

# Integrating Complementarity and Landscape Analysis Using Site Specific Information and Vegetation Cover

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## Introduction:

Southeastern North Carolina is a biologically rich region where human population and the rate of development are increasing rapidly, putting natural systems and biodiversity at risk (Figure 1). This study is intended to facilitate conservation planning for this region by combining standard procedures for site evaluation used by the Natural Heritage Programs across the country with new approaches that address conservation needs at the landscape level. Prioritization was based on a unique combination of the standard Heritage protocol where individual sites are ranked based on regional, state, and national significance of species and plant communities they support and the significance of areas to indicator animal guilds.

## Methods:

Data used in this analysis include:

- Rare species locations, high quality and rare plant community locations and condition, significant natural areas (NC Natural Heritage Program).
- Butterfly and macro-moth faunal surveys and habitat indicator studies (NC Natural Heritage Program).
- Collection sites from specimen records (NC Museum of Natural Sciences).
- Vegetation cover map developed by the NC Gap Analysis Project.

## Determining Conservation Priorities:

### Element Analysis and Site Ranking

Site ranking was done using a modification of the approach that has evolved at the NC Natural Heritage Program over the past 20 years. It uses the rarity rankings of Natural Heritage elements (species and community types) and the quality ranks of individual occurrences of those elements. Occurrences are compared to other known occurrences to determine the highest quality and those most crucial to long term survival of the element. Sites are rated for their potential contribution to a complementary set that will support the best examples of all elements. The analysis assures that all elements will be covered in the sites where they are most likely to persist. Sites that are critical to the survival of an element are included even if they contain few or no other elements. The highest ranked sites are those that contain the most irreplaceable features – the rarest elements, the highest quality examples, and the largest concentrations of elements.

### Landscape analysis using animal guilds

The use of guilds allowed us to assess the conservation significance of different sites as core areas or connectors. Twenty-two indicator guilds were identified as the conservation targets in the landscape analysis. These guilds were defined to include vertebrate and invertebrate species with strong affinities for habitats that are becoming reduced, degraded, or fragmented within the study area. The species chosen are believed to be dependent on an intact landscape to maintain their viability. Some of the guilds were defined to include members with large range requirements. Other guilds were defined to include species dependent on a meta-population structure. While the same habitat could be used by different guilds, species membership was generally limited to one guild.

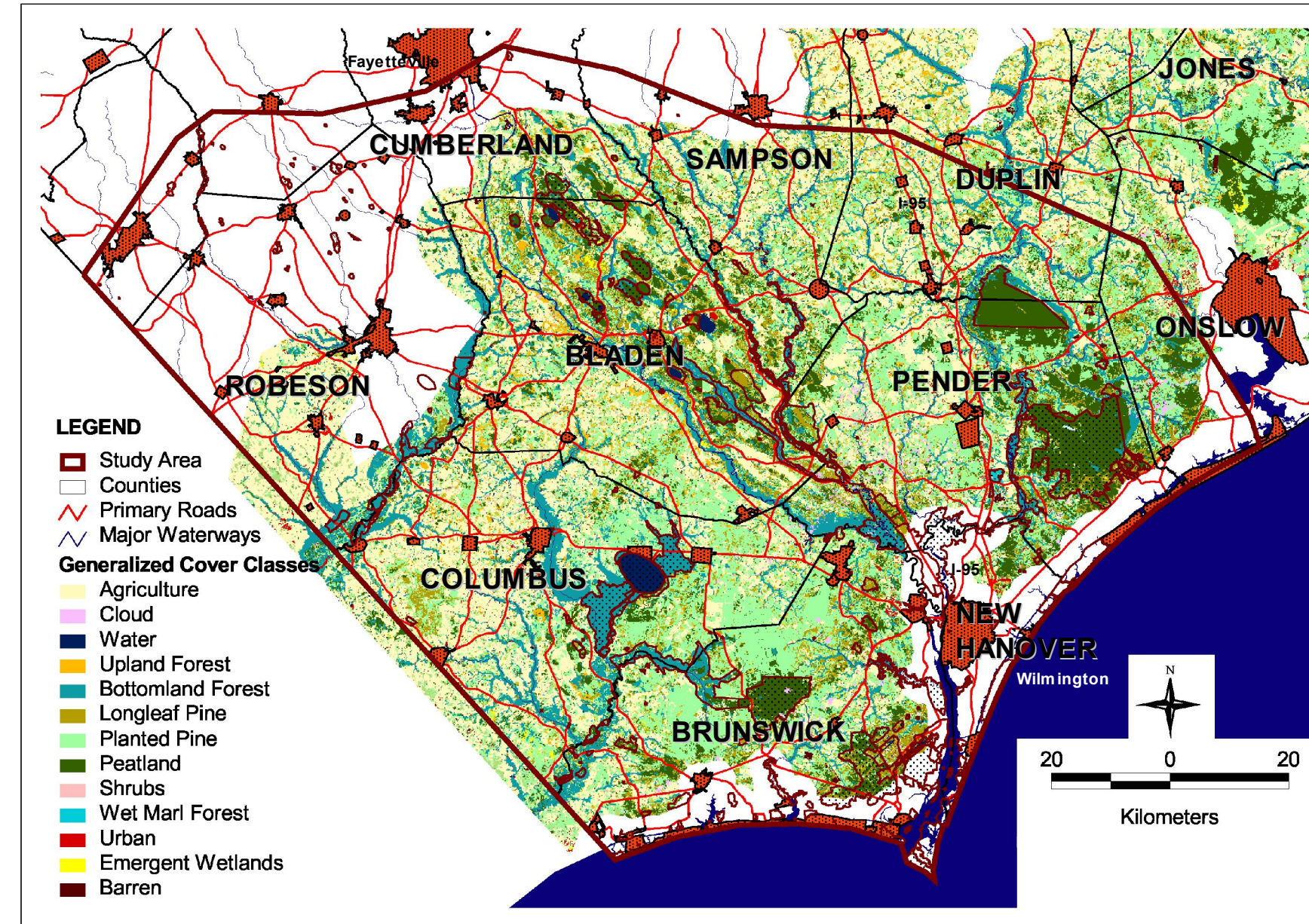


Figure 1: Study Area With Generalized Vegetation Cover, Municipalities and Major Roads.

For each guild the location of known sites and specimen records were mapped. Where the vegetation map units parallel the known habitat requirements for the guild members, a binary map of suitable vegetation classes was created (Figure 3 and 4). Areas with concentrations of guild member records and/or concentrations of habitat were identified as core areas. Connections were identified where suitable habitat existed between core areas. Potential core areas were identified in areas where the vegetation map indicates concentrations of suitable habitat, but where no previous surveys have been conducted.

## Results and Discussion:

### HIGH PRIORITY SITES:

A total of 237 sites were identified as a complementary set to conserve the best examples of each element (Figure 2). Of these, 66 were ranked A. A sample of the highly significant sites identified through this process include the Holly Shelter Swamp Gameland, Rocky Point Marl Forest, and Cooley's meadowrue (*Thalictrum cooleyii*) sites.

Holly Shelter Game land, an area maintained by the North Carolina Wildlife Resources Commission, supports a large concentration of rare species, the most extensive high quality collection of Pine Savanna communities in the state, and some of the most extensive and high quality Low Pocosin, High Pocosin, and Pond Pine Woodland communities. It received an A rank for numerous reasons.

Rocky Point Marl forest is the only community in which that tree species is found in North Carolina. This site is ranked A despite having only one or two elements, because of the extreme rarity of the Wet Marl Forest community. There are few, perhaps no other sites where this community type could be protected.

Cooley's meadowrue is a globally rare (G1) herbaceous plant known to occur on only twelve sites throughout its range. Eleven are in North Carolina, most in small sites that are somewhat isolated and most not in excellent condition. Most of the sites also contain other rare plant occurrences and some have recoverable examples of an extremely rare Pine Savanna community association. All viable sites for this very rare plant are considered priorities, and those with the most intact communities and largest set of other rare plants are ranked A.

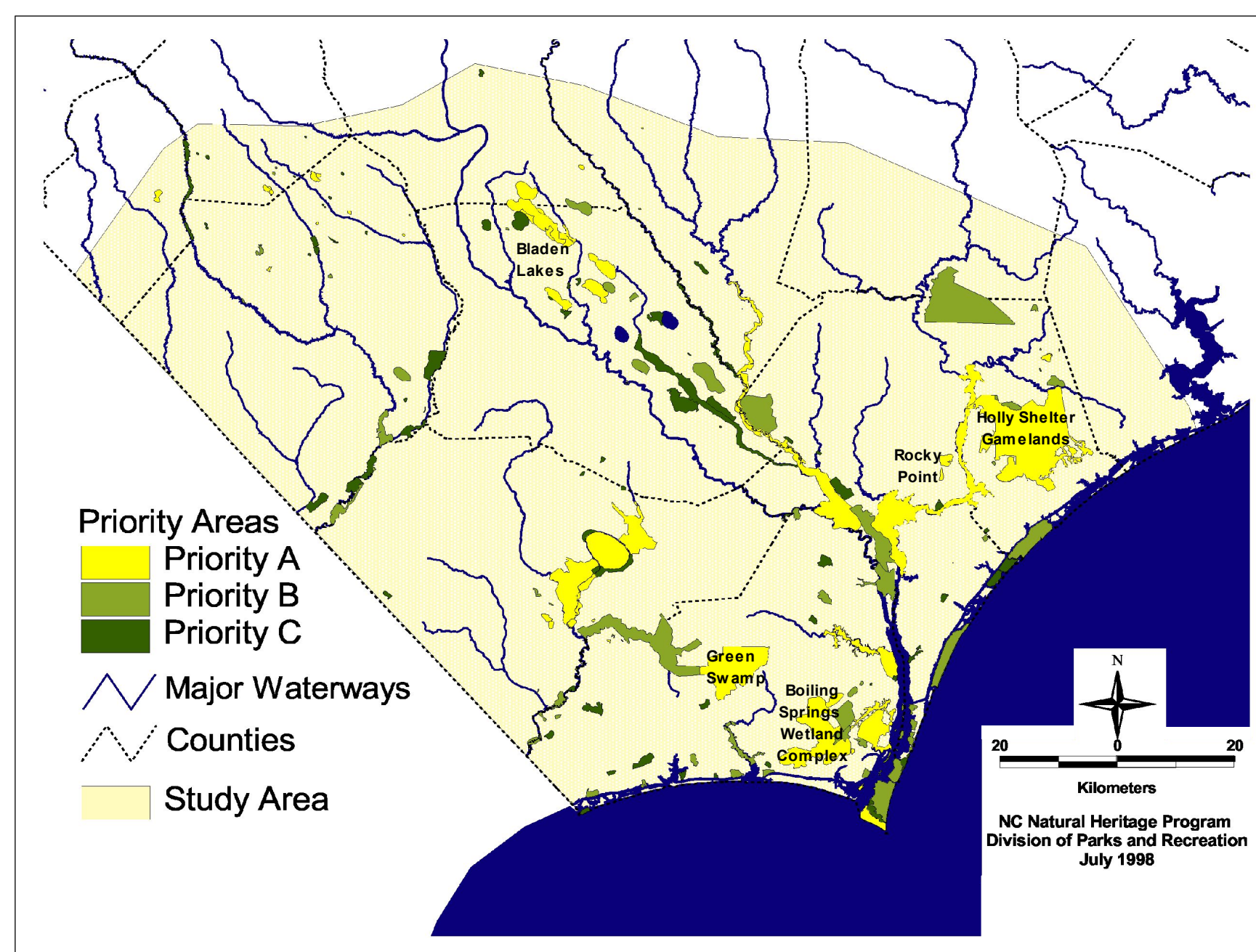


Figure 2: Priority Areas Based on Natural Heritage Element Analysis and Site Ranking.

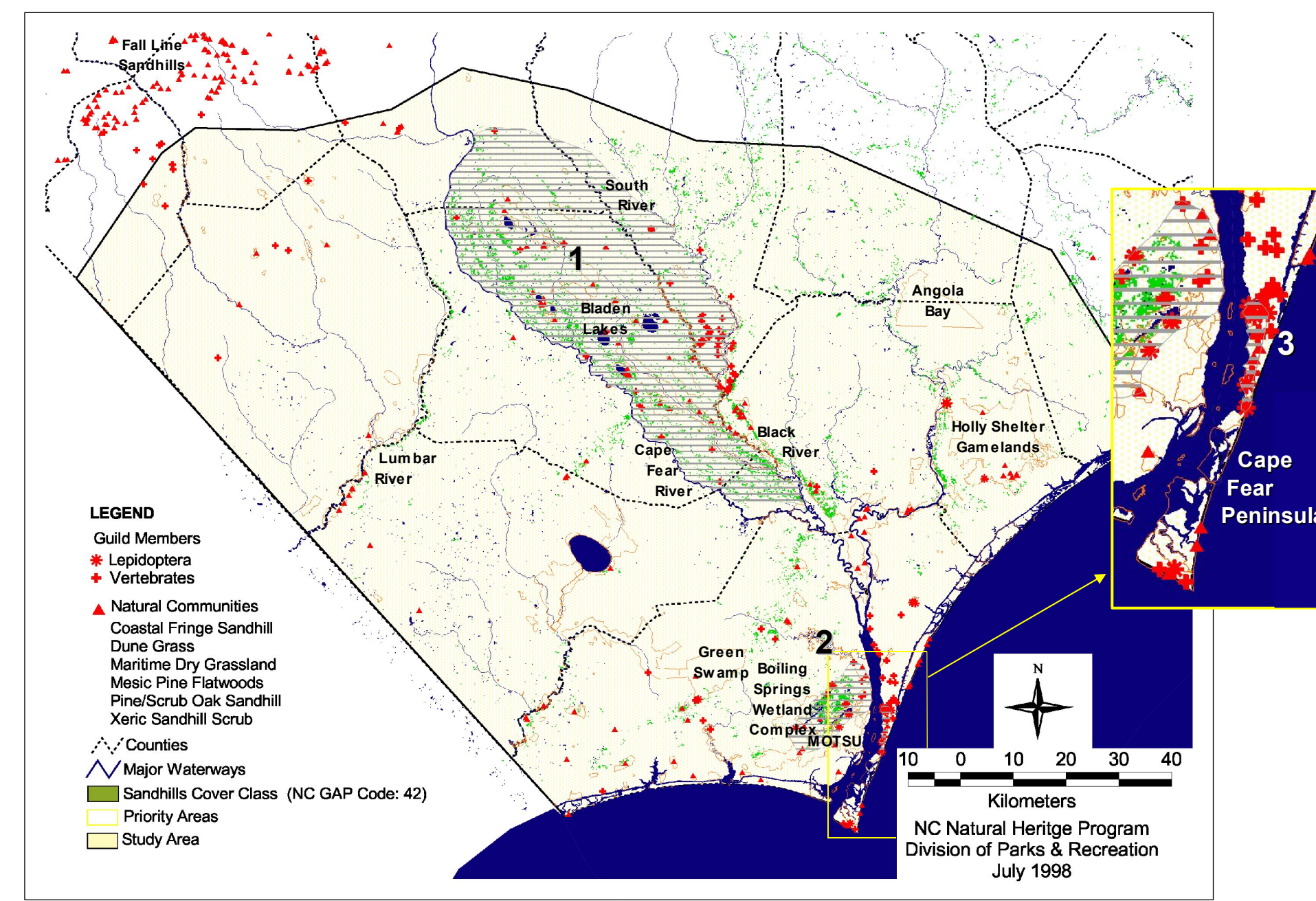


Figure 3: Sandhills Guild

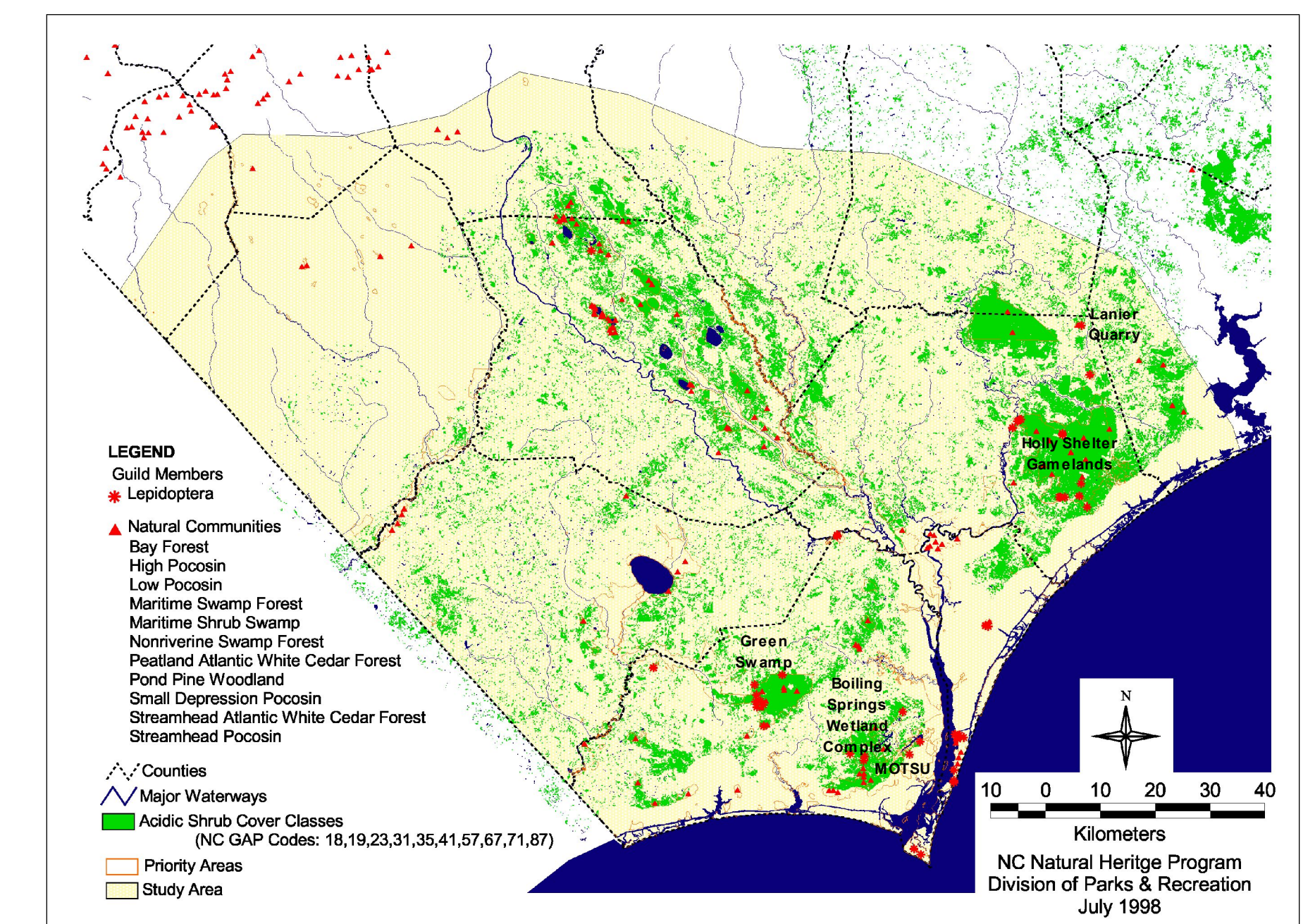


Figure 4: Acidic Shrubland Guild

## SANDHILLS GUILD

### Description:

All of the members of this guild are associated with moderately to extremely xeric open habitats with well-drained sandy substrates. Four of the snakes included in the Sandhills Guild – northern scarlet snake (*Cemophora coccinea copei*), southern hognose snake (*Heterodon simus*), northern pine snake (*Pituophis melanoleucus melanoleucus*), and eastern coral snake (*Micrurus fulvius fulvius*) – are burrowers. All lepidopteran members of this group have larvae that are believed to feed on herbaceous plant species. Where the host plants have been identified, they are associated primarily, although not necessarily exclusively, with sandhills habitats.

Reptiles	Lepidoptera
<i>Cemophora coccinea copei</i>	<i>Incisalia irus</i>
<i>Heterodon simus</i>	<i>Loboclela plemyraria</i>
<i>Masticophis flagellum flagellum</i>	<i>Pygarctia abdominalis</i>
<i>Pituophis melanoleucus melanoleucus</i>	<i>Ptychocheilus bistrigata</i>
<i>Micrurus fulvius fulvius</i>	<i>Trichostilia manifestata</i>
	<i>Schinia scissoides</i>

### Habitat Distribution:

The primary types of natural communities contributing habitat for this guild are Xeric Sandhill Scrub, Pine/Scrub Oak Sandhill, and Coastal Fringe Sandhill. Since maritime habitats are used by at least some of these guild members (e.g., coachwhip), Dune Grass and Maritime Dry Grasslands were also included.

### Landscape Units of Conservation Importance:

**Core Areas:**  
1. The Cape Fear Peninsula. The entire peninsula historically supported high reptilian diversity, however, the northern half has been highly developed in the past 15 years and recent observations of indicator species are lacking. Therefore, only the southern half is identified as a core. Most of this core area is contained in B ranked priority sites identified by element analysis.

2. The Bladen Lakes/Southern Sampson County. These areas are divided to some extent by the South River and colly Swamp and their floodplains, and are separated from additional sand ridges by the larger floodplains of the Black and Cape Fear Rivers. They represent the largest area of functionally connected sandhills habitat in the study area. A number of priority sites of medium to large size have been identified in Bladen County by element analysis, but the large expanse of lower quality sandhills was not previously identified as a priority. The portion of the core area in southern Sampson County, to the east, was not previously identified.

3. Southeastern Brunswick County. Compared to the regions just mentioned, this area is relatively undivided by rivers and swamps. However, this area is susceptible to degradation due to increasing development pressure. Several large and medium sites were identified by element analysis, including the Boiling Spring Lakes Wetland Complex and Boiling Spring Lakes Limesink Complex, but much of the core area was not previously considered a priority.

**Connectors:** These core areas appear to be isolated from one another. An extensive sand ridge occurs in southern Brunswick County that may have once provided a link between the Boiling Spring Lakes Wetland Complex and the sandhills on the south side of the Green Swamp. However, most of this area has now been developed or otherwise heavily altered, although some tracts of restorable habitat might still remain. Other areas containing representatives of this guild are even more isolated, although, as mentioned, a connecting line of sandhills appears to link the southern part of the Green Swamp to a series of small natural areas located farther toward the northeast. Towards the north and west, the sandhills of the project area are cut off from the Fall-Line Sandhills by the Cape Fear River and its floodplain; by habitat conversion in the flatlands adjoining the river in southern Cumberland County; and by the City of Fayetteville. For the herps, at least, I-95 also constitutes a formidable barrier to movements.

### Survey Needs:

The sand ridges of western Pender County and the string of sand ridges located along the lower Lumber River in Robeson County are prime areas for both herpetological and insect surveys. Insect surveys are also needed for the entire area of sandhills in Bladen County. Conversely, systematic herpetological surveys need to be conducted at Holly Shelter Game Land, MOTSU, and the Boiling Spring Lakes Wetland Complex.

### Protection Needs:

The core area on the lower Cape Fear Peninsula is protected as part of Carolina Beach State Park and the Military Ocean Terminal Sunny Point (MOTSU) Bufferlands. Smaller areas of sandhills habitats are protected at MOTSU, the Green Swamp TNC Preserve, Holly Shelter Game Land, and within state park units in the Bladen Lakes area. The natural communities at these sites are also maintained through use of prescribed burns at most of these sites. Also in public ownership are large tracts of longleaf pine/sandhills habitats in the Bladen Lakes State Forest. These tracts, as well as many of the privately held ones, are mostly fire-suppressed and subject to intensive pine-straw raking. The sandhill ecosystems in all of these sites should be regarded as highly threatened and in need of substantial protection and management efforts.

## ACIDIC SHRUBLANDS GUILD

### Description:

This guild includes species that are characteristic of pocosins and forested peatlands possessing dense shrub layers; all are believed to have larvae that feed on species of heaths, hollies, bays, and other shrubs that require acidic soil conditions. Like their host plants, however, these species are not restricted to peatlands, and occur in a variety of other acidic habitats, such as flatwoods, heath barrens, and at least some of the successional woodlands that have replaced natural fire-maintained communities of the Coastal Plain.

Other species, including several vertebrates, also occur regularly in pocosins and other Coastal Plain shrublands, but are excluded from this guild because they occupy a wider range of non-shrubby habitats; black bear (*Ursus americanus*), bobcat (*Felis rufus*), and common yellowthroat (*Geothlypis trichas*) are examples of this group. Other species excluded from this guild are species, such as worm-eating warbler (*Helminthophila vermivorus*), Swainson's warbler (*Limnithlypis swainsonii*), and moths such as *Datana ranaeae*, which require the presence of shrubs, but which rarely occur in pocosins. Most of these species are included in other, more specialized habitat guilds.

Lepidoptera	<i>Argyrotritis deleta</i>
<i>Celastrina n. sp.</i>	<i>Argyrotritis flavistriaria</i>
<i>Glena cognataria</i>	<i>Catocala praeclara</i>
<i>Metarranthia lateritaria (of Guenee)</i>	<i>Nola clethrae</i>
<i>Metarranthia sp. 1</i>	<i>Acrionicta tritona</i>
<i>Callosamia securifera</i>	<i>Acrionicta lanceolaria</i>
<i>Sphinx gordius</i>	<i>Epiglaea apiata</i>
<i>Spilosoma dubia</i>	<i>Anomogyna youngii</i>
<i>Dysgonia similis</i>	<i>Metaleptis fishii</i>
<i>Argyrotritis sylvana</i>	
<i>Argyrotritis erasa</i>	

### Habitat Distribution:

A large number of natural communities supply habitat for this guild: High Pocosin, Low Pocosin, Streamhead Pocosin, Small Depression Pocosin, Pond Pine Woodland, Bay Forest, Non-riverine Swamp Forest, Peatland Atlantic White Cedar Forest, Maritime Shrub Swamp, Maritime Shrub Swamp, and Wet Pine Flatwoods. As mentioned above, fire-suppressed savannas and woodlands that have developed under conditions of severe fire-suppression on acidic sites also possess shrub thickets that provide habitat for these species. The vegetation map units used to estimate habitat coverage for this guild include the savanna/wet pine flatwood category discussed previously for the longleaf guilds, plus eleven peatland categories. As shown by the black shading on Figure 4, the peatland units accurately represent the large peatdome at Holly Shelter, Angola Bay, Green Swamp, and the Boiling Spring Lakes Wetland Complex. In general, these units appear to contain few false positives.

### Landscape Units of Conservation Importance:

**Core Areas:** Although the largest concentrations of this guild, as noted above, are associated with particularly large and high-quality examples of peatland shrub communities, the difference between these sites and the sites with the poorest guild representation is much smaller than for other guilds. Few species, if any, are restricted to the highest quality sites. Discrete core areas may not actually exist for this guild, at least in today's fire-suppressed and generally shrubby landscapes. However, the high quality, extensive examples identified in element analysis are where the guilds reach their greatest diversity and certainly contribute to their viability in the region. In any case, these sites are important as the best examples of both plant and animal communities of this type.

**Connectors:** Members of this guild appear to move fairly freely through the landscape, making use of altered habitats as well as high-quality natural communities as stepping stones or dispersal corridors.

### Survey Needs:

No tracts of habitat appear to be high priorities for surveys for this guild. The habitat requirement of the four seemingly rare species in this guild need to be better understood.

### Protection Needs:

Several extensive, high quality examples receive protection as natural areas, are publicly owned, or have protection actions under way. Boiling Spring Lakes Wetland Complex is the only site with known high numbers of species in this guild having no protection action. No protection needs for this guild have been identified beyond **peatlands** previously identified high quality sites.

>The analysis allowed us to identify some key areas outside of the current reserve network that are critical to landscape integrity for the guilds and others that are critical for rare species and plant communities that function in isolation.

>We also identified areas within the existing conservation network that could contribute significantly to landscape integrity with changes in management.

>Both element analysis/site ranking and guild-oriented landscape analysis identified areas that would not be prioritized by the other method. The two methods are complementary and allowed for a thorough analysis of conservation needs in the study area.

>Use of the guilds allowed us to:

- 1) Address landscape integrity in a way not possible using element analysis alone.
- 2) Address landscape integrity for species with different habitat needs, avoiding the problems of using a single or small set of umbrella species.
- 3) Overcome some problems of limited or concentrated records for single species by combining records of species with similar habitat affinities.
- 4) Consider varying species needs within the same habitat.

>Clearly defined core areas could not be identified for certain guilds. For example, the acidic peatland guild uses habitat that is diffusely located throughout the landscape.

>An analysis of this detail would not have been possible without the extensive inventory work that has been conducted over years in this portion of the state.

>The vegetation map was useful in complementing the wealth of inventory data by helping us refine the core area boundaries, identifying potential core areas that need inventory work, and identifying potential corridors between sites.

We are looking for feedback on the approach, please contact us with questions or comments:

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