

## DRAFT –Successional Upland Communities

### Ecosystem Description

Successional upland communities are also referred to as early successional habitats. They are dominated by herbaceous vegetation and/or shrub cover because most trees have been removed, either through natural means or by human activity. Similarly, successional wetlands [provide link to this description] comprise herb and shrub dominated communities that develop on frequently flooded, semi-permanently flooded, or other wetland sites following disturbance, either natural or manmade. Successional upland communities can be separated into grassland and shrubland types.

- Grassland types are dominated by native vegetation such as mixed grasses, wildflowers, and vines. Examples of this habitat include fallow farm fields, hayfields, pastures with native grasses, savannas, prairies, meadows, and mountain balds. While areas such as ball fields, golf courses, intensively managed horse farms, and mowed lawns are dominated by grasses, they do not provide quality grassland habitat for priority species.
- Shrubland types have a mixture of young saplings, shrubs, and woody plants typically less than ten feet tall with scattered open patches of grasses, wildflowers, and vines. Vegetation composition is generally dependent on disturbance frequency and patterns. Hedgerows, clear-cuts and regenerating forests, field borders, large canopy gaps, and transportation or utility rights-of-way in dry to mesic uplands are often shrubland communities. Scattered mature trees may be present but not to the point that they shade out the beneficial understory vegetation. Shrubland habitats provide structural diversity that offers a variety of nesting sites, escape cover, and food for wildlife.

The niche that early successional communities occupy probably has always existed, having once been associated primarily with openings created by natural disturbances such as storms, floods, or fire. Since they rely on patterns of disturbance to maintain them, these communities are characteristically transient, constantly emerging across the landscape. They are composed primarily of native species of annual plants, reptiles, small mammals, birds, and insects that are associated with successional habitats and are often found nowhere else.

While early successional communities can be found statewide, composition and species associations will be highly correlated with the ecoregion where they occur.

**Southern Blue Ridge Mountains:** Early successional mountain habitats may range from relatively ancient grassy balds on or adjacent to broad ridgetops (containing a variety of unique grass and herb species) to shrub-dominated heath balds (alder, rhododendron and mountain

laurel are common dominant species) to lower elevation fields, meadows, pastures, and clear cuts resulting from agriculture or forestry activities.

- Grassy balds seem to have arisen in response to climatic and animal influences in the late Pleistocene and have been maintained by wild herbivores and, since the 1840s, by domestic livestock (Weigl and Knowles 1999). The balds support unique plant species and communities and many rare animal species (often with northern affinities) found nowhere else in the Southeast. They are also important stopover habitats for migrating birds.
- Heath balds, resulting from fire, cutting, or other disturbances, are often invaded by forest and support only a few specialized vertebrates (e.g., alder flycatcher).
- The remaining open grassy areas are montane 'old fields' which have occasionally been invaded by bald species but generally are either in agricultural use or have been abandoned to forest. Human influences, herbivore grazing, and environmental factors such as topographic position, climate, and natural fires have all played a role in the creation and maintenance of montane early successional areas.

All of these habitats have been modified by human activity and all are subject to natural succession once controlling mechanisms - such as grazing or cutting - have been eliminated. Without the return of the management factors, natural succession will limit the longevity of these habitats and their dependent plant and animal species. Though many montane early successional habitat types support species uniquely dependent on them, other types provide little benefit to plant and animal species, especially those patches of small size, and thus could only be considered marginal wildlife habitat at best. These kinds of places generally reflect human use and activity as the primary goals of their management and include a number of places such as large lawns, monoculture hayfields, golf courses, residential development and even urban development.

**Piedmont:** Early successional habitats are often found associated with agricultural or forestry activities and can contain a diverse assemblage of plants, with Piedmont prairies being a notable example of this (Davis *et al.* 2002). Historically, the Piedmont contained some prairie-type habitats (Barden 1997) with high plant, and presumably insect, diversity that were maintained through fire and herbivore grazing. Today, remnant tracts of prairie are found primarily along powerline rights-of-way and sites managed specifically for prairie restoration and maintenance.

Intensively managed habitats such as large lawns, golf courses, high production agricultural fields, monoculture hayfields, and intensively managed commercial timber stands often have low species and structural diversity that will have limited habitat value for wildlife.

**Coastal Plain:** The quantity of early successional habitat is not lacking but the quality is often questionable for most species of wildlife. This habitat is often found at the transition between agricultural fields and nearby woodlands, created by disturbances like clearcutting, disking, or

burning. There are, however, excellent opportunities for quality early successional habitat of large patch sizes for wildlife on industrial forestland in the Coastal Plain.

Table 1 provides of summary of expected climate change impacts to these natural communities.

<b>Table 1. Predicted Impacts of Climate Change</b>	
<b>Climate Change Factor</b>	<b>Comments</b>
Increased Temperature	Increased temperature is likely to have a strong effect on the composition of the plant communities in this group. These changes are also likely to affect host-plant specialist insects but impacts to other animals are difficult to predict.
Drought	Increased frequency of severe droughts is likely to have a strong effect on the composition of the plant communities in this group. These changes are also likely to affect host-plant specialist insects but impacts to other animals are difficult to predict.

### **Predicted Effects to Wildlife Species**

Tables 2 and 3 at the end of this report identify the species of conservation concern and priority species that use habitats in this ecosystem.

Species that occur widely throughout the state use successional upland communities, although there are also some regional variations (*e.g.*, Henslow's sparrows are restricted to the Coastal Plain and vesper sparrows breed only in the mountains). Cottontails and other small mammals benefit from shrub cover, which they use to escape detection from hawks and owls. American woodcock benefit from the protective nesting sites afforded by thick stands of alder and other small trees and shrubs. Turkeys, quail, kingbirds, and others benefit from the abundance of insects found in herbaceous openings.

More often, the species are affected by changes in the size of the habitat. For example, some birds associated with shrublands (*e.g.*, prairie warblers, yellow-breasted chat, field sparrow, indigo bunting, and American goldfinch) benefit from large patches of habitat that offer more interior areas and populations may decline with increases to habitat edge. Some species, such as northern bobwhite, may require large areas of contiguous habitat for long-term population viability.

Two species associated with early successional habitats, Bewick's Wren and regal fritillary, are believed extirpated from North Carolina. Several other species are declining, with eastern Henslow's sparrow, golden-winged warbler, Appalachian cottontail, and grizzled skipper listed as Federal Species of Concern, and eight additional species tracked as Elements by NHP. Ten of

the species associated with this community type that are of conservation concern are primarily northern species and are likely to be significantly affected by the effects of climate change.

Species in this habitat group are completely dependent on their ability to disperse from one habitat patch to another: their habitats themselves are normally transient and the species associated with them need to keep constantly on the move to keep up with their shifting landscape. Although many of the species associated with successional habitats are quite mobile, small mammals, reptiles, and at least some birds and insects are less mobile and highly vulnerable to the effects of habitat fragmentation. At least some of the decline of species that use successional uplands is likely due to decreased connectivity between habitat patches, in addition to the decreased extent of these habitats overall. In addition, roads have become a primary mortality factor for many species, particularly reptiles and amphibians.

Disturbed and artificially created/maintained habitats are particularly susceptible to invasion by exotic species, which in some cases can have significant impacts on the native species associated with early successional habitats. Changes in plant species composition may have strong impacts on the composition of insect species, since many have narrow host plant preferences. The vertebrate fauna may show fewer effects if plant composition changes because most, if not all, do not depend on a particular composition of plant species.

While most compositional changes are likely to have mixed effects, invasion by some exotic species can produce severe impacts, greatly reducing the diversity of both animal and plant communities. Fire ants can kill newly hatched ground nesting birds and reptiles as well as newly born mammals. Brown-headed cowbirds parasitize bird nests, and many exotic plant species take advantage of the light conditions in early successional habitats. The Appalachian Bewick's wren may have been extirpated from North Carolina due to competition with exotic house sparrows and European starlings, along with brood parasitism by brownheaded cowbirds (Potter *et al.*, 2006).

### **Climate Change Compared to Other Threats**

Loss of habitat and fragmentation of landscapes are the most significant threats to this ecosystem group. While development of yet more intensive agricultural and silvicultural practices, and loss of still more areas to development, would continue even in absence of climate change, these impacts are likely to be exacerbated both directly and indirectly by the effects of climate change.

Successional communities are often heavily infested with exotic invasive species. With increases in overall temperature, more invasions are likely, especially from tropical and sub-tropical regions. Integrated pest management practices should be preferred over more indiscriminate application of pesticides. While invasive species should be treated aggressively, with eradication as the goal wherever an exotic is just beginning to be established, control measures should always be carefully targeted, including the use of species-specific biological control agents.

Climate change will contribute to the loss of the large blocks of habitat or fragmentation that creates barriers between blocks that are critical for the survival of species in this group. Development of habitat has become the limiting factor for priority species utilizing this habitat. Across the state more generally, increased exploitation of wild or semi-wild lands for energy production is likely to be the most important indirect effect of climate change on this group. Table 4 compares climate change with other existing threats.

<b>Threat</b>	<b>Rank Order</b>	<b>Comments</b>
Conversion to agriculture/silviculture	1	The greatest threat to this habitat group is habitat loss due to development of more intensive agricultural and silvicultural practices. Modern, industrialized farming leaves fewer unutilized areas in and adjoining fields such as hedgerows, groves of shade trees, and weedy forest-field ecotones. Fewer fields are left fallow for very long. Pastures and hayfields are more intensively managed, using heavier applications of herbicides, pesticides, and fertilizers. Mowing of hayfields is also now conducted much more frequently than it has been in the past.
Fragmentation	1	More pressure will be placed on the utilization of marginal agricultural or silvicultural lands for energy production, including the development of otherwise "green" sources such as biomass, wind and solar energy. Increased frequency and severity of environmental perturbations may disproportionately affect ecosystems composed primarily of annuals or r-strategist species in general, particularly if landscapes continue to become more and more fragmented.
Pollution	2	Communities may be in close proximity to areas that are commonly quite polluted. Farm fields and pine plantations are regularly sprayed with biocides or fertilizers; powerline rights-of-way are now routinely sprayed with herbicides to keep them open; roadside rights-of-way are subject to pollutant laden runoff from the road surfaces as well as application of salt and other chemicals used to prevent icing in the winter; ruderal areas located near industrial areas are subject to both air- and water-borne pollutants emanating from the industrial plants. All of these pollutants can play a major role determining species viability within the semi-natural habitats used by this group.
Invasive Species	2	Two species that are likely to spread into new areas, particularly at higher elevations due to increased temperatures, are kudzu and fire ants. Both of these exotic species have strong impacts on early successional and other ruderal habitats. Along with changes in agricultural practices, loss of some habitat patches or connections between them may be attributable to the smothering invasion of kudzu.
Climate Change	3	Impacts from land use changes are likely to accelerate at least indirectly due to climate change, with more demand for biofuels or

**Table 4. Comparison Of Climate Change With Other Threats**

Threat	Rank Order	Comments
		other forms of energy production utilizing “waste grounds.” Like other native ecosystems, early successional habitats are also likely to be affected by increased temperatures, prolonged droughts, more frequent fires and storms, and especially invasion of exotic species.

### **Summary and Recommendations**

Loss of habitat and fragmentation are the most significant threats to this community type. Protection of agricultural reserves that maintain traditional farming practices offers the best hope for protecting areas still supporting high quality examples of this habitat group, including populations of its rarer species. Support for traditional or environmentally sustainable agricultural and silvicultural methods will help maintain this ecosystem group. Maintaining habitat connectivity across the landscape is also critical, both to maintain the resilience of these ecosystems in face of environmental perturbation and to allow shifts in range and species composition to take place.

### **Recommended Actions**

#### Surveys

- Determination the distribution and status of rare species or those believed to be declining (*e.g.*, alder flycatcher, loggerhead shrike, savannah sparrow, vesper sparrow, golden-winged warbler, blue-winged warbler, rock vole, Appalachian cottontail, timber rattlesnake, and smooth greensnake).
- Conduct surveys for species associated with successional habitats, including species for which current distribution information is already available or for species that are considered common.
- Determine distribution and status of priority species, including whip-poor-will, willow flycatcher, American kestrel, American woodcock, common nighthawk, bobolink, horned lark (*breeding distribution*), dickcissel, barn owl, short-eared owl, northern harrier, least weasel, meadow jumping mouse, coal skink, and box turtle.
- Determine the distribution of the least shrew, meadow jumping mouse, and old-field mouse (especially in Rutherford Co.).
- Document the status and distribution of mole kingsnake, eastern kingsnake, and eastern slender glass lizard.
- Determine the importance of early succession habitats for foraging bats.
- Implement winter surveys for birds (and other taxa) to measure populations at the time of the year when early succession habitat may be most limiting.
- Survey for grassland birds that are considered to be steeply declining, are not

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tracked well by typical survey methods, or have poorly understood distribution and status in the region (e.g., barn owl, grasshopper sparrow, Bachman's sparrow, eastern meadowlark and eastern kingbird).

- Conduct nocturnal surveys for Chuck-will's-widow and whip-poor-wills, concentrating on foraging areas.
- Determine vesper sparrow breeding status and loggerhead shrike status and distribution.
- Conduct migration surveys to determine the extent of use of early succession habitats by post-breeding and migratory birds.
- Determine the status and distribution of small mammals that are rare or difficult to detect (e.g., star-nosed mole, shrews, long-tailed weasel, southern bog lemming)

### Monitoring

- Develop, adapt, or enhance long-term monitoring efforts for all priority species associated with early successional habitats.
- Additional Breeding Bird Survey routes or point counts may need to be established in selected areas or habitats and more attention paid to the migration period and wintering ecology of early successional birds. Additional MAPS stations could also be beneficial, as well as migration banding stations.
- Monitoring protocols and procedures need to be developed for priority species that use this habitat. Use surrogate species to facilitate monitoring efforts.
- Develop monitoring systems to determine population trend information for grassland-dependent small mammals.
- Continue and expand long-term monitoring of grassland and scrub-shrub birds on Piedmont Game Lands and other public lands.
- Initiate long-term monitoring for Henslow's sparrow (and other grassland breeding and wintering birds) at the Voice of America (VOA) sites in Pitt and Beaufort Counties (Mangun and Kolb 2000).
- Establish long-term monitoring of eastern diamond-backed rattlesnake and northern pinesnake (Woodward and Barthalmus 1996).

### Research

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- Study golden-winged warbler population response to timber harvests of varying sizes and landscape contexts.

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- Investigate life history, breeding habits, and micro-habitat needs of bird species associated with early succession habitats (*e.g.*, whip-poor-will, common nighthawk, prairie warbler, bobolink, willow flycatcher, loggerhead shrike, horned lark, vesper sparrow, dickcissel).
- The genetic status of Appalachian cottontails relative to eastern cottontails needs to be investigated, with results used to shape conservation strategies for the species into the future.
- The most effective and efficient measures to create, restore, and maintain quality early successional habitat (*e.g.*, timber harvest, prescribed burning, mowing, herbicides, intermittent farming, grazing, etc.) needs to be emphasized, as well as understanding the differential impact that these strategies may have upon the wildlife species associated with early successional habitat.
- Examine the minimum habitat patch and habitat complex size required to sustain populations of shrub-scrub and grassland birds and mammals. Some studies suggest that patch size may be an important factor affecting both birds (Lanham and Guynn 1998) and mammals (Yates et al. 1997).
- Study the responses of bird communities to early successional habitat in managed landscapes and unmanaged landscapes.
- Evaluate the habitat requirements and management needs of grassland-dependent herpetofauna
- Identify factors limiting populations of loggerhead shrike.
- Examine impacts of cowbird parasitism and predation on neotropical migrant nesting productivity (*e.g.*, hooded warbler, Kentucky warbler, eastern wood-pewee and worm-eating warbler). Determine if cowbirds are negatively impacting bird productivity in portions of the western Piedmont with higher densities of livestock and cowbirds.
- Identify predators of field sparrow nests, and other species with high nest depredation rates.
- Examine the impacts of fire ants on herpetofauna, small mammals, and ground nesting birds, in addition to large scale management actions that could be used to control fire ants.
- Conduct economics and human dimensions research to determine how to make early succession habitat creation and maintenance more financially and socially acceptable for private landowners.
- Conduct genetics studies of priority: breeding sub-species of American kestrel in the lower Coastal Plain; Henslow's sparrows at the VOA sites; and Coastal Plain shrew species.
- Examine Chuck-will's-widow and whip-poor-will foraging areas on industrial and non-industrial forestland.

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- Conduct movement studies on northern pinesnake and eastern diamond-backed rattlesnake (using telemetry).
- Conduct population demographic studies for priority species on public and industrial forest lands.
- Examine predators effects on nest productivity of ground- and shrub- nesting birds (Yahner and Wright 1985 and Davison and Bollinger 2000).
- Determine the effects of clearcut stand size on shrubland birds (Krementz and Christie 2000).
- Determine the effects of silvicultural procedures on breeding, wintering and migrating birds on managed forests (Woodward et al. 2001, Easton and Martin 2002).
- Determine the effects of clearcut stand size on small mammals and reptiles (Yates et al. 1997).
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### Management Practices

- Use management techniques on a 2–3 year rotation to control woody vegetation (*e.g.*, hand-cutting of trees, prescribed fire, application of herbicides, periodic grazing, mowing).
- Manage through prescribed fire, selective herbicide application, or mowing whenever possible. Prescribed fire can produce better habitat than mowing or selective application of herbicides. Disking provides a beneficial vegetation response but can be harmful to priority reptile and amphibian species.
- Mowing should occur between mid-March and mid-April to ensure winter cover and to avoid disturbing wildlife during the critical stages of nesting and rearing young. Prohibit mowing between April 1 and October 1 to minimize impacts to ground nesting birds. Mowing 1/3 of a protected grassland each year will provide consistent wildlife cover, and enhance habitat diversity and food production.
- Manage utility corridors and other areas that require frequent vegetation control to benefit early successional species of wildlife. Re-vegetate utility rights-of-way into grassland or shrubland habitat using native species.
- Allow the edges of fields to become shrubby to create early-successional habitat around open fields.
- Best management practices for sustaining early successional habitats need to be developed, just as they have been for the protection of wetlands and other sensitive habitat types. Similar best management practices also need to be extended to non-agricultural land uses, including powerline, road, and railroad rights-of-way where the use of herbicides is increasingly taking the

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place of traditional mowing or bush-hogging methods.

- Integrated pest management practices should be preferred over more indiscriminate application of pesticides. While invasive species should be treated aggressively, with eradication as the goal wherever an exotic is just beginning to be established, control measures should always be carefully targeted, including the use of species-specific biological control agents.
- Ensure an adequate sustained supply of quality early successional habitat through a combination of management strategies and appropriate practices (including prescribed burning, timber harvest, grazing, herbicide use, or other practices) upon both public and private lands.
- Consider increasing the size of timber harvest areas where appropriate to support greater variety and density of early successional “area sensitive” species.
- Control of exotic species (*e.g.*, red cedar, fescue, miscanthus, Japanese spirea, tree of heaven, princess tree).
- Continue and enhance efforts to implement conservation measures upon private lands, through various programs and initiatives (*e.g.*, Farm Bill programs, CURE, stewardship program, etc.).
- Conservation programs should promote the integration of native warm season grasses into livestock operations and discourage haying or overgrazing during the grassland bird nesting season.
- On row crop farms conservation actions should focus on using technical guidance and outreach to help promote establishment of field borders, no-till agriculture, fallow rotations, hedgerows, and native herbaceous and shrub plantings. We should proactively encourage the establishment of large blocks of habitat and increasing the connectivity of existing habitats by encourage neighboring landowners to work together to create larger-scale habitat areas.
- Cooperative agreements and incentive programs should be forged with industrial timber companies to promote best management practices to enhance early succession habitat structure, maintenance and connectivity.
- Sites with potential for restoration of Piedmont prairies should be identified and beneficial management should be proactively promoted. Sources of local-ecotype native seed should be developed for use in restoration projects. The Piedmont Prairie Partnership is providing a framework for those interested in prairie restoration.

Land  
Protection

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- When early successional habitat is protected as open space in a development project, prepare a long term management plan and designate funds for long

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term management.

- While grassland complexes that total 125 acres in size will benefit many species, those that are more than 250 acres should benefit all area-sensitive grassland species of concern.
- If protecting grassland complexes this large is not possible, establish several smaller scattered grasslands. In this design, individual patches should be at least 15–20 acres in size and located within a mile of each other. In rural areas with extensive farmland, protect 20-acre grassland patches across the landscape.
- Where possible, protect grassland patches that are more circular in shape (*i.e.* not long and thin). Avoid establishing grasslands with very irregular borders and lots of edge.
- Restrict recreational activities to the edges of grasslands.
- Protect agricultural reserves that support the continuation of artificial disturbances that maintain successional communities.
- Protect sensitive grassy bald and heath bald habitats that are critical to numerous plant and animal species. Protection of those sites requires active management of them to ensure that they retain the characteristics necessary to sustain both the plants and animals they currently support.
- Protection of known rattlesnake dens.
- Conservation efforts should be geographically clustered, to the extent possible, to create larger areas of contiguous early succession habitat.
- Sites with potential for restoration of Piedmont prairies should be identified and beneficial management should be proactively promoted. Sources of local-ecotype native seed should be developed for use in restoration projects. The Piedmont Prairie Partnership is providing a framework for those interested in prairie restoration.

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**Table 2. Priority Species Utilizing Successional Uplands**

Species	Common Name	Element Rank:	Endemic	Major Disjunct	Extinction/Extirpation Prone	US/NC/WAP*	Comments
<b>BIRDS</b>							
<i>Aimophila aestivalis</i>	Bachman's Sparrow					/SC/P	
<i>Ammodramus henslowii</i>	Henslow's Sparrow					/SR/P	
<i>Ammodramus savannarum</i>	Grasshopper Sparrow						
<i>Asio flammeus</i>	Short-eared Owl						
<i>Caprimulgus carolinensis</i>	Chuck-will's-widow						
<i>Caprimulgus vociferus</i>	Whip-poor-will						
<i>Chondestes grammacus</i>	Lark Sparrow					/SR/P	
<i>Chordeiles minor</i>	Common Nighthawk						
<i>Circus cyaneus</i>	Northern Harrier					/SR/P	
<i>Cistothorus platensis</i>	Sedge Wren						
<i>Colinus virginianus</i>	Northern Bobwhite						
<i>Dendroica discolor</i>	Prairie Warbler						
<i>Dendroica pensylvanica</i>	Chestnut-sided Warbler						
<i>Dolichonyx oryzivorus</i>	Bobolink						
<i>Empidonax alnorum</i>	Alder Flycatcher					/SR/P	
<i>Empidonax traillii</i>	Willow Flycatcher						
<i>Eremophila alpestris</i>	Horned Lark						
<i>Falco sparverius</i>	American Kestrel						
<i>Icterus spurius</i>	Orchard Oriole						
<i>Lanius ludovicianus</i>	Loggerhead Shrike					/SC/P	
<i>Passerculus sandwichensis</i>	Savannah Sparrow					/SR/P	
<i>Passerina ciris</i>	Eastern Painted Bunting						
<i>Pooecetes gramineus</i>	Vesper Sparrow					/SR/P	
<i>Scolopax minor</i>	American Woodcock						
<i>Spiza americana</i>	Dickcissel						
<i>Spizella pusilla</i>	Field Sparrow						
<i>Sturnella magna</i>	Eastern Meadowlark						
<i>Tyrannus tyrannus</i>	Eastern Kingbird						
<i>Tyto alba</i>	Barn Owl						

**Table 2. Priority Species Utilizing Successional Uplands**

Species	Common Name	Element Rank:	Endemic	Major Disjunct	Extinction/Extirpation Prone	US/NC/WAP*	Comments
<i>Vermivora chrysoptera</i>	Golden-winged Warbler					/SR/P	
<i>Vermivora pinus</i>	Blue-winged Warbler					/SR/P	
<b>MAMMALS</b>							
<i>Condylura cristata</i>	Star-nosed Mole					/SC/P	
<i>Cryptotis parva</i>	Least Shrew						
<i>Microtus chrotorrhinus</i>	Rock Vole					/SC/P	
<i>Microtus pennsylvanicus</i>	Meadow Vole						
<i>Mustela frenata</i>	Long-tailed Weasel						
<i>Mustela nivalis</i>	Least Weasel					/SR/P	
<i>Peromyscus polionotus</i>	Old-field Mouse					/SR/P	
<i>Scalopus aquaticus</i>	Eastern Mole						
<i>Sylvilagus obscurus</i>	Appalachian Cottontail					/SR/P	
<i>Synaptomys cooperi helaletes</i>	Southern Bog Lemming						
<i>Zapus hudsonius</i>	Meadow Jumping Mouse						
<b>REPTILES</b>							
<i>Crotalus adamanteus</i>	Eastern Diamond-backed Rattlesnake						
<i>Crotalus horridus</i>	Timber Rattlesnake					/SC/P	
<i>Eumeces anthracinus</i>	Coal Skink						
<i>Lampropeltis calligaster rhombomaculata</i>	Mole Kingsnake						
<i>Lampropeltis getula getula</i>	Eastern Kingsnake						
<i>Masticophis flagellum</i>	Eastern Coachwhip					/SR/P	
<i>Opheodrys vernalis</i>	Smooth Greensnake					/SC/P	
<i>Ophisaurus attenuatus longicaudus</i>	Eastern Slender Glass Lizard						
<i>Pituophis melanoleucus melanoleucus</i>	Northern Pinesnake					/SC/P	
<i>Terrapene carolina</i>	Eastern Box Turtle						

**\* 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		
LE, XN	Endangered elsewhere, Non-Essential Experimental Population				

NC Natural Heritage Program, Climate Change Vulnerability Assessments:

<http://www.ncnhp.org/web/nhp/ecosystem-climate-assessment>

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

USFWS Endangered Species Listing Status: [http://www.fws.gov/raleigh/es\\_tes.html](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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