma opacum	Marbled salamander	G5/S5				/ /P	
Ambystoma talpoideum	Mole salamander	G5/S2				/SC/P	
Hemidactylium scutatum	Four-toed Salamander					/SC/P	
Hyla versicolor	Northern Gray Treefrog					/SR/P	
Plethodon glutinosus sensustricto	Northern Slimy Salamander					/ /P	
Scaphiopus holbrookii	Eastern Spadefoot					/ /P	

Table 6. Invertebrate Species Utilizing Piedmont and Coastal Plain Oak Forests							
Species	**Common Name**	**Element Rank**	**Endemic**	**Major Disjunct**	**Extinction/ Extirpation Prone**	**US/ NC/ WAP***	**Comments**
INVERTEBRATES							
Acronicta albarufa	Barrens daggermoth	G3G4/S1S2		YES		/SR/	Known in the Piedmont only from a single historical record
Callophrys augustinus	Brown elfin	G5/S4		YES		/ /	Only known from a few monadnocks in the Piedmont
Callophrys irus	Frosted elfin	G3/S2		Yes		/SR/	Only a few widely separated populations are known from the Piedmont
Catocala herodias gerhardi	Herodias underwing (moth)	G3T3/SU		YES		/SR/	Restricted to bear-oak stands associated with Piedmont monadnocks.
Erynnis martialis	Mottled duskywing	G3G4/S3				/SR/	
Eucoptocnemis dapsilis	An owlet moth	G4/S2S3				/W3/	
Heliomata infulata	Rare spring moth	G2G4/S2S3	YES	YES		/SR/	Only known from Hanging Rock State Park in the Piedmont
Hemeroplanis n. sp.	A noctuid moth	GNR/S2S3		YES		/SR/	Only known from Hanging Rock State Park in the Piedmont
Idaea eremiata	A wave (moth)	G4/S3S4				/W3/	
Lobocleta peralbata	An inchworm moth	GNR/SU				/W3/	
Megathymus yuccae	Yucca giant-skipper	G5/S3S4				/W2/	
Nemoria bifilata	An emerald moth	G4/S3?				/W3/	
Papilio cresphontes	Giant swallowtail	G5/S2				/SR/	

Table 6. Invertebrate Species Utilizing Piedmont and Coastal Plain Oak Forests							
Species	**Common Name**	**Element Rank**	**Endemic**	**Major Disjunct**	**Extinction/ Extirpation Prone**	**US/ NC/ WAP***	**Comments**
INVERTEBRATES							
Ptichodis bistrigata	Southern ptichodis (moth)	G3/S2S3				/SR/	
Stenoporpia polygrammaria	Faded gray geometer (moth)	GU/S1		YES		/W2/	Only recorded at Hanging Rock State Park in NC
Ulolonche modesta	Modest Quaker moth	G5/SU				/W3/	

*** US/ NC/ WAP Abbreviations (species are subject to reclassification by USFWS, NHP, or WRC).**

E	Endangered	SC	Special Concern	P	WAP Priority Species
T	Threatened	SR	Significantly Rare		
FSC	Federal Species of Concern	W	Watch Category		
T(S/A)	Threatened due to Similarity of Appearance				

NatureServe Element Rank: http://www.natureserve.org/explorer/ranking.htm

USFWS Endangered Species Listing Status: http://www.fws.gov/raleigh/es_tes.html

NC Natural Heritage Program Status:
http://www.ncnhp.org/Images/2010%20Rare%20Animal%20List.pdf

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