NC Sandhills Conservation Partnership
Conservation Reserve Design Working Group
Plan

May 2015

I. EXECUTIVE SUMMARY

The purpose of the Reserve Design is to: ***Synthesize biological information and create a vision to guide long-term conservation of native Sandhills species and ecosystems.*** To this end, the Reserve Design Working Group (RDWG) works to maintain an updated Reserve Design, which indicates priority areas for directing land protection, resource management, and/or private land incentive programs in order to conserve Sandhills species, ecosystems, and the ecological processes that sustain them.

The Reserve Design Working Group (RDWG) identified four primary objectives:

1. Identify the most important areas to conserve from a biological perspective.
2. Identify buffers to adequately conserve the resources and ecological processes of protected areas.
3. Identify connections between important areas that promote gene flow and wildlife movement.
4. Provide this information to other working groups and partners for implementation of land protection, resource management, and/or private land strategies.

Within the defined Sandhills Conservation Partnership focus area, the RDWG initiated specific strategies to inform and guide conservation: identify biological targets for conservation, including species, natural communities, and animal habitats unique to the Sandhills; map areas of known ecological significance; identify areas of potential ecological significance; and, map functional connectors and buffers.

The conservation targets represent a systematic approach to identify the specific features of biodiversity the Partnership is trying to conserve, and where it is trying to conserve them. There are currently 159 conservation targets, many of them associated with the longleaf pine ecosystem, but others with blackwater streams, streamhead pocosins, upland depressional wetlands, and other Sandhills habitats. The RDWG is reviewing these species, community, and ecosystem level targets, to see if there are omissions, or if some of the targets should be removed. However, many are endemic to the Sandhills, or the North Carolina populations or occurrences are predominantly in the Sandhills, meaning the focus area is one of the best - or in some cases the only - opportunities for conservation.

Based on the selected conservation targets, and where known occurrences are, a process of mapping was begun. The mapping includes primary areas for important habitats (emphasizing again the conservation targets), areas with potential habitat value based on aerial photo interpretation, restoration areas, buffers and corridors. The RDWG acknowledges that this is an ongoing effort, and the group will periodically review new information and update the reserve design.

II. PURPOSE

The NC Sandhills Conservation Partnership (hereafter referred to as the Partnership) was convened in response to landscape level changes that threaten both native biodiversity and training capacity on military installations. A number of working groups from a wide range of stakeholders were created to address these threats and identify strategic conservation opportunities. The purpose of the Reserve Design is to: ***Synthesize biological information and create a vision to guide long-term conservation of native Sandhills species and ecosystems.*** To this end, the RDWG works to maintain an updated Reserve Design, which indicates priority areas for directing land protection, resource management, and/or private land incentive programs in order to conserve Sandhills species, ecosystems, and the ecological processes that sustain them, such as fire.

III. OBJECTIVES AND STRATEGIES

The RDWG identified four primary objectives:

1. Identify the most important areas to conserve from a biological perspective.
2. Identify buffers to adequately conserve the resources and ecological processes of protected areas.
3. Identify connections between important areas that promote gene flow and wildlife movement.
4. Provide this information to other working groups and partners for implementation of land protection, resource management, and/or private land strategies.

The RDWG created six strategies to meet the objectives:

1. Identify biological targets for conservation, including species, natural communities, and animal habitats unique to the Sandhills
2. Map areas of known ecological significance
3. Identify areas of potential ecological significance
4. Identify functions of individual connectors and buffers; fill information gaps; map functional connectors and buffers
5. Periodically review new information and update reserve design
6. Interpret and share this information for the purposes of implementing the conservation plan, including the Green Growth Toolbox, other working groups, and communication with local land use planners and governments.

IV. FOCUS AREA

The focus area for the Sandhills Conservation Partnership is based on Sandhills soils. It includes much of Hoke, Harnett, Cumberland, Moore, Scotland, and Richmond counties, plus smaller portions of Lee and Montgomery counties. The three large managed areas within this focus area are the Sandhills Game Land, Fort Bragg, and Camp Mackall. There are no major rivers (and the distance between waterways actually contributes to fire ecology), but some of the notable waterways include the Little River and Rockfish Creek, which flow into the Cape Fear River, and Drowning and Naked Creek, which are major tributaries to the Lumber River.

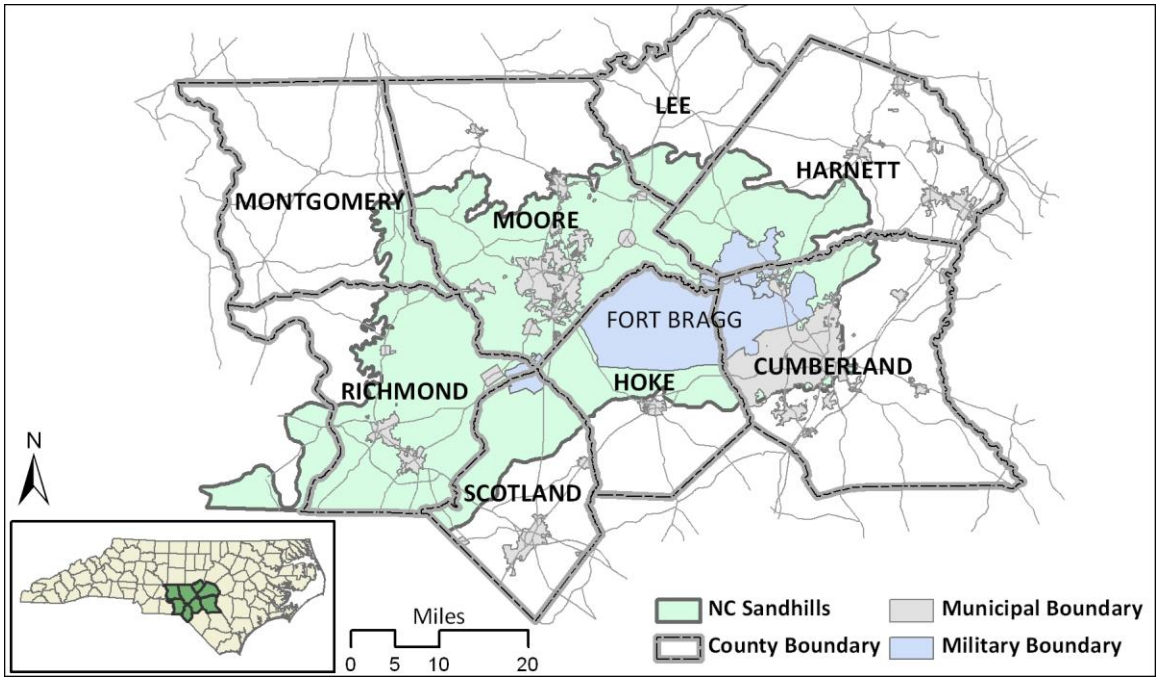

Figure 1: NC Sandhills Focus Area

V. METHODS

Selection of conservation targets

Biodiversity is composed of species, the genes they contain, the communities and ecosystems they form, and the processes that connect them. The systematic approach of the RDWG is to identify conservation targets that will encompass and represent the full suite of biodiversity in the Sandhills. Conservation targets were defined at the species, community, and ecosystem level. They include rare species, species that are not necessarily rare but are of concern due to declines, or other factors such as endemism, and natural community (or ecosystem) types. While large, this set of conservation targets does not cover all of the biodiversity of the region. The natural community and ecosystem targets play a key role in that they are intended to serve as an "umbrella", such that conserving our targets captures much of the diversity of unknown

species in the Sandhills, as well as the diversity of ecological processes such as fire.
The full set of conservation targets is used in creating the reserve design, to the extent that data are available on them. This is necessary to ensure that biodiversity and the variety of ecosystem processes are protected to the extent possible. For the purposes of the Partnership's Strategic Conservation Plan adopted June 2013, the species and natural community targets are nested into broader community and ecosystem targets.

The full set of species and natural community conservation targets is listed in Appendix 1 and grouped into four broad ecosystem and community targets below. The Reserve Design Working Group explicitly incorporated the known locations of rare species and rare community types. Protection of the conservation targets requires conservation of sufficient amounts of critical habitats. The Sandhills focus area contains a high level of endemism and, as noted in the tables in Appendix 1, there are some elements where the Sandhills presents the only globally known opportunity for conservation (e.g. St Francis' satyr). The list of conservation targets has been revisited to ensure that appropriate Wildlife Action Plan priority species are included, and should be revisited again when the Wildlife Action Plan is revised in 2015.

Longleaf Pine – Longleaf pine forests make up the matrix habitat for the Sandhills Focus Area. Longleaf community types encompass the primary location for biodiversity in the Sandhills, and have experienced great losses in the extent of original habitat. The habitat is maintained by fire, and the understory, particularly wiregrass (*Aristida stricta*) is crucial to ecosystem processes.

Streamhead Pocosins/Seeps -- Common traits of this group include an occurrence on wet soils dependent on seepage, and site location near streamheads or slopes. These habitats are sensitive to diverse sets of environmental factors.

Blackwater Streams -- General characteristics of blackwater streams are sandy bottoms, slow to moderate flow rates, clear acidic water stained by tannins, and low turbidity. Sandhills blackwater streams also experience less variable flow rates than other blackwater streams due to the seepage soils of the area, which results in steadier stream inputs. "Blackwater streams" here represents an aggregate of three distinct natural community types with diverse characteristics and species composition – beaver ponds (and successional sedge meadows), floodplain forests, and aquatic communities. The aquatic blackwater stream communities of the Sandhills include sections of three major watersheds: the Lumber, Yadkin and Cape Fear.

Upland Depressional Wetlands -- Upland depressional wetlands are an aggregate of three distinct natural community types with certain distinguishing characteristics and species composition. General characteristics of upland depressional wetlands are areas with standing water occurring seasonally to year round, with a shrubby border, high herbaceous diversity, and subject to seasonal fire. An active fire regime is assumed to be important for nutrient cycling and woody vegetation control. These areas are relatively unstudied with much yet to be

learned of their ecological importance and roles. These communities are susceptible to similar threats and mitigation (protection/abatement) strategies, thereby lending to their consolidation into one target.

The complete list of conservation targets is attached as Appendix 1, and includes some targets associated with other habitats, including early-successional and semi-natural habitats.

Sandhills Reserve Design

The Reserve Design was undertaken to identify critical areas for protection within the Sandhills project area. While many areas are valuable, the RDWG focuses on delineating areas with the *greatest* biological value; these are the places where limited resources and the strongest protection strategies should be directed.

The Reserve Design consists of areas of land mapped as different layers that define their ecological significance and our level of knowledge. These map layers include:

- **Primary areas** are places with known site-specific significant resources, such as rare species, or rare or high quality natural communities. They are usually in good ecological condition but may be somewhat degraded or in need of restoration even though significant resources are still present. These key components of the reserve system contain conservation targets and are most worthy of preservation and management as natural areas. They also represent the most threatened areas in the sense of either having rare features or high integrity, and given the difficult and costly process involved in ecological restoration, it could be said that they have the most to lose ecologically.
    - Natural Heritage Program Natural Areas (NHPNAs): These areas are designated by the Natural Heritage Program and are among the best examples in the nation, state, multi-county region, or county for a particular element (rare species or natural community) or for the combination of elements they contain. Boundaries are intended to be drawn to encompass all the significant features and the local areas needed for their survival, but individual boundaries achieve the latter to varying degrees. The boundaries were drawn by the biologist who surveyed the site, based on field knowledge.
    - Other Element Occurrence Sites (Protosites): These areas have one or more significant elements, usually rare plants but sometimes rare animals or natural communities that are conservation targets. They have not been designated as NHPNAs because they either have not been investigated by Natural Heritage Program biologists or they were not found to be of sufficient quality. With further investigation, some might be designated NHPNAs, while others would remain as places of some, but lower, significance They represent additional opportunities to protect populations of rare species and augment their overall viability. For this project, boundaries were drawn based on topography and aerial photo interpretation. [In some of the maps and data, these are

"Protosites", but should also be analyzed as restoration areas.
    - Other natural managed areas: This category includes portions of the Sandhills Game Land that were not included in the other categories, but which consist primarily of natural communities in fair to good condition. Previous inventory work on the Sandhills Game Land focused on rare plants and less on natural communities. Large parts of these areas would likely qualify as NHPNAs with further investigation, with remaining areas likely regarded as restoration areas.

- **Restoration areas** are places where rare species or high quality natural communities are no longer present but which have been found to retain enough ecological features on-site to be good candidates for restoration. An example would be a property that contains remnants of native components of natural longleaf ecosystems (such as wiregrass herbaceous layer). Restoration in these areas, where some of the most difficult-to-replace features are still present, offers the best chance for significant habitat improvement with the least effort and investment. The next task is to collect information, and devise a mechanism to map and track important restoration areas. This category of land is new, and much more field survey is needed to fully map all the restoration areas.

- **Landscape Habitat Indicator Guilds** are areas identified as being intact on a larger landscape scale for members of a specific group of animals that share an affinity for particular habitats, and are sensitive to fragmentation. See Appendix B for a summary of the Landscape Habitat Indicator Guilds and how they were identified.

- **Red-cockaded woodpecker foraging areas** have been determined by the RCW working group as the most important areas for conservation of the species. Details can be found in their report

- **Connectors** are places identified as potentially important for connecting core areas for a particular group of animals to move from one suitable habitat to another.

    - Wildlife Habitat Corridors are identified land important for the movement of wildlife between habitat areas in the Sandhills. The movement of animals and plants between habitat patches is important to maintain the long term viability of populations. Animals in particular need to move around the landscape to meet their needs. Major roads, large scale developments, and other land uses that limit the ability of wildlife to move through the landscape will have disproportionately large impacts in the areas identified by this data layer.

- **Potential Uplands Habitats** are places identified through aerial photography whose resources are not known but which have a higher probability of being classified as primary or restoration areas with on-the-ground survey. They are identified as high,

medium, or low potential, but they have not yet been investigated on the ground. A ground-truthing effort by the Reserve Design Working Group was initiated in 2013 with the objective that over time these areas will be investigated and either converted to another category or dropped. Criteria and a survey protocol have been developed for the members of the partnership to gather information on these areas (see Appendix D).

- **Buffers** either to provide or protect ecological function, or facilitate management.
    - Smoke Awareness Areas: Identify locations that are most likely to experience smoke from prescribed burns and are based on lands likely to be managed with fire, prevailing winds, and other environmental factors. Prescribed burning is a critical land management tool to maintain habitat quality in longleaf pine forests while reducing risk of catastrophic wildfire. Incompatible development in these areas could create conflicts between land managers and residents, negatively impacting the ability of managers to conduct controlled burns and increasing the risk of catastrophic wildfire.
    - Rivers/Streams/Floodplain Complex Buffers: To protect water quality and provide important streamside habitat.

Mapping of Resources

The components of the reserve design are separated for the purposes of explaining the maps into two tiers. Tier 1 resources are the rarest, most sensitive and have the highest degree of specificity in mapping. Tier 2 resources provide landscape context and function and may be less rare or sensitive or may be mapped more coarsely than Tier 1 resources. Appendix C contains detailed information on the methods that were used to develop the map layers.

Tier One resources are important, and emphasis should be placed to protect and manage as much as possible for natural habitat value and conservation of Sandhills ecosystems.

Tier Two resources provide function, but not every acre needs to be -- or can be -- managed to maximize natural ecosystem benefit. Some of the mapped areas are large, and the conservation strategies will be different, including supporting the viability of working lands.

The resulting map (see Figure 4) of the Tier One and Tier Two resources describe a natural area surface which will serve as the Sandhills Conservation Partnership's Reserve Design, with particular conservation emphasis on the Tier One resources. A vulnerability assessment will be done for the Land Protection Working Group in which stressors and threats are mapped in relation to the reserve design, to guide the partnership's land protection and management both short and long term decision processes. The reserve design surface has been incorporated into the ongoing Sustainable Sandhills Land Use Analysis, and the Green Growth Toolbox.

TIER ONE DATASETS (Listed in order of importance)

- Primary areas (NHPNAs, Other Element Occurrence Sites, Other natural areas)
- Habitat Specialist Landscape Habitat Indicator Guild Core Areas: Core areas are tracts of habitat which contain a minimum number of guild members, with the integrity of its landscape measured by the number of observed guild members relative to the number expected. The core areas indicate suitable habitat for the indicator species and represent suitable habitat for a range of other animals, including Wildlife Action Plan Priority Species.
- Active Red-Cockaded Woodpecker Foraging Areas: These include areas with some level of development that retain significance.

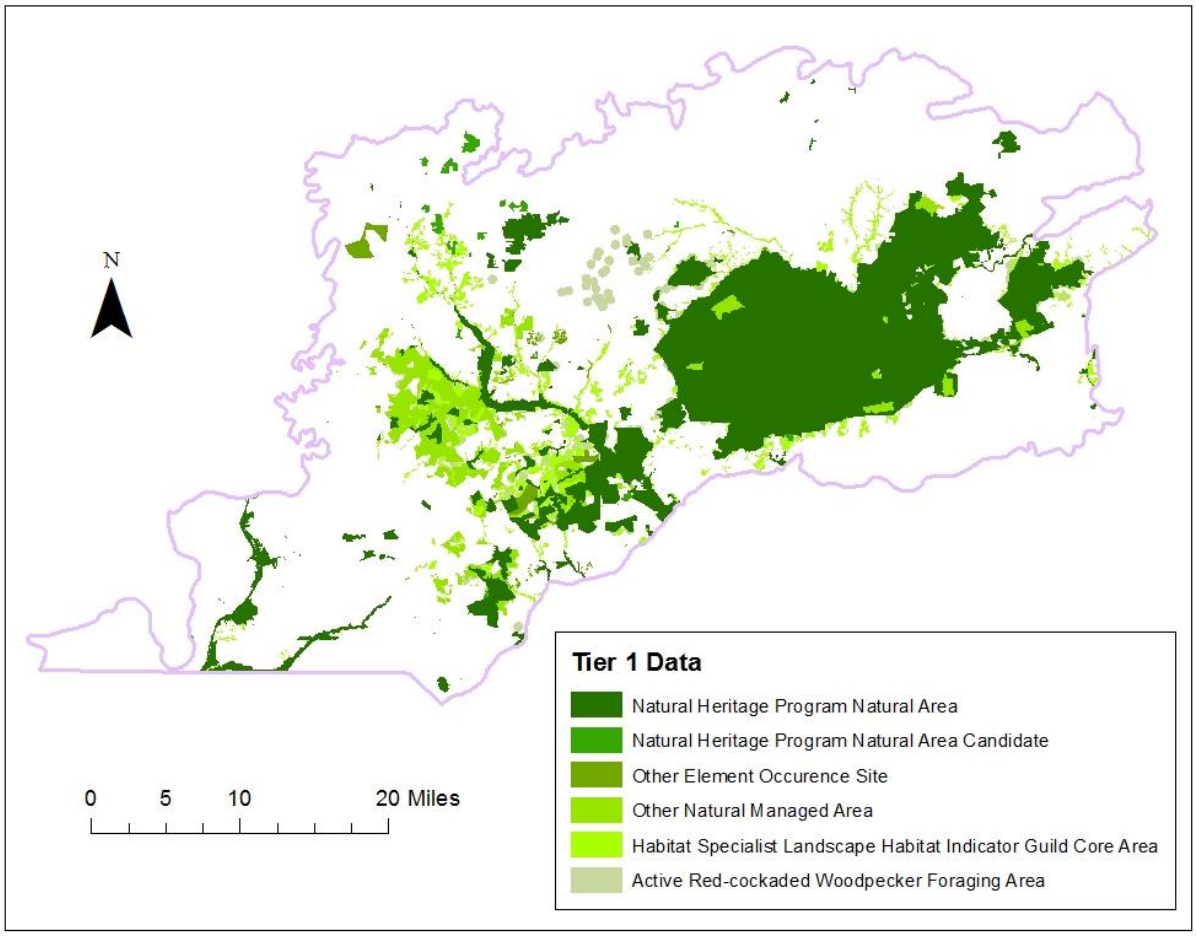

Figure 2: Map of Tier 1 Resources

TIER TWO DATASETS: (Not in priority order and do not contain same weight as Tier 1)

- Restoration Areas
- Potential Uplands Habitat
- Wildlife Habitat Connectors
- Habitat Generalist Landscape Habitat Indicator Guild Core Areas: The Tier Two indicator guilds include wider-ranging animals that are not habitat specialists, but are sensitive to fragmentation, as well as other expansive guilds. In both Tier One and Tier Two Landscape Habitat Indicator Guilds, the core areas also represent the best opportunities to provide buffer and corridor, as they retain a high level of connectivity (for the identified guild members).
- Inactive Red-Cockaded Woodpecker Foraging Areas
- Smoke Awareness Areas
- Rivers/Streams/Floodplain Complex Buffers

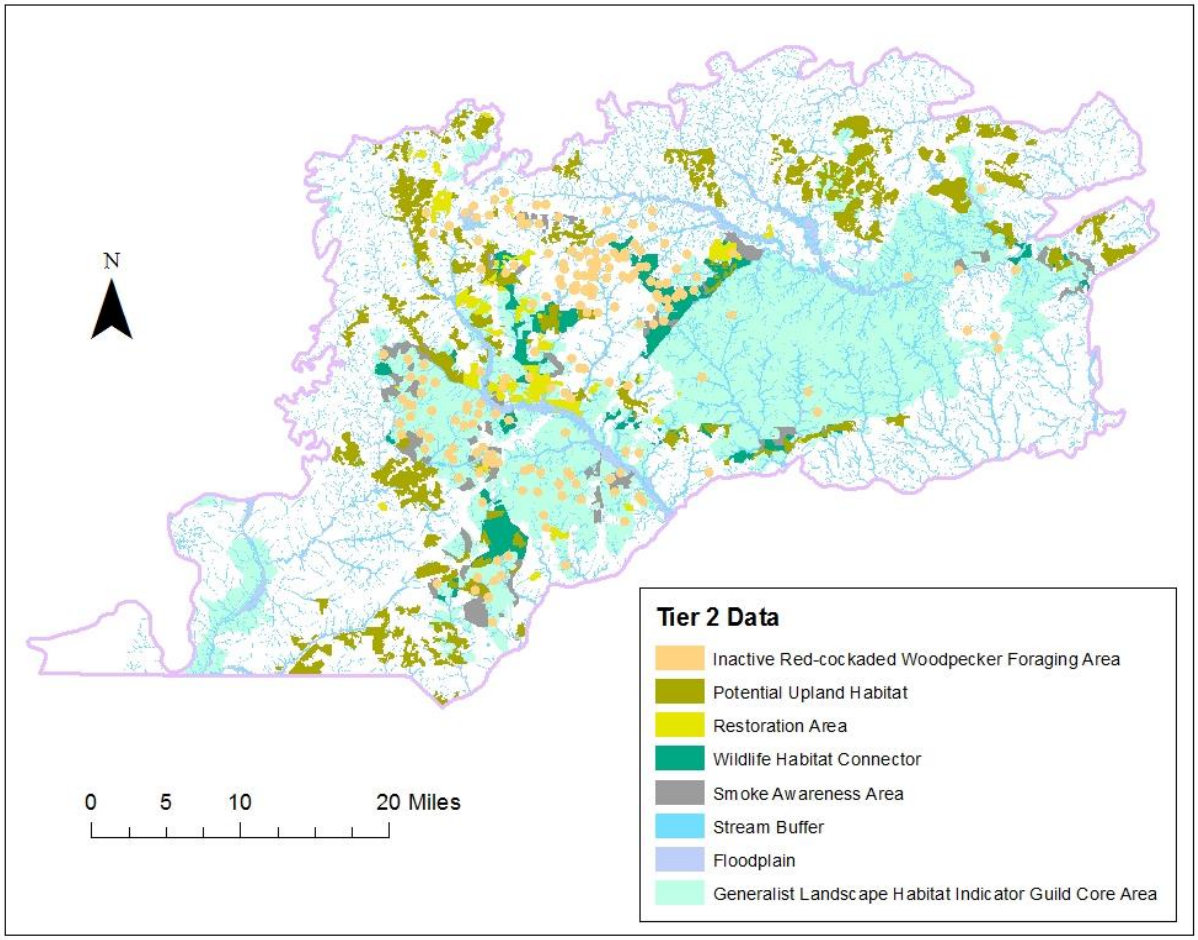

Figure 3: Map of Tier 2 Resources

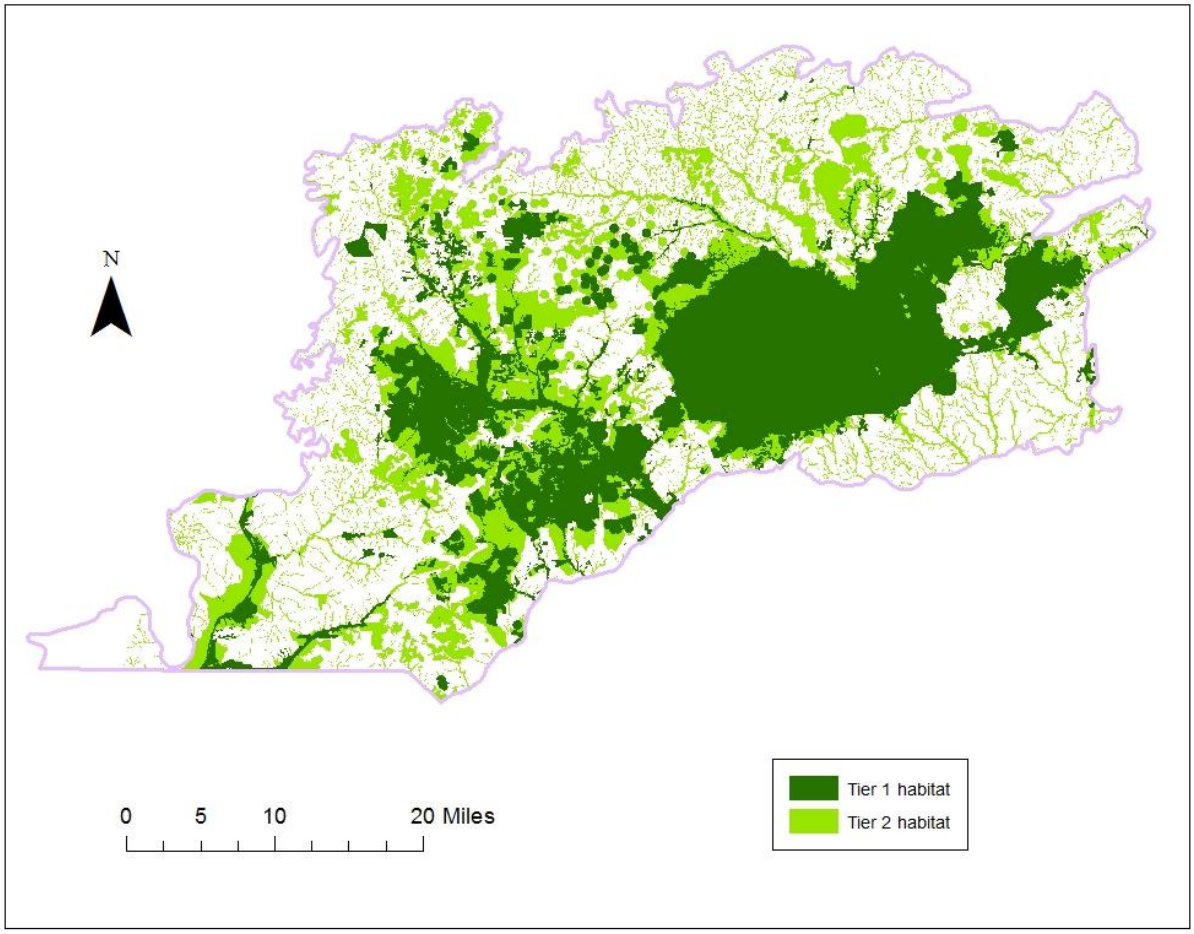

Figure 4: Map of Reserve Design

VI. CONSERVATION STRATEGIES

Overall Priorities for the Sandhills Focus Area

A guiding principle of the RDWG is to promote strategies that protect conservation targets in the areas in which they currently exist; it is extremely difficult, and in some cases is impossible, to recreate or restore ecosystems. Based on the threats identified in the Partnership's Strategic Conservation Plan, the Reserve Design Working Group identified the below prioritized list of strategies to abate threats.

1. Increase protection -- Protecting land with value to conservation targets is the highest priority; land with the highest value to conservation targets will include the Primary Areas and Tier One Core Areas (based on LHIG work). Targeted restoration opportunities might also play an important role.

2. Use appropriate management -- To sustain conservation targets, maintain corridor function and promote ecological processes, especially prescribed fire.
3. Reduce habitat fragmentation -- Increase spatial area of target habitats by "building back" some habitat in key locations and connecting large blocks of habitat.
4. Increase outreach and coordination among partners and with communities to promote greater communication and involvement
5. Continue inventory work – Investigate potential areas until all can be defined either as primary areas or restoration areas, or dropped from the design. Investigate primary areas that have not been visited recently to verify that they are still intact, and determine more precise buffer needs for primary areas.

Conservation at the local and landscape scale

Conservation of terrestrial, wetland, and aquatic targets within the Sandhills landscape will require conservation-minded management on lands determined to be critical to the long-term protection of the targets. These areas include lands currently managed by public agencies and conservation non-profits, and lands requiring acquisition from, or formal management agreements with, willing landowners. Long-term conservation will also require identifying and abating threats to the ecological functions of these lands and implementing necessary management activities.

Areas of high quality/high integrity should be the most resilient, and their conservation will help maintain viability of ecosystems and species. Protecting larger blocks of habitat, maintaining habitat in a well-managed condition that maintains or mimics natural ecosystem processes, maintaining landscape connections between habitat blocks, and conserving and managing examples of sensitive habitats across a range of environmental conditions (e.g. forests conserved across various soil types; multiple wetlands conserved in a complex with various hydrological conditions) will make Sandhills habitats and species more resilient to future stresses such as climate change. Primary areas that currently exist within managed areas should be managed for the conservation targets and, if possible expanded in area. Action should also be taken to create functional corridors between primary areas within a managed area or between adjoining managed areas. As noted above, ecosystems are not closed systems, and areas outside of primary areas may be utilized for foraging and movement. These ecosystem functions should be considered, for conservation of at-risk species, as well as for general wildlife and plant life, since they are interconnected.

The Landscape/Habitat Indicator Guilds can assist with this aspect of conservation. The Reserve Design working group has noted that if a small, isolated target is conserved, that elevates the need for conservation of connecting areas. Depending on the specific situation, actions could be taken to implement conservation at a landscape scale, especially in relation to the Landscape/Habitat Indicator Guilds:

- Protection: Direct Acquisition or Easements
    - More limited in the case of landscapes than for smaller, stand-alone Primary Areas. In some cases – e.g., landscape bottlenecks – small sites that are strategically important for landscape function should be targeted for direct protection, even if there are no rare species or high-quality natural communities present. Partner involvement would be the same as for Primary areas.

- Management Agreements: Registry or Conservation Incentives
    - Allows for multiple land uses, which is likely to be more acceptable to the larger group of landowners needed to be involved in landscape conservation than easements or land sales
        - Incentive programs that would "sweeten" agreements are likely to bring in more landowners, a key need in landscape conservation
    - Recommendations on allowable land uses should be guild-specific, incorporating information on likely impacts to guild members, especially on their ability to use the rest of the landscape.
        - Creation of uncrossable gaps (or wide areas of habitat unsuitable for dispersal) should be avoided, especially in bottleneck areas
            - Clearcutting should be discouraged in favor of selective harvest methods.
        - Longer rotations of between tree harvests should be encouraged; short rotations – particularly those stimulated by wood chipping – should be discouraged
    - Partner involvement could include monitoring of agreements

- Land Use Planning/Environmental Impact Analysis
    - Limitations on infrastructure development in key landscape areas
    - Assessment of secondary and cumulative impacts based on project footprints provided by LHIG Core areas
    - Partners would likely include local and state government agencies with planning and permitting authority, but should also include agencies involved in SEPA review

- Mitigation/Restoration
    - Use of constructed wildlife passages – including wildlife-friendly bridge designs – to minimize impacts of road and other infrastructure projects
    - Restoration of key areas – including Inter-Core Connectors – to enhance or regain dispersal between core areas
        - Use in compensatory mitigation projects

In Potential Uplands Habitat areas, biological surveys will continue to be done where access is granted by landowners. Inventory for habitat will continue to inform the efforts of the Sandhills Conservation Partnership, and the potential areas will either be moved to Primary, Restoration, or deleted from the map.

Part of the strategy for buffer and corridor conservation is included in the discussion of landscape conservation above, but some questions remain (e.g. what land use or level of activity will help maintain ecological function?), and should be addressed at the local scale through detailed reserve design. As such, buffer and corridor conservation will be the focus of future planning, with the Reserve Design working group attempting to focus on a smaller portion of the entire Sandhills focus area to consider and map appropriate specific areas for conservation. In general, minimal fragmentation of habitat is desired for the corridors and buffers, and preferable land uses specific to particular buffers and corridors could be recommended. As an example, what type of land use would be most appropriate within a river or stream buffer? Are there forestry practices acceptable in upland buffer areas, which we would not endorse in palustrine forested habitat? What type of land use would be most appropriate within a smoke management buffer?

The Reserve Design is a vision of what we hope to conserve in the Sandhills. Our approach to the plan is an iterative process, and this is our first attempt. As more data and information become available, efforts will be made to incorporate newer and better information. The RDWG should periodically reconvene and review new information to update the plan, and currently looking at 2015 as appropriate, to coincide with update of Wildlife Action Plan.

Appendix A: Conservation Targets

Conservation Targets associated with longleaf pine habitats

Scientific Name	Common Name	Importance of Sandhills	Name Category
Peucaea aestivalis	Bachman's Sparrow	North Carolina populations predominantly in Sandhills	Vertebrate Animal
Acronicta albarufa	Barrens dagger moth	Two of three known NC populations in Sandhills	Invertebrate Animal
Amblyscirtes alternata	Dusky Roadside-Skipper	Half of NC populations in Sandhills	Invertebrate Animal
Aristida condensata†	Big Three-awn Grass		Vascular Plant
Astragalus michauxii	Sandhills Milk-vetch	North Carolina populations predominantly in Sandhills	Vascular Plant
Campylopus carolinae	Savanna Campylopus	G2 species	Nonvascular Plant
Carex tenax†	Wire Sedge	occurs nowhere else in NC	Vascular Plant
Crocanthemum rosmarinifolium†	Rosemary Sunrose	All of known NC populations in Sandhills	Vascular Plant
Euphorbia cordifolia†	Heartleaf Sandmat		Vascular Plant
Desmodium fernaldii	Fernald's Tick-trefoil		Vascular Plant
Dichanthelium fusiforme	Spindle-fruited Witch Grass	1 pop on Bragg 2006	Vascular Plant
Gaillardia aestivalis var aestivalis†	Sandhills Gaillardia	occurs nowhere else in NC	Vascular Plant
Galactia mollis†	Soft Milk-pea	occurs nowhere else in NC	Vascular Plant
Crocanthemum carolinianum†	Carolina Sunrose		Vascular Plant
Hesperia attalus	Dotted Skipper	All of known NC populations in Sandhills	Invertebrate Animal
Hesperia meskei	Meske's Skipper	occurs nowhere else in NC except 1-2 sites	Invertebrate Animal
Heterodon simus	Southern Hognose Snake	North Carolina populations predominantly in Sandhills	Vertebrate Animal
Iris prismatica	slender blue iris		Vascular Plant
Liatris squarrulosa	Earle's Blazing-star		Vascular Plant
Masticophis flagellum	Coachwhip	North Carolina populations predominantly in Sandhills	Vertebrate Animal
Mesic Pine Flatwoods			Natural Community
Picoides borealis&†*	Red-cockaded Woodpecker	Over half of NC pop in Sandhills	Vertebrate Animal
Pine Savanna			Natural Community
Pine/Scrub Oak Sandhill			Natural Community
Pituophis melanoleucus melanoleucus	Northern Pine Snake	North Carolina populations predominantly in Sandhills	Vertebrate Animal
Asemeia grandiflora	Showy Milkwort	occurs nowhere else in NC	Vascular Plant
Pond Pine Woodland			Natural Community
Pseudognaphalium helleri	Heller's Rabbit-Tobacco		Vascular Plant
Pteroglossaspis ecristata†	Spiked Medusa	Only known extant population in NC is in Sandhills	Vascular Plant
Pyxidanthera brevifolia	Sandhills Pyxie-moss	endemic	Vascular Plant
Rhus michauxii†*	Michaux's Sumac	North Carolina populations predominantly in Sandhills	Vascular Plant
Ruellia ciliosa var ciliosa†	Sandhills Wild-petunia	occurs nowhere else in NC	Vascular Plant
Salvia azurea	Azure Sage	occurs nowhere else in NC	Vascular Plant
Sandhill Seep			Natural Community
Satyrium edwardsii	Edwards' Hairstreak	North Carolina populations predominantly in Sandhills	Invertebrate Animal

Schwalbea Americana†*	Chaffseed	occurs nowhere else in NC	Vascular Plant
Sistrurus miliarius	Pigmy Rattlesnake	About half of NC populations	Vertebrate Animal
Small Depression Pocosin			Natural Community
Small Depression Pond			Natural Community
Solidago tortifolia†	Twisted-leaf Goldenrod		Vascular Plant
Stylisma pickeringii var. pickeringii	Pickering's Dawnflower	North Carolina populations predominantly in Sandhills	Vascular Plant
Trichostema setaceum	Narrowleaf Bluecurls		Vascular Plant
Tridens carolinianus	Carolina Triodia	occurs nowhere else in NC	Vascular Plant
Tridens chapmanii†	Chapman's Redtop		Vascular Plant
Vaccinium virgatum	Small-flower Blueberry	occurs nowhere else in NC	Vascular Plant
Vernal Pool			Natural Community
Warea cuneifolia†	Carolina Pineland-cress	occurs nowhere else in NC	Vascular Plant
Wet Pine Flatwoods			Natural Community
Xeric Sandhill Scrub			Natural Community
Colinus virginianus	Northern Bobwhite Quail		Vertebrate Animal
Falco sparverius	American Kestrel		Vertebrate Animal

Conservation Targets associated with streamhead pocosin/seep habitats

Scientific Name	**Common Name**	**Importance of Sandhills**	**Name Category**
Agalinis aphylla	Scale-leaf Gerardia		Vascular Plant
Carex sp. 4 (Carex austrodeflexa)	Canebrake Sedge	North Carolina populations predominantly in Sandhills	Vascular Plant
Canebrake			Natural Community
Chelone cuthbertii	Cuthbert's Turtlehead		Vascular Plant
Danthonia epilis	Bog Oatgrass		Vascular Plant
Dichanthelium sp. 9 (Dicanthelium cryptanthum)	Hidden-flowered Witch Grass		Vascular Plant
Eupatorium resinosum	Pine Barren Boneset	North Carolina populations predominantly in Sandhills	Vascular Plant
Hemidactylium scutatum	Four-toed Salamander		Vertebrate Animal
Hypoxis rigida	Stiff-leaved Yellow Stargrass		Vascular Plant
Kalmia cuneata	White Wicky	near-endemic	Vascular Plant
Lilium pyrophilum†	Sandhills Lily	endemic	Vascular Plant
Lindera subcoriacea	Bog Spicebush	North Carolina populations predominantly in Sandhills	Vascular Plant
Lysimachia asperulifolia†*	Rough-leaf Loosestrife		Vascular Plant
Parnassia caroliniana†	Carolina Grass-of-parnassus		Vascular Plant
Streamhead Pocosin			Natural Community
Eriocaulon texense†	Texas Hatpins		Vascular Plant
Hyla andersonii	Pine Barrens Treefrog	North Carolina populations predominantly in Sandhills	Vertebrate Animal
Melanoplus nubilus	A Short-winged Melanoplus		Invertebrate Animal
Solidago verna	Spring-flowering Goldenrod		Vascular Plant
Xyris chapmanii	Chapman's Yellow-eyed-grass	occurs nowhere else in NC	Vascular Plant
Xyris scabrifolia	Harper's Yellow-eyed-grass	North Carolina populations predominantly in Sandhills	Vascular Plant
Streamhead Atlantic White Cedar Forest			Natural Community
Peatland Atlantic White Cedar Forest			Natural Community

Conservation Targets associated with blackwater stream habitats

Scientific Name	Common Name	Importance of Sandhills	Name Category
Amorpha georgiana†	Georgia Indigo-bush	North Carolina populations predominantly in Sandhills	Vascular Plant
Callophrys hesseli	Hessel's hairstreak	Widespread, maybe one-third of Eos in Sandhills. Atlantic white cedar habitat in rapid decline	Invertebrate Animal
Cambarus hystricosus	Sandhills spiny crayfish	Endemic	Invertebrate Animal
Carex socialis	Social sedge		Vascular Plant
Coastal Plain Bottomland Hardwoods (Blackwater Subtype)			Natural Community
Coastal Plain Levee Forest (Blackwater Subtype)			Natural Community
Coastal Plain Semipermanent Impoundment			Natural Community
Coastal Plain Small Stream Swamp (Blackwater Subtype)			Natural Community
Corynorhinus rafinesquii	Rafinesque's Big-eared Bat	Perceived Population Decline	Vertebrate Animal
Cypress--Gum Swamp (Blackwater Subtype)			Natural Community
Cyprinella sp. 1	Thinlip chub	North Carolina populations predominantly in Sandhills	Vertebrate Animal
Dry Oak--Hickory Forest			Natural Community
Eriocaulon aquaticum	Seven-angled Pipewort		Vascular Plant
Etheostoma mariae	Pinewoods darter	Near-endemic	Vertebrate Animal
Hexalectris spicata	Crested coralroot		Vascular Plant
Ilex amelanchier	Sarvis holly		Vascular Plant
Limnothlypis swainsonii	Swainson's warbler	Perceived Population Decline	Vertebrate Animal
Little River Bluff		endemic	Natural Community
Little River Seepage Bank		endemic	Natural Community
Mesic Mixed Hardwood Forest (Coastal Plain Subtype)			Natural Community
Myotis austroriparius	Southeastern myotis	Perceived Population Decline	Vertebrate Animal
Euphyes bimacula	Two-spotted Skipper		Invertebrate Animal
Piedmont/Coastal Plain Heath Bluff			Natural Community
Rhynchospora crinipes†	Alabama beaksedge	occurs nowhere else in NC	Vascular Plant
Sand and Mud Bar			Natural Community
Schoenoplectus etuberculatus	Canby's bulrush		Vascular Plant
Semotilus lumbee	Sandhills chub	endemic	Vertebrate Animal
Thalictrum macrostylum	Small-leaved Meadowrue		Vascular Plant
Torreyochloa pallida var pallida	Pale mannagrass		Vascular Plant
Carex canescens ssp. canescens	Silvery sedge	North Carolina populations predominantly in Sandhills	Vascular Plant
Carex decomposita	Cypress knee sedge		Vascular Plant
Eleocharis robbinsii	Robbins' spikerush		Vascular Plant
Ludwigia sphaerocarpa†	Globe-fruit Seedbox		Vascular Plant
Rhynchospora scirpoides	Long-beak Baldsedge		Vascular Plant
Sagittaria macrocarpa†	Streamhead sagittaria	endemic	Vascular Plant
Schoenoplectus subterminalis	Swaying bulrush	occurs nowhere else in NC	Vascular Plant
Sphagnum torreyanum	Giant peatmoss		Nonvascular Plant
Utricularia geminiscapa	Two-flowered Bladderwort		Vascular Plant

Utricularia olivacea†	Dwarf bladderwort		Vascular Plant
Cladium mariscoides	Twig-rush		Vascular Plant
*Neonympha mitchellii francisci**	Saint francis' satyr	Endemic	Invertebrate Animal

Conservation Targets associated with upland depressional wetland habitats

Scientific Name	**Common Name**	**Importance of Sandhills**	**Name Category**
Vaccinium macrocarpon†	Cranberry		Vascular Plant
Rhexia aristosa	Awned Meadow-beauty		Vascular Plant
Rhynchospora macra†	Southern White Beaksedge	occurs nowhere else in NC	Vascular Plant
Carex exilis†	Coastal Sedge	occurs nowhere else in NC	Vascular Plant
Dionaea muscipula	Venus Flytrap		Vascular Plant
Carex barrattii	Barratt's Sedge	historic	Vascular Plant
Agalinis virgata†	Branched Gerardia		Vascular Plant
Ambystoma mabeei	Mabee's Salamander		Vertebrate Animal
Lobelia boykinii	Boykin's Lobelia	Best population at Ft Bragg	Vascular Plant
Ambystoma tigrinum†	Eastern Tiger Salamander	5 of x occurrences, but more in the Carolina bay region	Vertebrate Animal
Deirochelys reticularia	Chicken Turtle		Vertebrate Animal
Eleocharis atropurpurea	Purple Spikerush		Vascular Plant
Eupatorium paludicola†	Savanna Boneset	G2 species	Vascular Plant
Ludwigia suffruticosa†	Shrubby Seedbox		Vascular Plant
Muhlenbergia torreyana	Pinebarren Smokegrass		Vascular Plant
Persicaria hirsuta†	Hairy Smartweed		Vascular Plant
Pseudacris ornata	Ornate Chorus Frog		Vertebrate Animal
Lithobates capito†	Carolina Gopher Frog	2 of 7 known populations left in NC occur in Sandhills	Vertebrate Animal
Sagittaria isoetiformis†	Quillwort Arrowhead		Vascular Plant
Scleria reticularis†	Netted Nutrush		Vascular Plant
Stylisma aquatica†	Water Dawnflower		Vascular Plant

*Federally listed as Threatened or Endangered
†State listed as Threatened or Endangered

Appendix B – Landscape/Habitat Indicator Guilds

Identification of Ecologically Intact Landscapes in North Carolina

The North Carolina Natural Heritage Program (NHP) uses a survey-based approach to identify and evaluate ecologically significant landscape units across the state. As in NHP's standard approach to mapping and evaluating occurrences (EOs) of rare species and natural communities, we identify and rank occurrences of landscape units according to the biological features they contain, as recorded in ground-based surveys. While we also use aerial photographs, GAP vegetation cover maps, and other data obtained from remote sensing to map the overall extent of a given habitat unit, all units must contain a minimum number of survey records to qualify for inclusion in our system. Units are also ranked according to their surveyed contents rather than by size, shape, patchiness, or other measures of a habitat block derivable from remote sensing.

The Elements of our landscape analysis – analogous to NHP Species or Community Elements – are termed Landscape/Habitat Indicator Guilds. We term the overall process of identifying and ranking these units LHI Guild Analysis, and, as implied by the name, there are several features that characterize this approach: Landscape Units Mapped occurrences of the LHI guilds are termed core areas. These units are intended to represent habitat units that are still large enough and/or well-connected enough to support the entire range of species associated with a particular landscape type (defined by habitats – see below). Core areas are defined as consisting of residential habitat for these species, including foraging, denning and breeding habitats. Core areas are also theoretically traversable from one end to the other. Although there may be gaps in suitable habitat embedded within the core areas, all are assumed to be crossable. Core areas therefore have a connecting function as well as a residential function. The boundaries of a core area occur at the edge of wider habitat gaps that are unlikely to be crossed, including impassable barriers such as four-lane highways. In some cases, we define Between-Core Connectors that bridge these larger breaks between two identified core areas. However, these features are regarded as much more speculative – not based on survey data – than are the core areas, and is consequently only a secondary focus of our landscape analysis.

Habitat-by-Habitat Analysis LHI guilds, as implied above, are defined according to the habitats they use for residence, foraging, and breeding. Within a given geographically defined area, species may "see" the landscapes they occupy very differently, depending on their habitat associations. Black bears, red-cockaded woodpeckers, and Venus flytrap moths may all live side by side within a particular longleaf pine savanna, but differ greatly in their use of other adjoining types of habitat, such as sandhills, pocosins, or pine plantations. Depending on the extent and distribution of these habitats, these species may "see" the landscape as being more-or-less continuous or highly fragmented. Consequently, landscape integrity – or its obverse, habitat fragmentation – must take habitat associations into account. Hence, our use of combined landscape/habitat units is the basis for our analysis.

Indicator Species The heart of our survey-based approach is the use of indicator species to determine what habitat units constitute core areas and what priority rank they should receive. These species are selected based on their sensitivity to the integrity/fragmentation of specific types of habitat. They are thus selected on a functional basis rather than on rarity, the main criteria used to define our other types of NHP Elements. They must be both habitat specialists – the species most likely to be affected by fragmentation, loss, or degradation of a particular type of habitat – and dependent on the presence of large areas or inter-connected blocks of habitat.

Habitat specialist animals fit these requirements better than plants, since they typically have much larger individual spatial requirements, having to move around to acquire food, water, shelter and mates. Many animals have larger spatial requirements at the population level, as well, particularly species that cope with environmental disturbances – e.g., many species of insects – by living in metapopulations, with subpopulations dispersed over many separate habitat units.

Grouping by Guilds Indicator species are treated as groups rather than individually. These groups are termed guilds since they are defined on the basis of common ecological factors – in this case affinity for particular types of habitat – rather than taxonomy. As is true for other ecological guilds, they also have a particular structure: the membership of each guild is mutually exclusive – a species is assigned to just one guild – but different guilds can overlap spatially. These structural features strongly distinguish “guilds” from “communities”, which have broadly overlapping membership but little, if any, spatial overlap.

LHI Guild Analysis proceeds by compiling survey records for a particular guild and looking for concentrations of records within a given unit of habitat. Core areas are defined wherever at least 25% of the guild members have been recorded. The quality of the core area – its Occurrence Rank – is based on the proportion of guild members recorded within it, estimating how well it has maintained the complement of landscape/habitat sensitive species expected to occur within that area. C-Ranked occurrences have between 25-50% of the expected species, B-Ranked between 50 and 75% and A-Ranked between 75 and 100%.

Appendix C: Methods for mapping

Natural Heritage Program Natural Areas (Formerly SNHAs):
Most of these areas were designated before this project, during various Natural Heritage inventories in the region. In particular, the Moore County inventory (Carter and LeGrand 1989); the Longleaf Pine inventory (Carter 1991); the Fort Bragg rare plant inventory (The Nature Conservancy 1993); the Sandhills Game Land rare plant inventories (Russo, Sorrie, and Van Eerden 1994; Sorrie 1998); and, the Richmond County inventory (Sorrie 2001) defined most of the Natural Heritage Program Natural Areas in the Sandhills. The RDWG has also incorporated information from the Cumberland (2002), Hoke (2004), Scotland (2005), and Harnett (2007) County inventories. Investigation continues, and we will incorporate the results new information as it becomes available.

Other Element Occurrence Sites (Protosites):
The occurrence records on which these areas are based came from a variety of sources. Many on Fort Bragg and the Sandhills Game Land were found during the rare plant inventories, but most outside of those areas are from collection records or from volunteer reports of findings. Element occurrences of species and habitat identified this way are generally not studied as thoroughly as those in the inventories. The occurrence records do not include boundaries of populations nor have the habitat necessary to sustain them.

For this project, each location was examined on maps and aerial photos. Only those that could be located with at least moderate confidence and that were believed extant based on the amount of change in the area, were included. Boundaries were drawn from topographic maps to include the likely habitat unit. In cases where rare plant populations occurred in power line corridors or other artificial mowed habitat, parts of the surrounding area were included to allow for the possibility of restoring habitat for species expansion. Most of these areas need detailed ground investigation. The spatial data will be updated every 2 years.

Other Natural Areas:
These include the remainder of the Sandhills Game Land that was not included in NHPNAs or Other Element Occurrence Sites. These areas were not examined on aerial photography, but general experience in the area indicates that most of it contains natural communities in fairly good condition.

Red-cockaded Woodpecker Foraging Areas:
These areas were created to identify critical foraging habitat surrounding Red-cockaded woodpecker (RCW) clusters. The intent of this dataset is to eventually use “cluster cores” identified using a RCW Matrix program. The “cluster core” boundaries are defined using tree data which can accurately visualize core habitat use by RCWs. Unfortunately, we are not able to create these cores yet due to a GIS compatibility issue. The foraging areas are currently defined by a 500 meter buffer around cluster centers. This provides a general estimate of

foraging habitat use, but is not precise. This dataset is a work in progress and will change once "cluster cores" are developed.

Restoration Areas:
The Natural Heritage Program has not traditionally maintained records on restorable lower quality areas, but field investigations during 2001 and early 2002 identified areas that fit into this category. Restoration areas lacked components needed to be considered good or even fair quality natural communities, but retained components that indicate some historical continuity and/or that will allow restoration to be easier or more complete. Because the ground cover contains most of the species diversity in longleaf pine communities, sites with remnant ground cover are better candidates for restoration than those where it has been completely lost. Typical examples include areas that have been clear-cut and had substantial soil disturbance but which still have some wiregrass and other natural ground cover plants. Areas where fire suppression and canopy cutting has allowed the understory to become thick and eliminate most but not all of the ground cover are also typical examples. Overall, work to identify restoration areas has been limited so it is likely that substantial additional areas remain to be found.

Landscape Habitat Indicator Guild Core Areas:
Different species use different habitat patches, make use of different habitat links to move from one area to another, and are differentially affected by habitat degradation and fragmentation. Therefore, landscape analysis must take these differences into account. The approach used consisted of identifying the broad habitat types of interest and a group of animal species, or indicator guilds, that are restricted to those habitat types. The species in the guilds are selected for their fidelity to the habitat and may be either common or rare. The taxonomic groups of animals vary among guilds. Some are primarily reptiles or other vertebrates; some consist solely of insects. The abundance and diversity of guild members present in a given area of a particular habitat type serves to indicate both ecosystem quality and landscape integrity.

A number of landscape habitat indicator guilds have been recognized in the Sandhills: Streamhead Atlantic White Cedar Forests; Cypress-Gum Swamp Forests; Dry-Hydric Hardwood and Mixed Forests; Dry-Wet Hardwood and Mixed Forests; Dry-Xeric Mixed Forests, Woodlands, and Barrens; Forest Canebrakes; Forested Floodplains; Freshwater Marshes; Sandhill Streamhead Mires; Pitcher Plant Meadows and General Wet, Herbaceous Swales; Sandhills Seeps and Wet Sandy Herbaceous Swales; Sandhill Streamhead Swamp and Pocosins; Savannas and Wet, Sandy Herbaceous Swales; Semi-Natural Grasslands; Sparsely Settled Mixed Habitats; Wet-Mesic Hardwood and Mixed Forest; Wet-Mesic Pine Woodlands; Wet-Xeric Longleaf Pine Woodlands/Ephemeral Pools; Wet-Xeric Longleaf-Wiregrass Woodlands; and, Xeric-Mesic Longleaf Pine and Mixed Oak Woodlands. Animal species in each guild are mutually exclusive, but a given piece of land may harbor several guilds with affinity for different aspects of the habitat.

For each guild, the occurrence records of guild members not previously mapped were mapped, and the combination of habitat patches and species occurrences was visually examined with aerial photos to identify core areas and connectors.

Core areas are blocks of habitat where guilds have their best representation in terms of diversity and abundance. The primary data are the occurrence records for guild members. The habitat map was used to determine the boundaries of the core areas. Large blocks of habitat that lack occurrence records for guild members were not designated as core areas.

Wildlife Habitat Connectors:
Connectors are links between core areas, formed either by continuous strips of guild habitat or by archipelagos of habitat. Since connectors do not necessarily support resident populations of the guild species, there may be few, if any, occurrence records for guild members within them. Connectors may also consist of poorer quality habitat.

The Reserve Design Working Group assembled for a series of four workshops in 2012. The goal of these workshops was to develop detailed site designs for each of the Sandhills Conservation Focus Areas, that identify individual privately owned land holdings, the protection and restoration of which would enhance resilience of the Sandhills Reserve as a whole. Using expert opinion, aided by high resolution aerial imagery and Reserve Design data layers, polygons were drawn that encompass smoke awareness areas and wildlife habitat connectors necessary for the effective long-term management of existing protected lands in the Sandhills.

Wildlife Habitat Connectors were identified in the workshops that provided connectivity for wildlife passage between core areas. Each area was identified targeting specific wildlife species. This information can be found in the attribute table of the GIS shapefile.

Potential Uplands Habitat:
Because the most intense inventories have focused only on particular areas within the Sandhills, there is a question of what additional significant areas remain unknown, particularly outside of public lands. Areas that might be significant were identified to focus further investigation.

Areas with potential significance were identified with a two-step process. The Gap Analysis Program's draft vegetation map of the Sandhills was initially used to identify potential areas. This map was created using Landsat TM data from 1993, along with ancillary GIS data such as soils and wetland mapping. The vegetation classes were approximately at the alliance level of the National Vegetation Classification. The vegetation classes were consolidated into categories of natural sandhill communities, other natural communities, and unnatural cover such as urban, agriculture, and pine plantations. The reclassified raster map was used as a base to digitize polygons of contiguous natural communities, with an emphasis on sandhill communities. These polygons were then examined and refined using digital aerial photos.

Areas that did not appear to have potential natural cover were removed, and adjacent areas that did appear to have potential were added. For the central part of the project area, true color digital aerial photos taken in 2000 by Fort Bragg were used. These had a pixel size of one foot and were easily interpreted. For peripheral areas not covered by the Fort Bragg photos, the State's 1993 black and white digital orthophoto quads were used. These photos were less interpretable, due to both a lack of color and a lower resolution storage format. Later in the project, digital color infrared aerial photos based on the 1998 National High Altitude Photography photos were acquired and used to reassess all peripheral areas. A more recent Landsat image was then used to detect changes to potential areas, and the map was adjusted accordingly.

Potential Uplands Habitats were subjectively rated as high, medium, or low potential. This was done for whole polygons separately on each digital photo. This results in some prominent straight lines between polygons of different potential at the edges of the photos. The emphasis in rating was on upland sandhill communities, but streamheads and seeps were also included. Swamps were included in polygons but contributed less to the rating of potential. Areas of swamp without upland sandhill vegetation were not mapped. Areas were considered to have high potential if the signature on the photo looked visually like natural structure for that community. For sandhill communities, this was an open canopy of medium to large pine. Medium potential areas included younger, denser but not extremely dense pine, sparse pine with heavy deciduous cover, areas with visible ground disturbance of moderate intensity, and recent clear-cuts that appeared to have been high potential sandhill vegetation before cutting and that did not show evidence of bedding. Low potential areas included dense pine stands, areas with heavier soil disturbance, areas fragmented by soil disturbance, and recent clear-cuts in areas that were less clearly good quality vegetation before cutting. The potential categories are defined fairly inclusively, so that any place that might have significance is included. A high percentage of them may not turn out to have much significance, especially in the low potential category. Areas not considered having potential include areas with more than isolated houses, plowed areas, and bedded plantations with any but the most open canopies.

We found substantial discrepancies between what was interpreted from the aerial photos and what was indicated on the Gap Analysis map. Most discrepancies were developments, fields, pine plantations, and clear-cuts that probably happened after the 1993 imagery was captured. Clear misclassification of the land cover by the Gap Analysis map occurred but was less common. This work indicated the substantial loss of natural vegetation and even greater increase in fragmentation in just seven years. Near the towns, new house construction was the most common loss. In more remote areas, pine plantation was the greatest loss, but apparent clearing of new fields was also significant. Map 4 shows the identified potential uplands habitats within the Sandhills Conservation Partnership Focus Area.

While the initial work focused on the sandhill uplands, the streamheads and seeps target and the upland depressions target were included because they tend to occur as small patches

embedded in the upland landscape. Because of the ecological significance of aquatic resources in the Sandhills focus area, the RDWG wanted to selectively focus on aquatic ecosystems, particularly blackwater streams, as conservation targets. The working group recognized that protection of key upland sites might not adequately conserve aquatic resources.

Beginning in 2013, a ground-truthing effort was initiated with the objective to reclassify the Potential Uplands Habitat data into three distinct categories: NHPNA candidate, restoration, and removal, with the latter intending to be dropped from the dataset entirely. The survey criteria and protocol are found in Appendix D. Since 2013, multiple organized field surveys were conducted, with the most recent in February of 2014. The efforts have resulted in evaluation of approximately 1/3 of the Potential Uplands Habitat areas. Field surveys will continue, but the limiting factor of lack of site access remains.

Buffers

Having identified the areas of known and potential high biological value, the group addressed the need for protection of buffers in these areas. Terrestrial buffer widths were based on distance of red-cockaded woodpecker foraging partition radius and smoke management zone. The currently accepted distance for both considerations is one half-mile. We would want to filter out all Primary Areas that do not require a half-mile buffer (e.g. Aquatic habitats, floodplains, bottomland swamp). The following initial decision rules were recommended by the group:

Smoke Awareness Areas:

Smoke Awareness Areas were identified by land managers and Reserve Design Working Group members during the series of 4 workshops in 2012 to identify the most likely areas where active prescribed fire is expected to take place with consideration for prevailing winds and developed areas. These smoke awareness areas were extended out up to a half mile from the conservation and managed land boundaries.

Rivers/Streams/Floodplain Complex Buffers:

Decision Rules were created for the purpose of mapping desired buffers for waterways and floodplains. A default width of 50 feet for all intermittent and perennial streams was judged feasible based on existing state regulations (e.g. Tar-Pamlico and Neuse Riparian Buffer Protection Rules). Building on the idea of adequately conserving key aquatic resources, a minimum of 100 feet from the edge of defined floodplains was mapped for: 3rd order streams and higher; any stream adjacent to terrestrial primary areas; and, any stream flowing into aquatic NHPNAs. The most stringent protection, a buffer of 300 feet, was mapped for aquatic primary areas if no floodplain exists or if the floodplain is less than 300 feet in width.

Established buffers should benefit aquatic resources, water quality, and migratory birds, and so to specify which streams should receive additional focus, rivers and streams were analyzed. Analysis for further potential River/Stream/Floodplain Complex buffers included delineation

using the following data layers: GAP vegetation classification; Hydric Soils; County Wetland data; State Outstanding Resource Waters; Division of Water Quality Bio-classification of "Excellent"; and, a 100-year floodplain data layer. Delineated floodplain areas other than Primary Areas defined as Potential. Calculated Buffer of Primary Areas defined as Secondary portion.

Aerial photos, cadastral data, and land cover data were used to determine if habitat still exists within established buffers and corridors and to categorize properties by land use type e.g. "working landscapes" (includes private farmland, forests etc.). All buffers and corridors were reviewed by Land Protection Focus Area and adjusted accordingly.

Appendix D

Reserve Design Potential Uplands Habitat Survey

INSTRUCTIONS

The purpose of the survey is to evaluate areas in the Reserve Design's Potential Uplands Habitat layer. Potential Uplands Habitats are private lands identified from aerial photography as possibly containing upland longleaf pine habitats which in some locations include streamheads, seeps, and upland depression landforms. These areas are termed 'potential habitats' because they may contain priority habitats, but the presence and quality of the habitat has not been confirmed on the ground. The Potential Uplands Habitat layer was last updated in Jan 2010 with 2008 aerial photography.

This survey is designed to ground truth the sites and determine whether the habitats are candidates for Natural Heritage Program Natural Area (NHPNA) designation, display evidence of restoration potential, or should be removed. For a site to be a NHPNA Candidate, the site should exhibit wire grass ground cover and mature longleaf pine in much of the uplands and/or have small patch rare communities present and a lack of widespread soil disturbance. These sites should currently support or have a high likelihood of supporting rare species associated with longleaf pine forest, wetland, seep, or streamhead habitats. NHPNA Candidate site designation will necessitate a more in depth future visit to evaluate the site's true NHPNA potential. Restoration areas are places where rare species or high quality natural communities are no longer present but which have been found to retain enough ecological features on-site to be good candidates for restoration. Upland sites in this category should have longleaf pine trees *and* native herbaceous groundcover such as wiregrass. These sites may have a closed canopy or be fire suppressed. Properties with wetlands, seeps, and streamheads in somewhat degraded condition should also be classified as "restoration potential". Restoration in these areas, where some of the most difficult-to-replace features are still present, offers the best chance for significant habitat improvement with the least effort and investment. Recommendation for removal should occur if the site exhibits insufficient wiregrass ground cover, no longleaf pine, there are no small patch rare communities present, or if there is widespread soil disturbance. Each of these three designations is contingent on sufficient visual access to the site.

As much of the potential habitat area as possible should be assessed. If no suitable access exists, check the insufficient access box at the bottom of the datasheet and indicate reasons why point was not surveyed in the comments section.

Once you have completed the survey, take digital picture(s) of representative habitat visible from your point and record photo numbers on the datasheet. When submitting photos, rename them to include the FID of the potential area shapefile.

EQUIPMENT NEEDED

- DATA SHEETS/CLIPBOARD/PEN OR PENCIL
- MAPS OR OTHER MATERIAL
- GPS (OPTIONAL)
- DIGITAL CAMERA

RECORDING DATA

- **DATE:** THE DATE THE SURVEY WAS COMPLETED
- **OBSERVER:** THE INITIALS OF THE OBSERVER
- **PHOTO TAKEN:** CHECK THIS BOX IF YOU TOOK REPRESENTATIVE PHOTOS OF THE SITE. AFTER THE LAST PICTURE, TAKE A PICTURE OF THE DATASHEET OR MAP WITH FID INDICATED TO ASSIST IN LABELING THE PHOTO BACK IN THE OFFICE.

SURVEY METHOD:

- **ROADSIDE:** CHECK THIS BOX IF THE SITE WAS SURVEYED SOLELY FROM THE ROAD
- **FOREST ROAD DRIVE-THROUGH:** CHECK THIS BOX IT YOU GAINED ACCESS TO FOREST ROADS THROUGH THE SITE BUT DID NOT WALK AROUND ON THE PROPERTY
- **WALKTHROUGH:** CHECK THIS BOX IF YOU WERE ABLE TO WALK AROUND ON THE SITE OFF OF FOREST OR PUBLIC ROADS

- **% POTENTIAL AREA OBSERVED:** PROVIDE A NUMERICAL ESTIMATE OF THE AMOUNT OF THE SITE VISUALLY OBSERVED. THIS ESTIMATE WILL INDICATE WHETHER THE SITE WAS SUFFICIENTLY SURVEYED TO PROVIDE AN ACCURATE RECOMMENDATION.

QUESTION 1: IS THERE WIREGRASS GROUNDCOVER OVER MUCH OF THE UPLANDS (AT NATURAL OR REDUCED DENSITY BUT NOT LARGELY ABSENT)?

- **FULL:** CHECK THIS BOX IF THERE IS WIREGRASS & OTHER NATIVE HERBACEOUS GROUNDCOVER OVER 30% OR MORE OF THE UPLANDS
- **REDUCED DENSITY:** CHECK THIS BOX IF THERE IS WIREGRASS & OTHER NATIVE HERBACEOUS GROUNDCOVER OVER 5-30% OF THE UPLANDS
- **LARGELY ABSENT:** CHECK THIS BOX IF THERE IS <5% WIREGRASS GROUNDCOVER
- **% COVERAGE**: PROVIDE A NUMERICAL ESTIMATE OF THE % COVERAGE OF WIREGRASS GROUNDCOVER ACROSS THE SITE.
- **DESCRIPTION:** PROVIDE A WRITTEN DESCRIPTION OF THE CONDITION OF WIREGRASS GROUNDCOVER

QUESTION 2: IS THERE LONGLEAF PINE PRESENT IN MUCH OF THE UPLANDS?

- **YES**: CHECK THIS BOX IF LONGLEAF PINE IS PRESENT IN MUCH OF THE UPLANDS
- **NO:** CHECK THIS BOX IF LONGLEAF PINE IS NOT PRESENT IN MUCH OF THE UPLANDS
- **AVG. CANOPY TREE DBH:** PROVIDE AN ESTIMATE OF THE AVERAGE CANOPY TREE DBH IN INCHES
- **MAX CANOPY TREE DBH:** PROVIDE AN ESTIMATE OF THE LARGEST CANOPY TREE DBH IN INCHES
- **DESCRIBE THE DISTRIBUTION AND STAND DENSITY:** PROVIDE A DESCRIPTION OF THE TREE DISTRIBUTION AND DENSITY. I.E. PATCHINESS, UNIFORMITY, PLANTATION, OVERSTOCKED, MEDIUM OR LOW DENSITY, EVEN OR UNEVEN-AGED.
-

QUESTION 3: HAS THERE BEEN WIDESPREAD SOIL DISTURBANCE (BEDDING, ETC.)?

- **YES:** CHECK THIS BOX IF THERE HAS BEEN WIDESPREAD SOIL DISTURBANCE
- **NO:** CHECK THIS BOX IF THERE HAS NOT BEEN WIDESPREAD SOIL DISTURBANCE
- **IF YES, DESCRIBE:** PROVIDE A DESCRIPTION OF THE DISTURBANCE

QUESTION 4: ARE THERE SMALL PATCH RARE COMMUNITIES PRESENT (E.G. SANDHILL SEEPS, ROCK OUTCROPS, SMALL DEPRESSION COMMUNITIES)?

- **YES:** CHECK THIS BOX IF SMALL PATCH RARE COMMUNITIES ARE PRESENT ON THE SITE
- **NO:** CHECK THIS BOX IF SMALL PATCH RARE COMMUNITIES ARE NOT PRESENT ON THE SITE
- **IF YES, DESCRIBE:** PROVIDE A DESCRIPTION OF TYPE, CONDITION AND EXTENT OF THE COMMUNITY TYPE(S) PRESENT

RECOMMENDATION:

- **REMOVAL:** CHECK THIS BOX IF RECOMMEND REMOVING THE SITE FROM POTENTIAL UPLANDS HABITAT LAYER
- **NHPNA CANDIDATE:** CHECK THIS BOX IF RECOMMEND SITE SHOULD BE SURVEYED AS A NHPNA CANDIDATE
- **RESTORATION AREA CANDIDATE:** CHECK THIS BOX IF RECOMMEND SITE AS A RESTORATION AREA CANDIDATE
- **INSUFFICIENT ACCESS:** CHECK THIS BOX IF INSUFFICIENT VISUAL ACCESS TO THE SITE LIMITED ABILITY TO ADEQUATELY SURVEY AND ANSWER QUESTIONS
- **COMMENTS:** PROVIDE A WRITTEN DESCRIPTION OF THE SITE AND ANY PERTINENT REASONING FOR RECOMMENDATION

AFTER SURVEY:

- CHECK OVER THE DATASHEET TO MAKE SURE ALL APPROPRIATE FIELDS ARE COMPLETED.
- MAKE SURE TO HAVE TAKEN ONE OR MORE PICTURES OF REPRESENTATIVE HABITAT AT THE SITE.
- **AFTER THE LAST PICTURE IS TAKEN**, TAKE A PICTURE OF THE COMPLETED DATASHEET.
    - *WHEN SUBMITTING PHOTOS, RENAME THEM TO INCLUDE THE FID*

2013 Potential Areas Evaluation datasheet

Date:_____ Observer: _____ Potential Area FID_____Photo taken_☐
Survey Method: Roadside ☐ Forest Road Drive-through ☐ Walkthrough ☐ % potential area observed _____
Describe level of survey effort_____

1. Is there wiregrass ground cover over much of the uplands (at natural or reduced density but not largely absent)?
   Full ☐ Reduced density ☐ Largely absent ☐ % coverage_____

Description:_____

2. Is there longleaf pine present in much of the uplands?
   Yes ☐ No ☐ Avg. canopy tree DBH_____ Max canopy tree DBH_____

Describe distribution and stand density_____

3. Has there been widespread soil disturbance (bedding, etc.)?
   Yes ☐ No ☐ If yes, describe _____
4. Are there small patch rare communities present (e.g. sandhill seeps, rock outcrops, small depression communities)?
   Yes ☐ No ☐ If yes, describe _____

Recommendation: Removal ☐ NHPNA Candidate ☐ Restoration Area Candidate ☐ Insufficient Access ☐ Comments:

_____

Date:_____ Observer: _____ Potential Area FID_____Photo taken_☐
Survey Method: Roadside ☐ Forest Road Drive-through ☐ Walkthrough ☐ % potential area observed _____
Describe level of survey effort_____

1. Is there wiregrass ground cover over much of the uplands (at natural or reduced density but not largely absent)?
   Full ☐ Reduced density ☐ Largely absent ☐ % coverage_____

Description:_____

2. Is there longleaf pine present in much of the uplands?
   Yes ☐ No ☐ Avg. canopy tree DBH_____ Max canopy tree DBH_____

Describe distribution and stand density_____

3. Has there been widespread soil disturbance (bedding, etc.)?
   Yes ☐ No ☐ If yes, describe _____
4. Are there small patch rare communities present (e.g. sandhill seeps, rock outcrops, small depression communities)?
   Yes ☐ No ☐ If yes, describe _____

Recommendation: Removal ☐ NHPNA Candidate ☐ Restoration Area Candidate ☐ Insufficient Access ☐ Comments:

Bibliography:

Hall, Stephen. 2008. STATEWIDE ASSESSMENT OF CONSERVATION PRIORITIES AT THE LANDSCAPE LEVEL (March 31, 2008). NC Natural Heritage Program, Raleigh, NC.

Hall, Stephen. 2009. STATEWIDE ASSESSMENT OF CONSERVATION PRIORITIES AT THE LANDSCAPE LEVEL: Upland and Interbasin Habitats, Eastern Piedmont Region (February 3, 2009). NC Natural Heritage Program, Raleigh, NC.

Hall, Stephen. 2008. STATEWIDE ASSESSMENT OF CONSERVATION PRIORITIES AT THE LANDSCAPE LEVEL: Upland and Interbasin Habitats, Fall-line Sandhills Region (November 24, 2008). NC Natural Heritage Program, Raleigh, NC.

Hall, Stephen. 2009. STATEWIDE ASSESSMENT OF CONSERVATION PRIORITIES AT THE LANDSCAPE LEVEL: Upland and Interbasin Habitats, Northern Coastal Plain Region (July 9, 2009). NC Natural Heritage Program, Raleigh, NC.

Hall, Stephen. 2008. STATEWIDE ASSESSMENT OF CONSERVATION PRIORITIES AT THE LANDSCAPE LEVEL: Upland and Interbasin Habitats, Southern Coastal Plain Region (July 30, 2008). NC Natural Heritage Program, Raleigh, NC.

Hall, Stephen. 2009. STATEWIDE ASSESSMENT OF CONSERVATION PRIORITIES AT THE LANDSCAPE LEVEL: Upland and Interbasin Habitats, Western Piedmont Region (December 11, 2009). NC Natural Heritage Program, Raleigh, NC.