North Carolina Natural Heritage Program

Conservation Planning Tool

Updated 2018 by Meredith Wojcik

North Carolina Natural Heritage Program
Division of Land and Water Stewardship
Department of Natural and Cultural Resources
Raleigh, NC

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John Amoroso

Amy Axon

Misty Buchanan

Kim Douglass

John Finnegan

Steve Hall

Julia Harrell

Evan Kane

Sarah McRae

Scott Pohlman

Judith Ratcliffe

Linda Rudd

Mike Schafale

Will Summer

Allison Schwarz Weakley

Meredith Wojcik

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INTRODUCTION TO THE CONSERVATION PLANNING TOOL

North Carolina's Natural Heritage Program (NCNHP) developed the Conservation Planning Tool to help coordinate statewide conservation efforts by providing a comprehensive map showing priority areas for multiple state agencies. Careful stewardship of these lands will help sustain biodiversity, protect water quality, develop opportunities for recreation, and preserve the natural processes that support humans and the quality of life we enjoy in North Carolina.

North Carolina Conservation Planning Tool. The Conservation Planning Tool (CPT) identifies and prioritizes, on a statewide scale, essential high quality natural resources required to maintain healthy and sustainable ecosystems. This analysis pinpoints areas that are already protected as well as areas in the landscape that represent "gaps" in a functional ecosystem network. The goal of this planning tool is to highlight areas of opportunity for collaborative planning to conserve significant natural resources. The planning tool also supports the goals and missions of many government agencies, nongovernmental organizations, and state trust funds.

The overall planning process uses a series of qualitative and quantitative natural resource assessments to prioritize essential areas of land and water. These assessments focus on data that have been grouped to represent an area of resource concern. Although individual assessments are focused on a particular aspect of the landscape, collectively they represent indicators of overall ecosystem health. Composed of GIS data layers, the assessment can be used by individual organizations and government agencies to inform decisions about conservation in North Carolina. Any combination of the assessment data layers can be studied to inform and add value to local conservation or land use planning goals.

Planning for this network of natural systems must be scientifically based and informative at state, regional, and local scales and encourage land-use planning and practices that are good for natural systems and for people. This approach also provides a mechanism for diverse interests to come together to identify priority lands for protection, providing predictability and certainty for both conservationists and land planners.

The approach to conservation of land and water involves five steps:

1. Identify lands in your area that have been identified as the most important by reviewing the CPT report and the series of focused assessments. These statewide layers can be overlaid on any existing land use map at the same scale, including parcel data.
2. Verify the presence and value of these lands on the ground.
3. Conserve those lands that are currently not protected through targeted acquisitions and easements.
4. Explore the possibility of joining these lands via a system of connectors through conservation or restoration.
5. Implement suitable management, if needed, with the help of state programs, local governments, land trusts, and other entities.

The CPT and associated assessment maps are intended to be updated every year, ensuring that the most recent available data are included. In addition, new partners and ongoing collaborative planning will continually provide new information and data layers that will be vital for ongoing analyses and assessments.

Importance of Field Verification at the Parcel Level. Because of our ever-changing landscape, field verification of the data presented in the CPT will need to occur before any major investments toward conservation are made. In addition, some datasets were evaluated on land cover data, aerial photography, and modeled projection; these are cases where field verification is especially needed.

Benefits of Strategic Conservation Planning

Natural resources support many aspects of our economic development, cultural heritage, and quality of life. These natural assets directly provide a living for people in industries such as fisheries, forestry, and outdoor recreation. For city dwellers, filtration through forests and wetlands provides clean drinking water. For those living or farming near shorelines, streams, or steep hillsides, natural vegetation protects their land from erosion. Nature lovers enjoy recreational time hiking, camping, observing, and photographing the diversity of plants and wildlife. The CPT can provide a framework for future growth while also ensuring that significant natural functions and resources will be preserved for future generations by identifying essential areas in the landscape for conservation and guiding development to areas where it might have the least impact.

Focusing on a strategy for permanent protection of a functional system of essential natural resources will:

- Provide a balance to protecting land that provides resources consumed by humans (e.g., crops, seafood), resources that directly benefit humans (e.g., recreation, wetlands, water sources, floodplains) with protection of ecological services;
- Ensure the continuation of ecosystem services in each region that help clean the air and water;
- Support North Carolina's economy, especially the agricultural and forest products industry, military, infrastructure development, seafood industry, nature tourism, and outdoor recreation; and
- Reduce the need for expensive stormwater management, flood control, and restoration projects by protecting water resources including streams, wetlands, and riparian corridors.

The state's strategic conservation planning effort focuses on the identification of existing significant habitats, based on the needs of both wildlife and humans, as well as focusing on lands that can be identified as serving multiple benefits for compatible land uses. This natural network, once identified, should serve to inform future growth patterns for win-win scenarios. Existing conservation programs will benefit by:

- Conserving and connecting large contiguous areas of natural land containing important natural resources;

- Providing a focal point to coordinate existing conservation programs and increase their overall effectiveness and efficiency; and
- Guiding and coordinating land conservation and preservation efforts across the state.

Developers, private landowners, and others benefit from having a clear understanding of where the most ecologically valuable lands are located and where targeted conservation activities will be directed. Citizens interested in increased stewardship activities will know where their efforts are most needed. Land planners and developers can use the CPT maps as a reference in the development of site plans and management objectives. Local governments can use the CPT maps and data to enhance their efforts to provide open space, recreation lands, and natural areas that retain the unique character of their communities and rural landscapes. This can complement their efforts to direct growth to specified areas.

Strategic Approach to Conservation Planning

North Carolina's strategic approach to conservation planning is broad in scope to address a wide variety of ecological functions and resources throughout the state. The conservation plan applies a "green infrastructure" method, which has been successful in other states. Green infrastructure emphasizes the importance of maintaining an interconnected network of green space that conserves natural ecosystem values, provides associated benefits to human populations, and forms a network of essential natural resources that support the ecosystem functions on which all life depends (Benedict and McMahon 2006).

Identifying Essential Ecosystem Resources. The CPT strategically focuses on lands that are sufficiently large and intact to provide a broad range of ecological functions and resources. These lands may include terrestrial and aquatic habitats such as rivers, floodplains, and coastal waters; wetlands; working farms; forests; parks; game lands; and urban forests. The overall structure of the CPT is a raster-based GIS analysis producing a series of maps in which cells are ranked for their ecological significance. The ranking was based on geospatial data and ranking rules devised by expert committees and reviewed by other interested parties.

Evaluation of Ecosystem Resources and Functions. To identify and prioritize the areas in North Carolina's landscape that are essential for conservation, multiple natural resource assessments were developed. Recognizing the dual role that ecosystem functions play for wildlife and humans, separate assessments more accurately rank the functions of each.

The CPT separates ecological resources into four "Essential Ecosystem Resources" classifications. Among these groupings, many kinds of market and nonmarket benefits are given consideration and separate assessments were developed to evaluate the relative value of particular resources. One assessment, **Biodiversity and Wildlife Habitat**, targets direct-use, indirect-use, and nonuse benefits and includes water services and marine/estuarine resources, which address our abundant but threatened aquatic resources. The **Open Space and Conservation Lands** assessment documents areas that have been set aside for

conservation purposes and/or recreational activities. Finally, the **Agricultural Lands** and **Forest Lands** assessments focus primarily on marketable commodities.

Assessment Development Process.

1. Determine the scope of the assessments.
2. Identify the components of the landscape that contribute to healthy ecosystem functions.
3. Separate the components into the identified assessment areas.
4. Identify indicators of these components that are available as geospatial data layers.
5. Integrate these data sources to produce each targeted assessment and map.
6. Establish ranking systems to distinguish relative levels of conservation value.

Conservation Decision Support. Major factors in conservation decisions include opportunities, costs, constraints of funding sources, and specific missions and interests of the conservation entities. The CPT maps and rankings will be useful in choosing among options available at a given time. The maps show the scale of conservation needs as well as data gaps. It is necessary to verify the significance of any conservation site and the potential benefits of conservation action before substantial investments are made.

Resource Functions. The maps represent a number of different ecosystem functions, all of which are important. Therefore, the rankings are based less on the relative importance of the particular functions than on the need and ability to focus conservation action on specific tracts of land.

Resource Rarity and Distinctiveness. Sites that support the rarest resources, such as rare species or unusually pristine natural areas, are not considered interchangeable with most other areas (which are unlikely to support the same conservation target). Thus the need to focus protection actions on specific tracts with rare resources is high, and the lands containing these resources were highly ranked. These are areas that, if lost, have no substitutes. When many areas of similar type and integrity are available, there is less need to focus conservation action on any one specific site.

Data Spatial Precision, Accuracy, and Completeness. Data that are highly specific and accurate for the functions being measured have a greater power to distinguish conservation need than data sets that are diffuse or inaccurate. Data that do not precisely differentiate examples with high integrity (for the specified ecological functions) from those with low integrity are less able to guide conservation actions. For common functions and land types, data need to be able to indicate the best examples in order to focus conservation actions.

ESSENTIAL ECOSYSTEM RESOURCE ASSESSMENT

Biodiversity/Wildlife Habitat Assessment

Introduction. The main focus areas for the Biodiversity/Wildlife Habitat assessment are aquatic and terrestrial habitats, landscape function, and connectivity. Other vital processes were included in the overall evaluation to address the roles that wetlands and stream buffers play in the ecosystem. The data used in the assessment are the best representations of spatial information for ecological functions statewide. Previously defined places, such as natural areas or Outstanding Resource Waters (ORW), or other intact large scale landscapes, represent the most important places to focus conservation action because they indicate high quality systems.

Methodology. The process and results of the Biodiversity and Wildlife Habitat Assessment were initially developed by an assessment team made up of N.C. Natural Heritage Program staff and reviewed by field ecologists, biologists, and botanists from several state natural resource agencies and nongovernment partner organizations. The results were also compared to other inventories and studies of important natural resources in North Carolina. Most areas identified by the assessment were largely consistent with existing focus areas of state and local conservation organizations.

The critical components that were selected to rank natural areas for the Biodiversity and Wildlife Habitat Assessment were determined through a rigorous evaluation process. Areas in the landscape were evaluated for their rarity and distinctiveness, their function, and the accuracy, precision, and completeness of the data sets that were selected to represent them.

For assessment of biodiversity, the available data represent three major components of ecological resources. These are:

- Biodiversity, of both aquatic and terrestrial species and communities;
- Large scale terrestrial landscapes, including core wildlife habitats and habitat connectors; and
- Other lands of particular importance to ecosystem processes, such as riparian buffers and wetlands.

Rare species and high quality natural habitats are indicators of landscapes that are currently functional. To ensure that our native species of plants and wildlife flourish, the natural areas that support them must be identified and preserved.

Terrestrial Measures. Conservation of biodiversity, as an indicator of a healthy ecosystem, requires the preservation of a large number of species, most of which have specific habitats and therefore require site-specific conservation. The biodiversity focus was aimed mainly at species that are rare or sensitive.

Ecosystem integrity is represented by selecting high quality examples of natural communities that serve as coarse filters for less-known species that are not measured directly. For terrestrial natural communities, the Natural Heritage Program database of

natural community occurrences and natural areas represent the optimal available information about the best examples of each of these community types.

Wildlife habitats were identified as large-scale terrestrial landscapes that support processes that act over long distances, and they include wide-ranging species that require extensive areas, such as large carnivores, edge-sensitive forest interior species, and species that depend on metapopulation structures. These ecosystem functions generally depend less on high local integrity and depend more on contiguous large patches of habitats and the existence of connectors between them. Maps of Landscape Habitat Indicator Guilds were used as our primary assessment of larger-scale landscape function, as well as Important Bird Areas (IBAs) as defined by the Audubon Society. Landscape Habitat Indicator Guilds are identified by NCNHP staff and mapped statewide to evaluate landscape integrity and function.

Riparian buffers and wetlands are also significant for biodiversity, wildlife habitat, and maintaining healthy ecosystems. Wetlands support several important processes of hydrologic regulation and nutrient cycling. In the Coastal Plain, the Division of Coastal Management has rated wetlands for their level of function. The resulting data set (N.C. Coastal Region Evaluation of Wetland Systems [NC-CREWS]) was used where available. In the rest of the state, the National Wetlands Inventory (NWI) was used. The NWI contains little indication of wetland integrity but is the only mapped data on wetlands currently available outside the coastal region.

Aquatic Measures. For aquatic natural communities, no classification or database like the NCNHP database for terrestrial communities exists, so several other data layers were used as surrogates, including: streams with Division of Water Resources Excellent or Good Bioclassification ratings, High Quality Waters (HQW) and Outstanding Resource Waters (ORW), wild brook trout streams, and anadromous fish spawning waters. These data sets, represented by GIS data layers, distinguish areas of high integrity but do not allow addressing individual aquatic community types beyond a very coarse level.

Basis for Ranking. Within the areas identified as important for ecosystem function, the relative ranking of data is intended to provide a focus on the areas that have the highest ecological significance. The ranking scale used in this assessment is a categorical ordinal scale. The rankings show relative significance of the areas but are not quantitative. Neither comparison of proportions nor addition of ranking categories is appropriate. The use of an ordinal scale is appropriate for a variety of reasons, including the incommensurate nature of the data and factors used, the difficulty in translating objective measures into quantitative measures of actual ecological value, the way in which quantitative methods can easily obscure the true nature of decisions, and the lack of quantitative data for many of the measures.

The relative ranking of each unit of land, or 30 by 30 meter area, was derived from rankings of the individual data layers representing different functions. Each data set was assigned a ranking between 1 and 10 (moderate to maximum conservation value). Ten categories were

condensed into seven distinct relative values and given a description for ease in understanding the relative conservation value assigned.

Data layer rankings were assigned using professional judgment and were based on a combination of qualities of the ecological values represented and the following factors:

- Resource rarity and distinctiveness;
- Resource function; and
- Data precision, accuracy, and completeness.

The assessment team used these three factors as guiding principles to select and rank data sets.

Rarity and Distinctiveness. Rarity and distinctiveness of the features mapped are important for determining how much focus is warranted on specific locations on the map. For conserving and sustaining diverse sets of resources, such as species or community types that are scattered across the landscape, the most careful conservation biology treatments have utilized methods for identifying portfolios of sites to represent all of the biodiversity elements of conservation concern (hereafter referred to as elements). Portfolios that select multiple examples of each element and contain the best examples of each element offer the best chance of conserving diversity. Besides quality of occurrences, portfolio analysis includes a goal for how many examples of each element should be included. The portfolio selection process ensures a balanced focus and prevents either the more common elements or the rarest elements from commanding the sole focus. NCNHP's natural areas incorporate such representative portfolio analysis.

Data layers that included only very high quality examples contained few locations (such as ORWs) and were ranked higher than data layers that included numerous areas of mapped resources or levels of integrity that appeared to be more common (such as good stream bioclassification ratings). Where data layers contain both rare and common elements that are not differentiated they were ranked lower than if rarer elements were able to be distinguished.

Resource Function. By protecting high quality ecosystems, this assessment aims to conserve the majority of the state's species (not just the rarest ones), ecologically or taxonomically distinct populations, natural communities (including habitats for animals as well as plants), and the ecological processes that are responsible for both creating and maintaining the features of these ecosystems.

While a focus on rare species and communities is valuable, one of the aims of conservation should be to be as comprehensive in its coverage as possible. In this sense, making sure that all high integrity ecosystems receive some consideration, whether or not they contain any rare species or communities, is also valuable. Examples include:

- Division of Water Resources' nomination as ORW or HQW protection for any stream segment having an Excellent water quality rating is based on its Bioclassification (in which the rarity of species plays no explicit role);

- Ecosystem Enhancement Program's targeting of preservation credits in any watershed where ecosystems meet certain minimum criteria for integrity;
- Division of Coastal Management's targeting of all high quality shellfish areas, fish nursery areas, and submerged aquatic vegetation; and
- Wildlife Resource Commission's targeting of all wild brook trout waters.

The NHP's targeting of high quality natural communities, including common varieties, also serves this goal. However, the quality of the natural community is not a sufficient measure of ecosystem integrity by itself – an area can have essentially intact vegetation but still be missing many of its most characteristic species of animals. Other measures are also needed, including the measures of landscape integrity that are being addressed through use of the Landscape Habitat Indicator (LHI) Guilds analysis.

Data Precision, Accuracy, and Completeness. Accuracy refers to both the spatial accuracy and the content accuracy of the data – does it represent the value its ranking suggests? Data layers that are lower in precision or had low spatial resolution are deemed less suitable for focused conservation action, so they were given lower ranking. Data layers that have poor resolution or are of questionable accuracy were not used.

Completeness is important because the assessment ranks places in comparison with other places. If only some places are represented, there is little confidence that those areas represented are more important than any other areas. Data layers that were not reasonably comprehensive were not used. However, completeness was necessarily balanced against the importance of a data layer in representing factors no other data layer could represent.

Maximum Ranking Approach. Each individual data layer was given a ranking or rankings between 1 and 10, or "moderate conservation priority" to "maximum conservation priority." Where the data layer was quantitative or scaled, this inherent scale was used to derive multiple rankings. Many of the data layers represented only presence-absence (binary) values and were assigned a single value on the 1 to 10 scale (e.g., presence of wild brook trout waters or shellfish growing areas). A few had nonscaled categorical attributes that were assigned different values on the 1 to 10 scale (e.g., NHP natural areas, which were ranked 6-10 depending on their rating). Rankings for each data layer could consider the rankings of other data layers for comparison. These 10 rankings were then consolidated into seven categories of significance, ranging from "moderate" to "maximum" conservation priority (see Appendix C).

Grid cells (30 x 30 meter pixels) on the map that support more than one category of data were assigned the maximum value of the individual rankings of the data layers. In other words, a cell may receive a value for multiple data factors found to exist in that location, but only the highest score is shown. Using the maximum value offers several advantages: it is appropriate for an ordinal scale; it allows the importance of the most significant areas to come through, without being diluted by absence of other factors; and it is simple and transparent, and facilitates analysis and discussion about the meanings of the rankings. Rankings of each individual data layer can be thought of directly in terms of the final

ranking scale, and compared directly between scales. In addition, it is less sensitive than other combination techniques to redundancy in input data or the risk of double-counting.

Data Sources and Ranking. Details for each data layer selected for inclusion in the Biodiversity/Wildlife Habitat Assessment (BWHA) and the basis for its relative conservation ranking are provided below.

Terrestrial Habitats

- ***Natural Areas.***
  Natural areas are delineated by the Natural Heritage Program. They contain known locations of rare animal or plant species, rare or high quality occurrences of natural communities, and/or are sites for important animal assemblages (such as colonial nesting waterbirds). Collectively, these plants, animals, natural communities, and animal assemblages are referred to as "elements of natural diversity" or simply as "elements." Specific occurrences of these elements are referred to as "element occurrences."

  The boundaries of natural areas represent the areas containing the rare species and natural communities within them, as well as the habitat that is necessary to maintain the target elements. In addition to the conservation target of each natural area, numerous other species occur, and most ecosystem functions are well supported.

  Natural areas are rated for significance using parameters developed by the NCNHP, NatureServe, and The Nature Conservancy to measure statewide and global rarity for rare species and communities. Each natural area receives two ratings, which measure different values:

  1. Element Representational Value (R Value) rates each natural area on its importance in protecting the best occurrences of individual elements.
  2. Element Collective Value (C Value) rates each natural area on the basis of the number and rarity of the elements it contains.

  This paired rating system provides two distinct values for each site, one that reflects the biodiversity of the state and one that reflects the overall biodiversity of each natural area. Each site is assigned two values, a Representational Rating (R1-R5) and a Collective Value Rating (C1-C5).

  Representational Rating. This rating is designed to indicate a natural area's potential to contribute to a portfolio of the best sites for each tracked element within the state.

Representational Value Rating Categories for Natural Areas Based on Element Occurrences

Representational Rating	Definition
R1 (Exceptional)	Site contains one of the best two examples of G1 or G2 elements.*
R2 (Very High)	Site contains the 3rd or 4th best examples in the state of G1-G2 elements, and/or one of the best two examples of other elements.
R3 (High)	Site contains the 5th to 8th best examples in the state of G1-G2 elements and/or the 3rd to 6th best occurrences of other elements.
R4 (Moderate)	Site contains the 9th to12th best examples in the state of G1-G2 elements within it and/or the 7th to 10th best occurrences of other elements.
R5 (General)	Site contains one or more viable occurrences that are not among the 12 best of G1-G2 elements or among the ten best for other elements.

*G-Ranks are a measure of global imperilment of elements of biodiversity. G1=Critically imperiled, G2=Imperiled, G3=Vulnerable, G4=Apparently secure, G5=Secure. G-Ranks follow NatureServe methodology.

Collective Rating. This rating evaluates the conservation value of each natural area based on the number of tracked elements present and the rarity of those elements, weighted in terms of both global imperilment (G-Rank) and state imperilment (S-Rank). The score of a site is calculated by summing the cumulative scores of the extant elements in the site, based on weights assigned to each level of G-Rank and S-Rank as shown below.

Collective Value Point Scoring for Each G-Rank and S-Rank Combination

G-Rank	S-Rank	Element Score
G1	S1	10
G2	S1	9
G2	S2	8
G3	S1	7
G3	S2	6
G3	S3	5
G4/G5	S1	4
G4/G5	S2	3
G4/G5	S3	2
G4/G5	S4/S5	1

For each site, the scores for occurrences of each element are added to give the final Element Collective Rating for the site. The total scores are divided into 5 Categories of site significance: Exceptional (C1 rating), Very High (C2 rating), High (C3 rating), Moderate (C4 rating), and General (C5 rating). The minimum number of elements in a site with a C1 rating is 10, and the minimum for a site with a C5 rating is 1 (see below).

Collective Value Ratings

Element Collective Rating	Minimum Number of Elements
C1 (Exceptional)	10
C2 (Very High)	7
C3 (High)	4
C4 (Moderate)	2
C5 (General)	1

Natural areas represent the most important finer scale sites for biodiversity in North Carolina. They are the best sites for the rarest species and the best examples of all natural community types as defined in the Classification of the Natural Communities of North Carolina (Fourth Approximation) (Schafale 2012). Protecting examples of natural community types should protect many other species and ecosystem functions as well. Each site represents a component of a representative portfolio and is not interchangeable with any other.

In addition to their relative significance, natural areas are well studied and precisely mapped. Each natural area is individually drawn by an ecologist after studying the area on the ground and documenting the rare species and natural communities they contain. Protection of the full suite of natural areas is needed to conserve the diversity of rare species and their habitats within the state.

Natural Areas Ranking

Natural Areas Ranking	CPT Ranking
Exceptional or Very High	10
High or Moderate	8
General	6

- ***Element Occurrences.***
  Element Occurrences (EOs) are areas of land or water where elements of biodiversity – rare species, exemplary natural communities, or animal assemblages – occur. The most important occurrences are incorporated into natural areas. However, other "free-standing" occurrences not included within natural areas have additional value for viability of the elements in North Carolina.

  NCNHP ranks element occurrences based on their quality and viability (EO ranks), their mapping precision (representation accuracy), and their currency (last observed date) (NatureServe 2010). These ranks were used in selecting EOs and assigning

relative ranks for them in this assessment. Elements (species and communities) are also assigned ranks by NCNHP based on their imperilment (G ranks and S ranks) (Robinson and Finnegan 2016; Ratcliffe et al. 2016). Only occurrences that are believed viable and are reasonably spatially precise and accurate are used in this assessment.

EO Ranking

EO Rank	CPT Ranking
A, B, G1, G2, or S1	5
C, E, G3, G4, G5, S2, S3, S4, or S5	4

- ***Landscape Habitat Indicator Guilds (LHIG).***
  Landscape Habitat Indicator Guilds (LHIGs) are groups of animal species whose presence is indicative of landscape integrity, i.e., where either large blocks of habitat persist or where a number of smaller blocks are sufficiently well connected to support breeding populations of these species. These guilds are identified for a particular type of habitat, with both the habitat and the list of indicator species defined at the same time for a given guild (Hall 2008, 2008a, 2008b, 2009, 2009a, 2009b). The guilds, much like the natural areas, are good indicators of functional ecosystems.

  Guild indicator species are habitat specialists, but the habitats they occupy typically represent a combination of different natural communities. For example, the Wet Hardwoods guild in the Coastal Plain includes species that are primarily restricted to floodplain forests but include the following five types of natural communities within their habitat range: Blackwater Bottomland Hardwoods, Brownwater Bottomland Hardwoods, Brownwater Levee Forest, Coastal Plain Small Stream Swamp, and Nonriverine Wet Hardwood Forest. The indicator species represent a wide range of species, including rare species as well as more common species, many of which are target species for the Wildlife Resource Commission's Wildlife Action Plan.

  The landscape units defined by these guilds are termed core areas and are mapped by the Natural Heritage Program. Additionally, inter-core connectors are mapped where habitat bridges exist between two core areas. Unlike the core areas themselves, these connectors need only provide habitat suitable for dispersal, not necessarily breeding. Where different guilds share at least some of the same community types within their habitat combination, spatial overlap between guilds is possible, as reflected in the intersection of core areas and connectors.

  LHIG core areas and connectors were used in this analysis because they serve to identify areas that are important in supporting species or ecosystems that require landscape-scale blocks of habitat to survive. Guilds, core areas, and inter-core connectors are assigned element ranks (S-ranks). Additionally, clusters of core areas or connectors – which can overlap in space – are given a combined ranking based on the element ranks of the individual LHIGs and the occurrence ranks of the particular core areas or connectors.

For ranking combinations of overlapping core areas or connectors, an additive approach is used instead of the maximal value rule used to rank natural areas.

S-Rank. First, each core area is assigned a numeric value corresponding to the S-Rank of the guild it belongs to.

Occurrence Rank. Next, the occurrence rank of the core area is used as an additional weighting factor, following a simple linear function for assigning significance ranks:

- An A-ranked occurrence (the best in terms of quality) has 75-100 percent of the guild members present within a core area,
- a B-ranked occurrence between 50-74 percent,
- a C-ranked occurrence between 25-49 percent, and
- a D-ranked occurrence between 10-24 percent.

For a given core area, the final numeric score is simply the product of the S-Rank-based score and the (rounded) upper limit in terms of percentage of guild members.

Overlapping Guilds. For overlapping guilds, these scores are then summed and transformed into S-Rank equivalents. A combination of an A-ranked, S2 guild and an A-ranked occurrence of an S3 guild would produce a score of 88, which falls within the range of values for a single S2 guild.

Score Conversion. To convert these scores to the 10-point scale used by Biodiversity Wildlife Habitat Assessment, a value of 10 was assigned to all core area combinations resulting in a score equivalent to an S1. Scores of this magnitude were recorded in the Lower Roanoke Floodplain, the Albemarle-Pamlico Peninsula, and other areas that we regard as having state-level significance as landscape units. At the other end of the scale, we assigned a value of 1 to any combination of core areas equivalent to an S5. Although units with these scores may be relatively common, the assignment of at least a minimal value reflects their importance as intact landscape units for at least one guild.

Landscape Habitat Indicator Guilds Ranking

Guild Score Total	CPT Ranking
10000	10
7812	9
5623	8
4393	7
3162	6
2470	5
1778	4
1389	3
1000	2
672	1

- ***Important Bird Areas.***

Important Bird Areas (IBAs) are sites designated by the National Audubon Society that provide essential habitat for one or more species of bird, and they represent sites

important for the long-term viability and conservation of naturally occurring bird populations in North Carolina. IBAs include sites for breeding, wintering, and/or migrating birds and may be a few acres or thousands of acres in size. IBAs may include public or private lands and may be protected or unprotected.

To qualify as an IBA, sites must satisfy at least one of the following criteria. The site must support:

- Species of conservation concern (e.g. threatened and endangered species),
- Restricted-range species (species vulnerable because they are not widely distributed),
- Species that are vulnerable because their populations are concentrated in one general habitat type or biome, or
- Species, or groups of similar species (such as waterfowl or shorebirds), that are vulnerable because they occur at high densities due to their gregarious behavior.

IBAs represent a collection of sites that are assembled by a process of nomination and approval. Many of the areas are of high spatial precision; however, some have inclusions of seemingly degraded habitat.

Some IBAs are selected as the best examples for particular species or assemblages, and others are sites that are important but may be less unique. Because they represent important areas but may not be the best examples, represent an incomplete set of habitats, and may contain inclusions of poorer habitat, IBAs are ranked lower than natural areas or the more precisely mapped aquatic systems. Cells with IBAs currently receive a CPT Ranking of 6.

- ***Wetlands.***
  Wetlands play important roles in hydrologic cycling, water quality, and nutrient cycling, as well as serving as important habitat for many other ecosystem functions. Wetlands across North Carolina were mapped by the National Wetland Inventory (NWI) of the U.S. Fish and Wildlife Service (USFWS 1983). In North Carolina's outer Coastal Plain, wetlands maps were refined by the N.C. Division of Coastal Management and were rated for function (high, medium, and low) by a multi-factor rating model called the Coastal Region Evaluation of Wetland Significance (NC-CREWS 2003). As a general class, individual wetlands are not highly unique. Rare types and particularly high quality occurrences are covered by natural areas and natural community EOs, so this data layer represents the remaining wetlands. However, in the parts of the state where wetlands are represented by NWI (in the Piedmont and Mountains), wetlands are rare and very important. NWI mapping represents only a moderate level of accuracy and does not have a scale to determine condition or integrity. NC-CREWS data represent a higher level of accuracy and have an internal rating that allows differentiation among different levels of condition or function. The most functional wetlands with the highest level of accuracy are therefore ranked higher, and the least functional and least accurate are ranked lower.

Wetlands Ranking

CREWS ranking	CPT Rating
3	7
2	6
1	2
All other wetlands (NWI)	5

Aquatic Habitats.

- ***Aquatic Natural Areas.***
  Aquatic natural areas are conceptually similar to terrestrial natural areas. They represent the waters that are of most importance to North Carolina's biodiversity and are defined based on the actual presence of rare species. Because land adjacent to streams is essential for protection of water quality, the area included for aquatic natural areas includes not only the water itself, but a buffer of 300 feet on each side of the water bodies that are mapped as aquatic natural areas. Tributaries to the aquatic natural areas with federally listed species are buffered by 200 feet (per NCWRC 2002), and 100-foot buffers are applied to all other streams contributing to aquatic natural area watersheds.

  Because aquatic natural areas are the most important areas for North Carolina's aquatic biodiversity, some of them received the highest CPT rating possible. Aquatic natural areas rated as Outstanding or Very High significance represent the best collections of rare species in the state, but not all of North Carolina's aquatic biodiversity is represented by them at even a minimal level. Aquatic natural areas rated as High and Moderate are more numerous but are still rare and limited in extent.

  Aquatic Natural Areas Ranking

Natural Area Rating	CPT Rating
Exceptional or Very High	10
High or Moderate	8
General	6

- ***Outstanding Resource Waters (ORW).***
  Outstanding Resource Waters is a classification assigned by the Division of Water Resources (DWR), and this classification is intended to protect unique and special waters having excellent water quality and of exceptional state or national ecological or recreational significance. To qualify, waters must be rated as having excellent water quality by the Division of Water Resources and also have an "outstanding resource value," as defined by DWR url accessed 2017: https://deq.nc.gov/about/divisions/water-resources/planning/classification-standards/classifications#DWRsupplementalclassifications.

  This resource value must be one of the following:
  - Outstanding fish habitat or fisheries;
  - Unusually high level of water-based recreation;

- Some special designation, such as North Carolina or National
- Wild/Scenic/Natural/Recreational River, National Wildlife Refuge, etc.;
- Be an important component of a state or national park or forest; or
- Be of special ecological or scientific significance (rare or endangered species habitat, research, or educational areas).

As with High Quality Waters, the CPT maps only the ORWs that have a biological basis; recreation and special designation ORWs were omitted (classes SA, WS-I, and WS-II). The designated stream reach, along with its 100-foot buffer, is included. ORWs represent aquatic communities that are in excellent condition, and they often harbor rare species as well. They are well-studied streams that represent a high level of site-specific knowledge of community condition; therefore, they are given a high conservation value (CPT Rating = 9). Because they are designated by a process of nomination and public acceptance, the completeness of this data layer is limited.

NOTE: In the event that an ORW temporarily deteriorates, it can be simultaneously listed on the state's 303(d) list. This "temporary" action does not take the water body off the ORW list. For more information on the 303(d) list, see the DWR's website at https://deq.nc.gov/about/divisions/water-resources/planning/classification-standards/303d

- ***High Quality Waters (HQW).***
  High Quality Waters is a supplemental classification developed by the Division of Water Resources intended to protect waters with quality higher than state water quality standards. A waterway can be named HQW by definition or can be designated as HQW. (https://deq.nc.gov/about/divisions/water-resources/planning/classification-standards/classifications#DWRsupplementalclassifications, date unknown).
  The following are HQW by definition:

  - Water Supply I or II waters,
  - Shellfishing waters,
  - Outstanding Resource Waters,
  - Waters designated as Primary Nursery Areas or other functional nursery areas by the Marine Fisheries Commission, or
  - Native and Special Native (wild) Trout Waters as designated by the Wildlife Resources Commission.

  There are also waters that can be given supplemental designation as High Quality Waters. These include:
  - Waters for which Division of Water Resources (DWR) has received a petition for reclassification to either WS-I or WS-II, or
  - Waters rated as Excellent by DWR.

  Only HQWs with a strictly biologically based definition were included in this model. Water Supply Watersheds (WS-I, WS-II) were excluded, as were shellfishing waters (SA) since they are defined as all tributaries that flow into shellfishing areas. The

designated stream reach, along with its 100-foot land buffer, is included in the assessment. While HQWs are significant for water quality in North Carolina, they do not necessarily harbor rare species and are of lesser quality than Outstanding Resource Waters; therefore, for this assessment they are given a lower rating (CPT Rating = 8) than those areas with rare species present.

- ***Stream Bioclassification (Fish and Benthic) – Excellent/Natural and Good.***
  The bioclassification of North Carolina streams uses a multimetric index that rates the quality of warm water streams. The presence, condition, and numbers of the types of fish and benthic macroinvertebrates provide accurate information about the health of a specific water body. The Division of Water Resources assigns bioclassification ratings following a standardized protocol. For this project, the stream reach in which the sampling point occurs, along with its 100-foot land buffer, is included. Areas designated as natural swamp waters are Coastal Plain waters that have been determined to be in good natural condition. These streams naturally have low dissolved oxygen and low diversity of aquatic insects and fish, so they do not have high bioclassification scores. However, they represent the best data available for identifying good examples of aquatic communities and were considered to be indicators of the same level of integrity as the excellent fish and benthic sites.

  Streams with high ratings that are consistent over time are areas of unusually intact aquatic communities. Because we do not yet have the ability to classify and map aquatic communities as we do terrestrial communities, this is one of several measures used to identify examples of aquatic communities in excellent condition. Since many coastal plain streams cannot be ranked according to the bioclassification, the "Natural" designation of swamp waters is valued the same as excellent fish or benthic macroinvertebrate sites.

  Excellent/Natural rated waters represent a portion of the most significant aquatic communities in the state and receive a CPT Rating of 9. Excellent bioclassification sites and Natural Swamp Waters are rare and considered among the best. They are based on well-studied sample points that represent a high level of site-specific knowledge of community condition. However, the extent of the high quality community beyond the sample point is not well known. Using the standard DWR ratings, "good" bioclassification sites are not as high quality as the "excellent" sites; therefore, they receive a slightly lower CPT Rating of 7.

  Bioclassification sites are analogous to EOs of terrestrial communities, with the high bioclassification score analogous to a high EO rank. Since most high quality terrestrial communities are included within natural areas, and since aquatic communities have not been designated yet, the aquatic communities represented by the excellent bioclassification sites receive a higher rating than free-standing community EOs of high EO rank.

  While "good" bioclassification waters are significant for water quality in North Carolina, they do not necessarily harbor rare species; therefore, they are given a lower

rating than those areas with the rare species present. In addition, they are not as high quality as the "excellent" sites.

- ***Wild Brook Trout Waters.***
  These are waters that contain the naturally occurring and reproducing strains of Northern and Southern Appalachian brook trout. Streams in catchments where wild brook trout are known to occur, along with a 100-foot buffer, are included. Mapping and management of data related to Wild Brook Trout Waters is conducted by the Wildlife Resources Commission.

  The Southern Appalachian brook trout is the only native trout species in North Carolina, and they, along with Northern Appalachian brook trout, serve as indicators of watershed health. Robust wild brook trout populations demonstrate that a stream or river ecosystem is healthy and that water quality is excellent.

- ***Anadromous Fish Spawning Areas (AFSA).***
  Anadromous fish spawning areas consist of portions of freshwater streams and rivers and the adjacent flooded wetlands that are used by anadromous fish for spawning of eggs. Anadromous fish include species that must migrate from the ocean upstream to freshwaters to spawn. Some species, such as striped bass and blueback herring, require strong current velocities and spawn in the mainstem river channels. Others, such as alewife and shad, prefer slower currents and spawn in small streams and flooded wetlands. Because of the important contribution of riparian areas to the life cycles of these fish species, 100-foot buffers are included in the mapped anadromous fish spawning areas.

  Many anadromous fish species are important commercial or recreational fishery species (striped bass), some are depleted due to habitat alterations and fishing pressure (alewife and blueback herring), and some are state and federally listed (shortnose sturgeon). These species cannot survive if suitable spawning area is not maintained. For spawning to be successful and eggs to survive, high water quality conditions are needed in these areas (adequate oxygen levels, low sedimentation, and natural flows).

  Anadromous fish spawning areas receive a CPT Rating of 8 because they represent habitat that is essential for multiple species, including rare species, and have data to support delineation. The Division of Marine Fisheries has noted that protection of all anadromous fish spawning areas is a high priority. Anadromous fish use areas were designated by the N.C. Marine Fisheries Commission and Wildlife Resources Commission based on extensive coast-wide sampling for presence of eggs, larvae, and ripe females.

- ***Fish Nursery Areas (FNA).***
  The Division of Marine Fisheries designated certain estuarine areas as fish nursery areas. Past and present sampling indicates that these areas support a high abundance and diversity of juvenile fish species, particularly for estuarine dependent species that are spawned offshore during winter and migrate into the estuary. These nursery areas

generally consist of shallow soft bottom in the upper reaches of tidal wetland creeks. While a few species tend to dominate the composition, over 175 juvenile species have been documented. Areas are designated as primary or secondary nursery areas. Juveniles tend to settle out first in the shallowest and most upstream sites (primary nursery areas), and then migrate downstream to slightly deeper water (secondary nursery areas).

These areas are considered by DMF to be the highest quality nursery areas for many of the most common and important fishery species in North Carolina, including shrimp, flounder, blue crab, spot, and croaker, as well as a diversity of other species. Maintaining these areas in good condition is critical to the health of the entire estuarine system; therefore, they received a CPT Rating of 8.

- ***Stream Buffers.***
  A riparian buffer is the area of land adjacent to ephemeral, intermittent, or perennial streams, rivers, and other bodies of water that serves as a transition zone between aquatic and terrestrial environments and directly affects and is affected by that body of water. Riparian ecosystems perform many functions that are essential to maintaining water quality, aquatic species survival, and biological productivity. Riparian buffers represent the most effective and efficient way we can address water quality and habitat through spatial planning and should be part of a strategy for conservation of aquatic ecosystems.

  Although effective buffer size depends on specific site conditions, such as slope and soil type, this assessment used several uniform width buffers for application across the North Carolina landscape. Buffers were applied to streams from the N.C. Division of Water Resource's Assessment Unit Hydrology data layer.

  By virtue of their high productivity, diversity, continuity, and critical contributions to both aquatic and upland ecosystems, intact riparian ecosystems provide vital resources to North Carolina's fish and wildlife. In this assessment, both the significance of the waters being buffered and their ratings are used in determining the width of riparian buffers. Buffers of 100 feet or 200 feet were assigned to all water-related criteria.

  For Outstanding Resource Waters, High Quality Waters, wild brook trout waters, anadromous fish spawning waters, Excellent and Good fish and benthic bioclassification sites, and natural swamp waters, the 100-foot buffer is incorporated into the assessment along with the actual stream segments.

  Priority Watersheds have been designated by several natural resource agencies, including NCNHP and NCWRC. NCNHP Priority Watersheds are designated based on all 12-digit Hydrlogic Unit Codes (HUCs) that drain to an Aquatic Habitat (natural area). NCWRC Priority Watersheds are designated based on areas identified for habitat conservation. Criteria include areas with endemic species and specific areas that are critical to the survival of State Wildlife Action Plan priority species (e.g., particular streams or spawning sites). Streams within these watersheds are given 100-foot or 200-

foot buffers, with the larger buffers on streams in watersheds contributing to federally listed species habitat (NCWRC 2002).

After stream buffers were defined based on distance from the stream, cells with high (>20 percent) impervious surface cover were removed. These degraded areas are important to water quality in the adjacent streams but need restoration rather than conservation of current conditions.

Suggested Buffer Widths, Categories, and Assigned Rankings

Stream Buffer Width	Category	Assigned Ranking for Conservation Value
200 ft.	Watersheds with federally listed species	High (7)
100 ft.	NCNHP/NCWRC Priority Watersheds	Medium (3)
100 ft.	All streams (without additional significance)	Moderate (1)

- ***Oyster Sanctuaries.***
  Oyster sanctuaries are subtidal oyster reefs that have been restored by the Division of Marine Fisheries (DMF) and other nonprofit partners, primarily in the Pamlico Sound system. In these areas, natural materials have been added to restore the three-dimensional structure of the reefs. The areas are marked and designated for conservation. No harvest is allowed. These areas receive a relatively high conservation value (CPT Rating = 8) because their locations are well documented, they are regularly monitored by DMF staff, and they are relatively rare. They have become colonized with a diversity of organisms, including new oysters, and are providing fish with refuge and foraging areas. Populations of subtidal oyster reefs are severely depleted, so these areas represent limited and historically important habitat.

- ***Submerged Aquatic Vegetation Beds (SAV).***
  Submerged aquatic vegetation habitat is bottom that is recurrently occupied by living structures of submerged rooted vascular plants and includes the unvegetated areas between grass patches. This habitat occurs in subtidal and intertidal zones and may be colonized by estuarine or freshwater species.

  SAV habitat is well known for its numerous fish and invertebrates. More than 150 species have been documented using this habitat, mostly as a nursery area for summer spawned estuarine dependent species, such as black sea bass, red drum, spotted sea trout, weakfish, and hard clams. Bay scallops, which are currently severely depleted in population, are highly dependent on this habitat for survival. Protection of this habitat would allow a greater diversity of organisms to survive in North Carolina's coastal waters.

  This habitat has been partially mapped by federal and state agencies, and it is estimated to be approximately 200,000 acres of SAV in North Carolina (Deaton et al. 2010). SAV maps have been developed through a combination of remote sensing and field monitoring. There are currently not enough data to support prioritization within

grassbeds; once the environmental factors that enhance SAV growth are better understood, a subset of SAV habitat could be selected as a higher priority. Currently, SAV habitat is given a CPT Rating of 6.

- ***Shell Bottom in Shellfish Growing Areas (SGA).***
  Intertidal and subtidal oyster reefs or concentrations of shell mapped by the DMF and located in waters having Environmental Health Section shellfish harvest classifications of "open," "conditionally approved-open," and "conditionally approved-closed" represent shell bottom occurring in areas of highest water quality.

  Shell bottom is unique in that it is both a natural habitat and a culturally important fishery. The epifaunal habitat provides three-dimensional fish habitat in estuarine waters. Small crevices provide refuge for diminutive and juvenile fish species, foraging areas for larger fishery species, and support a higher abundance and diversity of organisms compared to unstructured soft bottom. Oyster reefs also provide many ecosystem services, such as filtering pollutants from the water column, stabilizing sediments and reducing shoreline erosion. It is important from an ecological and economic standpoint to maintain shell bottom habitat and the oyster fishery.

  Oyster beds in open harvest areas represent a high quality estuarine habitat and received a relatively high conservation value (CPT Rating = 8). Much supporting data exist for the mapped oyster beds. They are very vulnerable to water quality degradation from adjacent land use. Oyster beds in areas closed to shellfish harvest also offer valuable fish habitat. However, these waters are listed as impaired by DWR. The water quality degradation that has been shown to co-occur with increased fecal coliform contamination (elevated loading of nutrients, sediments, and toxins) indicates that these areas are of lower overall condition. Oyster beds in closed areas are included at a lower rating (CPT Rating = 5).

  Mapping of oyster beds has not yet been completed for Brunswick County and the Pamlico Sound. In Brunswick County, oyster beds are known to be very abundant, but they are currently unmapped and much area is closed to harvest.

- ***Hard Bottom Areas.***
  Hard bottom habitats are exposed areas of rock or consolidated sediments usually colonized by a thin veneer of live or dead biota, generally located in the ocean. Hard bottom, also referred to as live bottom, can be colonized with sponges, coral, algae, and other invertebrates, supporting a very diverse community, including subtropical reef fish and a valuable snapper-grouper fishery. Hard bottom is mapped by the Division of Marine Fisheries. This habitat is relatively rare and unique in North Carolina and greatly enchances the diversity of fish and invertebrates that can survive in North Carolina, and therefore received a medium-high conservation value (CPT Rating = 7).

Legend for the Biodiversity/Wildlife Habitat Assessment

Key to Identify Tool Results for the Biodiversity/Wildlife Habitat Assessment			
Category Name	**Value**	**Individual Input Layers**	**Source for Input Layers**
NHP	10	Natural Areas – Exceptional and Very High Site Rating	*N.C. Natural Heritage Program*
	8	Natural Areas – High and Moderate Site Rating	
	6	Natural Areas - General Site Rating	
	5	Element Occurrences – High ranking	
	4	Element Occurrences – Other	
Wetlands	7	Coastal Region Evaluation of Wetland Significance (CREWS) – Exceptional	*N.C. Division of Coastal Management*
	6	Coastal Region Evaluation of Wetland Significance (CREWS) – Substantial	
	5	National Wetland Inventory (NWI)	*U.S. Fish and Wildlife Service*
	2	Coastal Region Evaluation of Wetland Significance (CREWS) – Beneficial	*N.C. Division of Coastal Management*
Guilds	1-10	Landscape Habitat Indicator Guilds	*N.C. Natural Heritage Program*
DWR	10	Outstanding Resource Waters	*N.C. Division of Water Resources*
	9	Stream BioClassification – Excellent	
	8	High Quality Waters	
	7	Stream BioClassification – Good	
	1	All other streams	
Fish Habitat	9	Wild Brook Trout	*N.C. Wildlife Resources Commission*
	8	Anadromous Fish Spawning Areas	*N.C. Division of Marine Fisheries*
Fish Nursery	8	Fish Nursery Areas	*N.C. Division of Marine Fisheries*
Watersheds	7	Stream buffer tributaries to federally-listed species (Threatened & Endangered)	*N.C. Natural Heritage Program*
	3	Priority Watersheds	*N.C. Natural Heritage Program, N.C. Wildlife Resources Commission*
Marine	8	Oyster Sanctuaries	*N.C. Division of Marine Fisheries*
	6	Submerged Aquatic Vegetation (SAV)	
Hardbottom	8	Open Shellfish/Shellbottom	*N.C. Division of Marine Fisheries*
	7	Hard Bottom	
	5	Closed Shellfish/Shellbottom	
IBA	6	Important Bird Areas	*Audubon Society*
Impervious	-1	Impervious Surface above 20%	*U.S. Environmental Protection Agency*

Open Space and Conservation Lands Assessment

Introduction. The Open Space and Conservation Lands assessment is different from the other assessments in the Conservation Planning Tool; instead of valuing and ranking data representing various natural resources, existing data related to managed conservation lands and passive recreation lands was simply overlaid into a single map. This map is intended to inform the user about the location of existing conservation lands that are in "permanent conservation" and those that are managed by federal, state, local, and private entities.

Data Sources. The current Open Space and Conservation Lands map includes:
1. All known federal lands owned by:
    - National Park Service
    - U.S. Department of Defense
    - U.S. Fish and Wildlife Service
    - U.S. Forest Service

2. All lands managed for open space and owned by the state of North Carolina, including various state agencies:
    - Dedicated Nature Preserves
    - Department of Transportation
    - Division of Coastal Management
    - Division of Health and Human Services
    - Division of Marine Fisheries
    - Division of Parks and Recreation
        - State Parks
        - State Trails
        - State Natural Areas
        - State Recreation Areas
        - Potential expansion areas
    - Ecosystem Enhancement Program
    - Forest Service
    - Museum of Natural Sciences
    - Plant Conservation Program
    - Registered Heritage Areas
    - Soil and Water Conservation
    - State Historic Sites
    - UNC system universities and colleges
    - Wildlife Resources Commission
        - Game lands
        - Boating access points
    - Zoo

3. County and local government lands of conservation interest and/or managed for open space (when provided).

4. Private conservation lands managed for open space (when provided):
    - Conservation groups (e.g., The Nature Conservancy, National Audubon Society, N.C. Herpetological Society, The Conservation Fund)
    - Local land trusts
    - Utility companies

Agricultural Lands Assessment

Introduction. According to information prepared for NCSU by Mike Walden (2016), agriculture makes up 17 percent of the state's income and employs 17 percent of the workforce. Farmlands also make up an integral part of our open space, wildlife habitat, and groundwater recharge areas. These environmental services are an essential part of the quality of life for citizens of North Carolina.

Because of the economic and environmental importance of farmland to the state, the North Carolina Department of Agriculture and Consumer Services (NCDA&CS) administers the Agricultural Development and Farmland Preservation Trust Fund (ADFP). To more successfully administer these funds, the ADFP Trust Fund Advisory Board has developed an assessment tool of all agricultural land in the state. This assessment tool helps to prioritize the preservation of important agricultural working lands in North Carolina.

Methodology. The Overall Agricultural Score in this assessment is comprised of three separate evaluations:

- Government Policy,
- Agribusiness Infrastructure, and
- Soils.

The base layer for this assessment consists of parcels predicted to be in agricultural use. All scores are assigned at the parcel level. The base layer was derived from county tax parcels, the 2008 Common Land Units (CLU) layer produced by the U.S. Department of Agriculture (USDA) Farm Service Agency, and the Animal Health Programs (AHP) database maintained by the NCDA&CS. To determine which parcels were in agricultural land use, all parcels that intersected CLU cropland fields and/or AHP farms were selected. Parcels that intersected CLU fields were labeled as agricultural lands only if the total parcel acreage was greater than two acres and the percent of the parcel with CLU fields was greater than 10 percent. All parcels that intersected AHP farms were labeled as agricultural land.

Due to the outdated nature of the 2008 CLU data, areas of new residential or forested land on old agricultural fields may be included in this assessment as agricultural land, while newly cultivated agricultural lands may not be included. The NCDA&CS maintains an ongoing effort to update and correct errors in the base layer of agricultural parcels.

Additive Approach for the Overall Assessment Score. Points for the three individual evaluations are summed to obtain the Overall Assessment Score. For the Overall Assessment Score, parcels in Tier I are considered to be the highest priority for

conservation of working farmland. Within the individual assessments, parcels in Tier I represent the parcels that scored the best for each assessment alone.

Data Sources and Basis for Ranking.

Government Policy. The Government Policy assessment awards points to parcels in areas with government policies that support the conservation of working farmland.

1. *Underneath Military Training Route (MTR).*
Goal: To protect working lands around military training areas because the less developed nature of working lands is compatible with the needs of the military training areas.

32 points	**0 points**
Parcel is underneath the MTR	Parcel is not underneath the MTR

The MTR is a military flight path and special use area overlying a portion of 18 Eastern North Carolina counties. Linking conservation, working lands, and national defense promotes long-term sustainable land use for both the military and civilian sector. The military needs enduring training areas without encroachment from sprawl, which can inhibit training functionality.

2. *Proximity to ADFP Preserved Farmlands.*
Goal: To protect viable farming communities as a whole and connect open spaces.

30 points	**15 points**	**0 points**
<1 mile	1-2 miles	>2 miles

As more funding becomes available to protect working lands, priority will be given to lands near or adjacent to other protected working lands to clump protected lands and preserve the entire agricultural economy and community. This helps tie tracts of preserved lands together, limits fragmentation, and takes advantage of the environmental services these larger protected areas can provide.

3. *Counties with a Farmland Protection Plan.*
Goal: To give funding priority to counties that have a prepared farmland protection plan.

30 points	**0 points**
Parcel is in a county that has a Farmland Protection Plan.	Parcel is in a county that does not have a Farmland Protection Plan.

Farmland Protection Plans assess the state of farming in the county; coordinate activities, agencies, and funding for farmland and forestland preservation; and lower the matching percentage required for funds received from the ADFP Trust Fund.

4. *Proximity to Military Bases.*
Goal: To protect working lands around military bases because the less developed nature of working lands is compatible with the needs of the military bases.

20 points	**12 points**	**6 points**	**0 points**
<1 mile	1-2 miles	2-5 miles	>5 miles

Development around military bases inhibits their functionality and may affect the training that can take place on the bases. It has been determined by the Department of Defense and NCDA&CS that in order to protect these bases and their functionality, we must work together to protect the working lands around each base in North Carolina. Therefore, the ADFP Advisory Board has agreed to partner with the Department of Defense to protect these working lands.

5. *Counties with an Enhanced Voluntary Agricultural District (EVAD).*
Goal: To place emphasis on counties that have established enhanced Voluntary Agricultural Districts.

20 points	**0 points**
Parcel is in a county with an EVAD.	Parcel is not in a county with an EVAD.

The purpose of the Voluntary Agricultural District Program is to encourage the preservation and protection of farmland from nonfarm development. The ordinance provides for the creation of an Agricultural Advisory Board to administer this program, which also acts as advisor to the governing board of the county or city on projects, programs, or issues affecting the agricultural economy or way of life within the county or city. The Board reviews and approves applications for qualifying farmland, as well as establishes the agricultural district. These ordinances can also increase protection from nuisance suits, provide a waiver of water and sewer assessments, establish public hearings required for proposed farmland condemnation, and can increase eligibility for funding.

6. *Counties with a Volunteer Agriculture District (VAD).*
Goal: To place emphasis on counties that have established Voluntary Agricultural Districts.

12 points	**0 Points**
Parcel is in a county with a VAD.	Parcel is not in a county with a VAD.

7. *Proximity to CREP Easements.*
Goal: To place emphasis on areas where working lands can add conservation value to existing open space.

10 points	**5 points**	**0 points**
<1 mile	1-2 miles	>2 miles

The Conservation Reserve Enhancement Program (CREP) is a voluntary program utilizing federal and state resources to achieve long-term protection of environmentally sensitive cropland and marginal pastureland. These voluntary protection measures are accomplished through 10-, 15-, 30-year and permanent conservation easements.

Agricultural Infrastructure. The Agricultural Infrastructure assessment awards points to parcels in areas that have a strong agricultural business infrastructure. As farm operations that use agribusinesses diminish, the agribusinesses themselves go out of production due to the lost revenue. The remaining farm operations then need to travel further to get supplies. This puts more financial stress on farm operations and can cause the operation to go out of business because of the lack of services available. Preserving the

land base that supports the agribusiness infrastructure in North Carolina may help halt this trend that has negatively affected many of our rural economies.

1. *Crop County Cash Receipts/Farm Acres in County.*
Goal: To give funding priority to counties which have the largest agricultural economies for crops in the state.

44 points	**33 points**	**22 points**	**11 points**	**0 points**
Top 20 counties	Upper middle 20 counties	Middle 20 counties	Low middle 20 counties	Lowest 20 counties

2. *Livestock County Cash Receipts/Farm Acres in County.*
Goal: To give funding priority to counties which have the largest agricultural economies for livestock, dairy, and poultry in the state.

32 points	**24 points**	**16 points**	**8 points**	**0 points**
Top 20 counties	Upper middle 20 counties	Middle 20 counties	Low middle 20 counties	Lowest 20 counties

3. *Proximity to Slaughter Facilities.*
Goal: To place emphasis on agricultural lands which support slaughter facilities.

10 points	**5 points**	**2 points**	**0 point**
<15 miles	15-30 miles	30-45 miles	>45 miles

Slaughter facilities are businesses that slaughter and/or process meat in North Carolina and are important components of agribusiness that serve livestock and poultry farming operations. These data do not include USDA regulated facilities operated by individual meat or poultry corporations.

Soils.

1. *Realistic Yield.*
Goal: To place emphasis on parcels that have the best soils for agricultural use.

60x RYE Norm

Realistic yield goals are those average yield levels that produce the greatest difference between the value of the crop and the cost of producing the crop. The soil score was calculated in the following manner:

$$\frac{Realistic\ Yield\ for\ Corn\ Grain\ on\ Parcel}{Statewide\ Highest\ Realistic\ Yield\ for\ Corn\ Grain\ on\ a\ Parcel} + \frac{Realistic\ Yield\ for\ Wheat\ Grain\ on\ Parcel}{Statewide\ Highest\ Realistic\ Yield\ for\ Wheat\ Grain\ on\ a\ Parcel} + \frac{Realistic\ Yield\ for\ Full\ Season\ Soybeans\ on\ Parcel}{Statewide\ Highest\ Realistic\ Yield\ for\ Full\ Season\ Soybeans\ on\ a\ Parcel} = \boldsymbol{RYE\_NORM}$$

$$\frac{\boldsymbol{RYE\_NORM}}{\textit{Statewide Highest RYE\_NORM}} = \boldsymbol{RYE\_NORM2}$$

$$\boldsymbol{RYE\_NORM2} \times 60 = \boldsymbol{RYE\_SCORE} = \boldsymbol{SOIL\_SCORE}$$

Forest Lands Assessment

North Carolina's Forest Resources Assessment, a statewide analysis of the past, current, and projected future conditions of North Carolina's forest resources also known as the Forest Action Plan, was completed in 2010 by the North Carolina Forest Service and partners. The Forest Resource Assessment (including maps) reflects conservation, protection, and enhancement themes. It was developed to inform stakeholders about forest resources and to assist resource professionals with implementation of plan goals, strategies, objectives, and measures of success.

The seven goals identified for North Carolina are:

1. Increase the sustainable management and conservation of forest lands in NC.
2. Reduce negative impacts from threats to forests.
3. Increase the restoration, maintenance, and management of fire adapted species and ecosystems.
4. Maintain or increase the viability and sustainability of existing and emerging markets.
5. Increase and enhance fish and wildlife habitat in North Carolina's forests.
6. Manage, conserve, restore, and enhance forestlands important to current and future supplies of clean water for economic, social, and ecological uses.
7. Enhance the benefits and sustainable management of urban forests.

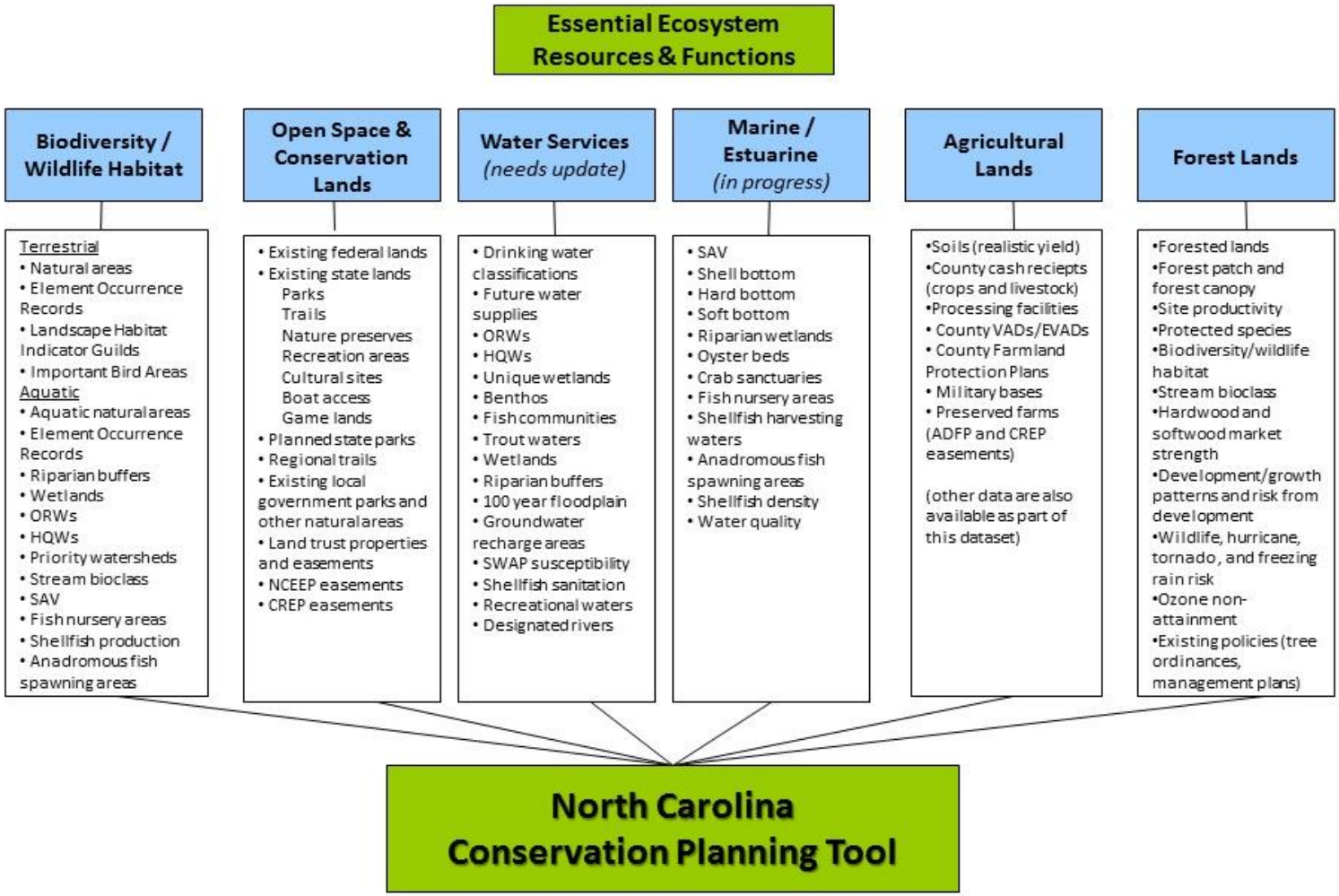
The complete assessment report is available at: http://www.ncforestassessment.com/

CONCLUSION: APPLICATION OF THE CONSERVATION PLANNING TOOL

Overall, the Conservation Planning Tool synthesizes information about conservation priorities from multiple resources agencies to help prioritize voluntary conservation activities for landowners, land managers, planners, funding agencies, and grant applicants, as they weigh the many economic and environmental benefits of any potential project. The Conservation Planning Tool maps can be viewed in the Natural Heritage Data Explorer online at www.ncnhp.org, where it may be overlaid on other land use maps such as tax parcels, aerial imagery, topo maps, and other references. Before any decisions are made based on Conservation Planning Tool data, the values shown on the map should be verified on the ground. It is hoped that this information will be used to help conserve lands through agreements, acquisitions and easements, and that protected areas can be connected through conservation corridors or restoration.

Building a network of nature preserves and working lands that will conserve and manage North Carolina's valuable natural resources for future generations will require close communication and collaboration among state programs, local governments, land trusts, and other land owners. The Conservation Planning Tool was created to facilitate these efforts and bring together data about conservation priorities from a variety of resources.

Appendix A: Essential Ecosystems Resource Assessment



Appendix B: Data Sources: Biodiversity/Wildlife Habitat

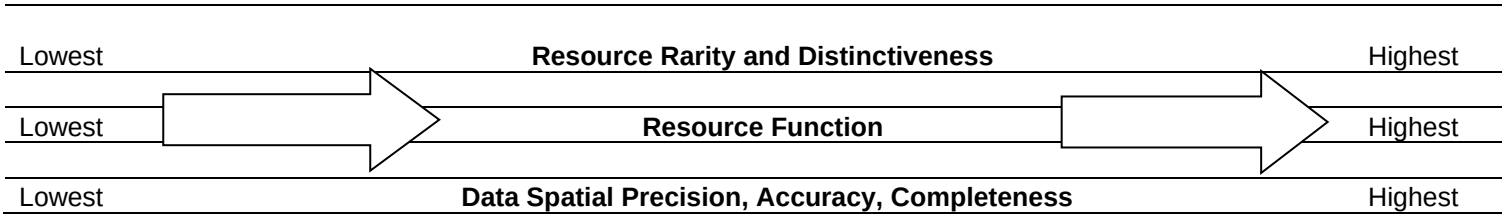
Terrestrial	Source	Date Updated
Landscape Habitat Indicator (LHI) Guilds	NHP	2013
NHNA - Exceptional and Very High Rating	NHP	2018
NHNA - High and Moderate Rating	NHP	2018
CREWS Wetlands - Exceptional Function	DCM	2003
NHNA - General Rating	NHP	2018
Important Bird Areas	Audubon	2012
CREWS Wetlands - Substantial Function	DCM	2003
NWI Wetlands	USFWS	1983
Natural Heritage EO - High Significance	NHP	2018
Natural Heritage EO – Other (Moderate) Significance	NHP	2018
CREWS Wetlands - Beneficial Function	DCM	2003
Aquatic		
ANHNA - Exceptional and Very High Rating	NHP	2018
Outstanding Resource Waters (select)	DWR	2014
ANHNA – High and Moderate Rating	NHP	2018
DWR Stream Bioclassification- Excellent Rating	DWR	2014
Wild Brook Trout Waters	WRC	2018
High Quality Waters (select)	DWR	2014
DWR Stream Bioclassification - Good Rating	DWR	2014
ANHNA – General Rating	NHP	2018
Tributaries to T&E Species	NHP	2018
NHP and WRC Priority Watersheds	NHP, WRC	2016, 2007
All streams	DWR	2007, 2018
Marine / Estuarine		
Anadramous Fish Spawning Areas	DMF	2015
Oyster Sanctuaries	DMF	2014
Shellfish Harvest - Open/Shell Bottom	DMF	2013
Fish Nursery Areas	DMF	2013
Hard Bottom Areas	DMF	2011
Submerged Aquatic Vegetation	DMF	2012
Shellfish Harvest - Closed / Shell Bottom	DEH/CGIA, DMF	2013

Note:
NHNA: Natural Heritage Natural Areas
ASNHA: Aquatic Natural Heritage Natural Areas
EO: Element Occurrence
T&E: Threatened and Endangered

Appendix C: Relative Ranking: Biodiversity/Wildlife Habitat

Category Name	Value	Individual Input Layers
NHP	10	Natural Heritage Natural Areas – Exceptional and Very High Site Rating
NHP	8	Natural Heritage Natural Areas – High and Moderate Site Rating
NHP	6	Natural Heritage Natural Areas - General Site Rating
NHP	5	Element Occurrences – High Ranking
NHP	4	Element Occurrences – Other
Wetlands	7	Coastal Region Evaluation of Wetland Significance (CREWS) – Exceptional
Wetlands	6	Coastal Region Evaluation of Wetland Significance (CREWS) – Substantial
Wetlands	5	National Wetlands Inventory (NWI)
Wetlands	2	Coastal Region Evaluation of Wetland Significance (CREWS) – Beneficial
Guilds	1-10	Landscape Habitat Indicator Guilds
DWR	10	Outstanding Resource Waters (ORW)
DWR	9	Stream BioClassification – Excellent
DWR	8	High Quality Waters (HQW)
DWR	7	Stream BioClassification – Good
DWR	1	All other streams
FishHabitat	9	Wild Brook Trout
FishHabitat	8	Anadromous Fish Spawning Areas (AFSA)
FishNursery	8	Fish Nursery Areas (FNA)
Watersheds	7	Stream buffer tributaries to Threatened & Endangered Species
Watersheds	3	Priority Watersheds
Marine	8	Oyster Sanctuaries
Marine	6	Submerged Aquatic Vegetation
Hardbottom	8	Open Shellfish /Shellbottom
Hardbottom	7	Hard Bottom
Hardbottom	5	Closed Shellfish /Shellbottom
IBA	6	Important Bird Area (IBA)
Impervious	-1	Impervious Surface above 20%

Moderate								Maximum	
1	2	3	4	5	6	7	8	9	10



Appendix D: Biodiversity/Wildlife Habitat Technical Document

For each individual layer or category, a model was created using ModelBuilder. All models had the same environmental settings to ensure consistency in processing across all layers. For the raster analysis settings, the cell size was set as 30 meters. The processing extent was set as follows:

Top (North): 322678.587700
Right (East): 978249.376000
Bottom (South): -40351.413000
Left (West): 119769.376000

Prior to any analysis, all data inputs were first projected to NAD 1983 State Plane North Carolina FIPS 3200 (Meters). The streams dataset, provided by DWR, which was used in multiple analyses, was edited first to remove all records with "basin boundary" in the comment field or "MINOR1" classifications of 202 or 205. This was to remove all basin boundaries, Carolina bays, and closure lines.

For all reclassifications steps, all non-null/NoData values were reclassified to the corresponding score, and all NoData cells that fall within the extent were reclassified as 0. The final rasters for each of the eleven categories (not the overall assessment) were created using cell statistics to calculate the maximum value for each cell across the inputs.

Raster data were saved in the Esri GRID format, except for the final category rasters and the final output. These were saved in TIFF (.tif) to facilitate the transfer of data between file locations without losing information stored in attribute tables.

Natural Heritage

Aquatic Natural Areas – Natural Heritage natural areas were first separated into aquatic and terrestrial natural areas using the selection tool. Natural areas were split up into aquatic and terrestrial because the aquatic natural areas were buffered by 300 feet to include important riparian habitat alongside the streams. Prior to the buffering, however, the aquatic natural areas were divided into three separate categories using the selection tool: aquatic natural areas with a combined rating (collective and representative ratings) of exceptional or very high, a combined rating of high or moderate, or a combined rating of general. This means unranked aquatic natural areas were excluded from the analysis. Each rating category was buffered by 300 feet, and then converted from a polygon to a raster. The rasters were then reclassified so that the highest-rated aquatic natural areas (exceptional or very high) received a value of 10, the next highest (high or moderate) received a value of 8, and those aquatic natural areas with a general rating received a value of 6.

Natural Areas – The terrestrial natural areas were analyzed identically to the aquatic natural areas, but were not buffered. Natural areas were separated into three separate categories based on combined rating (collective and representative ratings): exceptional or very high, high or moderate, and general. All three categories were converted from polygon to raster and then reclassified. Natural areas with exceptional or very high ratings received

a value of 10, natural areas with high or moderate ratings received a value of 8, and natural areas with a general rating received a value of 6.

Element Occurrences (EOs) – Element occurrences were first filtered using the selection tool to select only those with EO ranks of A, B, C, or E. EOs that are considered extirpated, historical, or of low viability are not useful for prioritizing the location of important elements for biodiversity. From those selected, another selection was applied, this time selecting for EOs with last observation dates greater than or equal to 1986. This was again to eliminate from analysis any EOs that are historical or likely historical. Another selection was applied to this layer with only current EOs of specific ranks, this time to select only EOs with representational accuracy of very high, high, or medium. This step prevents those EOs with low or very low accuracy from being included in the analysis, ensuring a minimum standard of data quality.

This EO layer was then separated into two groups based on element rarity and EO rank. The first group was selected as those EOs with G-ranks of G1 or G2 *or* S-ranks of S1 *or* EO ranks of A or B. The second group consisted of all other qualifying EOs, or more specifically, the second group was selected as those with G-ranks of G3-G5, *or* those with S-ranks of S2-S5 *or* those with EO ranks of C or E. Both groups were converted from polygon to raster and then reclassified. The raster for the first group with the higher ranks received a value of 5 and the raster for the second group received a value of 4.

Guilds

NHP provided a shapefile of Landscape Habitat Indicator Guild (LHIG) core areas (core_areas_2013-10-07.shp). The original Score field provided by NHP was used to add scores together where guilds overlapped; the total score was divided into CPT Ratings of 1 to 10 (below).

CPT Rating	Guild Score Total
10	10000
9	7812
8	5623
7	4393
6	3162
5	2470
4	1778
3	1389
2	1000
1	672

A SCOREINT field was created for further processing. SCOREINT is a long integer derived from the Guild Score Total *100. The shapefile was then run through a Python script to process each guild into a GRID layer. For each Guild, the polygon features are selected from the original shapefile, converted to GRID on the SCOREINT field, and reclassified to replace NoData values with 0. All the resulting GRIDs were added together

using the “max” function in Raster Calculator and classified as above (Guild Score Total less than 672 = 0). The Python script for Guild processing is (guildproc_win7_1013.py):

```
# Import system modules
import sys, string, os, arcgisscripting

# Create the Geoprocessor object
gp = arcgisscripting.create()

# Check out any necessary licenses
gp.CheckOutExtension("spatial")

# Load required toolboxes...
gp.AddToolbox("C:/Program Files (x86)/ArcGIS/ArcToolbox/Toolboxes/Conversion Tools.tbx")
gp.AddToolbox("C:/Program Files (x86)/ArcGIS/ArcToolbox/Toolboxes/Spatial Analyst Tools.tbx")
gp.AddToolbox("C:/Program Files (x86)/ArcGIS/ArcToolbox/Toolboxes/Analysis Tools.tbx")

# Set the Geoprocessing environment...
gp.extent = "119769.376 -40351.413 978249.376 322678.587"
gp.cellSize = "30"

# Local variables...
Input_true_raster_or_constant_value = "0"
core_areas = "core_areas_2013-10-07.shp"

# List of values for loop (check list for completeness, all guilds must be included)
guild_abbrs =
['awcf','blhf','cb','cgsw','cwhdf','dhhmf','dwhmf','dxmfst','dxmfwb','fc','ff','ffnrwf','fm','gcm','ghmf','gm','
gmdmhmf','gmhf','gmwmhmf','gwdhf','gwhf','gwmhf','hemmhmf','hpppm','lemdmhmf','lemwmhmf','
mdmbhf','mfhmf','mhf','mom','pdwbhf','pdwhmf','pfm','phb','pom','ppmgwhs','psng','pwhf','pwmhf','r
bbmf','rwdf','rwhf','rwmhf','sawcf','sff','sim','sm','sng','ssm','ssmh','sssp','sswshs','swshs','was','whcf
w','whf','wmhf','wmhmf','wmpw','wxlpwep','wxlww','xmlpmow','xmmmhg']

# Loop on Guild Type
for x in guild_abbrs:

    # Local variables in loop
    guildras = "out\\" + x + "ras"
    guild_shp = "out\\" + x + ".shp"
    guildnull = "out\\" + x + "null"
    guildcon = "out\\" + x + "con"

    # Process: Select...
    gp.Select_analysis(core_areas, guild_shp, "\"acronym\" = \'"+x+"\'")

    # Process: Feature to Raster...
    gp.FeatureToRaster_conversion(guild_shp, "scoreInt", guildras, "30")

    # Process: Is Null...
    gp.IsNull_sa(guildras, guildnull)

    # Process: Con...
    gp.Con_sa(guildnull, Input_true_raster_or_constant_value, guildcon, guildras, "")

    print x
```

Fish Habitat

Wild Brook Trout – The Natural Heritage Program received the wild brook trout data from WRC as GIS points. Using the select layer by location tool, all catchments containing wild brook trout points were selected. These catchments were then used to select streams (arc data) by location, selecting all streams that fell within these selected catchments. The selected catchments were also used to select the streams (poly data) that fell within the selected catchments. Both the selected stream arcs and polys were buffered by 100 feet and then converted from polygon to raster. They were both reclassified and given a value of 9.

Anadromous Fish Spawning Areas (AFSA) – The AFSA dataset was first selected using the surface field to include only include streams. Those streams were then buffered by 100 feet and converted from polygon to raster. The raster was reclassified to receive a value of 8.

Fish Nursery Areas

Fish Nursery Areas – Fish nursery areas were first selected to include only primary and secondary fish nursery areas. This was done by selecting all fish nursery areas that had a Rule ID of 15A NCAC 03R .0103 or 15A NCAC 03R .0104. These primary and secondary fish nursery areas were buffered by 100 feet, converted from polygon to raster, and reclassified to receive a value of 8.

Division of Water Resources

Outstanding Resource Waters / High Quality Waters (ORW/HQW) – Using DWR's stream classification data, two separate groups were selected: streams classified as high quality waters and streams classified as outstanding resource waters. When selecting streams classified as high quality waters, those classified as WS-I, WS-II, or SA as well as HQW designation were not selected. Those streams with water supply or shellfish classification are given HQW designation "by default" and not due to their biological resource quality, so they should not receive higher values. Both the high quality waters and the outstanding resource waters were buffered by 100 feet and then converted from polygon to raster. ORWs were reclassified and received a value of 10, and HQWs were reclassified and received a value of 8.

Stream Bioclassification – The stream bioclassification dataset was separated into two groups using the selection tool. The first group consisted of streams with a bioclassification of "Benthos Good (Nar, AL, FW)" or "Fish Community Good (Nar, AL, FW)." The second group consisted of streams with a bioclassification of "Benthos Excellent (Nar, AL, FW)" or "Fish Community Excellent (Nar, AL, FW)." Both groups were buffered by 100 feet and converted from polygon to raster. The group with "good" bioclassifications was reclassified and the received a value of 7. The group with "excellent" bioclassifications was reclassified and received a value of 9.

Streams – The streams dataset was then clipped into four different groups (mountains, piedmont, northern coastal plain, and southern coastal plain) to facilitate the processing of this large dataset. All four regions were treated identically: first buffered by 100 feet, then converted from polygon to raster, and finally reclassified with a value of 1.

Wetlands

NC-CREWS Wetlands – The NC-CREWS data were first merged to combine data from all the counties into one shapefile. The merged dataset was converted from polygon to raster, preserving the field containing the Overall Wetland Ranking (OWR). This raster was then reclassified so wetlands with an OWR of Beneficial Significance (1) received a value of 2, wetlands with an OWR of Substantial Significance (2) received a value of 6, and wetlands with an OWR of Exceptional Significance (3) received a value of 7. Unranked cells (-1) were reclassified to have a value of 0.

National Wetlands Inventory (NWI) – The NWI data were first clipped to only those counties not covered by the NC-CREWS dataset, as the quality of the NWI data is lower than the NC-CREWS data, so it was only used where NC-CREWS data were not available. The NWI data were selected to exclude impounded wetlands (attribute code ending in "h"). These nonimpounded wetlands were converted from polygon to raster and reclassified to receive a value of 5.

IBAs

Important Bird Areas (IBAs) – The IBA dataset was converted from polygon to raster and then reclassified to receive a value of 6.

Watersheds

Watersheds with Federally Listed Species – First, only aquatic EOs were selected, using the habitat field. From these aquatic EOs, only those that are U.S. status of threatened or endangered were selected. The aquatic threatened or endangered EOs were then filtered using the selection tool to remove all EOs with EO ranks of historical or extirpated or those with accuracies of low or very low. This selection of EOs was then used to select by location in the HUC12 layer all HUCs containing threatened or endangered EOs. These selected HUCs were then intersected with the streams dataset to produce a layer containing only those streams in HUCs with federally listed species. Those streams were buffered by 200 feet, and then converted from polygon to raster. They were then reclassified and received a value of 7.

Priority Watersheds – First, the most updated version of the NHP priority watersheds was generated. This was done by creating a feature layer of the HUC12 watersheds and then selecting by location within that feature layer for all watersheds that intersect with aquatic natural areas. Those selected watersheds (NHP priority watersheds) were merged with the NHP priority watersheds dataset from the previous year, to ensure all important confluences were included. This combined dataset was intersected with the streams dataset to produce a layer consisting of streams only within NHP priority watersheds. These streams were then clipped in to three groups by ecoregion to facilitate processing. All three stream sets were then buffered by 100 feet, converted from polygon to raster, and then reclassified to receive a value of 3. This process was repeated identically for the WRC Wildlife Action Plan priority watersheds, although no separation was needed for processing purposes. The watersheds were intersected with streams, buffered by 100 feet, converted from polygon to raster, and then reclassified to receive a value of 3.

Impervious Surface

Impervious Surface – The set null tool was used to set all cells with less than 21% impervious surface to NoData and all nonnull values were set as 99. A correction raster was created for Jockey's Ridge State Park. Jockey's Ridge was selected from the natural areas data and then converted from a polygon to a raster. That raster was reclassified so Jockey's Ridge received a value of 99. Using raster calculator, the Jockey's Ridge correction raster was subtracted from the >= 21% impervious surface raster, giving Jockey's Ridge a value of 0. This created a raster with values of 0, 99, and NoData. The raster was reclassified so all values of 99 remained 99, but both those cells with a value of 0 and those cells with a value of NoData were given a value of 0.

Marine

Oyster Sanctuaries – The oyster sanctuaries dataset was first buffered by 100 feet to ensure that it would convert to a raster without problems due to cell size. After buffering, they were converted from polygon to raster and then reclassified to receive a value of 8.

Submerged Aquatic Vegetation (SAV) – The SAV data were converted from polygon to raster and reclassified to receive a value of 6.

Hardbottom

Hard Bottom – For the hard bottom points, lines, and polygons (three separate datasets), the select tool was used to select only those with high or medium relief. All three datasets were buffered by 400 feet, converted from polygon to raster, and then reclassified to receive values of 7.

Shellfish Growing Areas – Shellfish Growing Areas were filtered using the select tool to only include those with surfaces designated as "canal," "mhw," or "water" and to remove all records with blank HA class values (these features include Lake Mattamuskeet, and various small polygons that appear to be boat slips at marinas). These shellfish growing areas were then separated into two groups: closed shellfish growing areas (HA class = CSHA – Prohibited) and open shellfish growing areas (HA class = Approved, Conditionally Approved – Open, or Conditionally Approved – Closed). These separate groups with open and closed designations were then used in the shellfish habitat/shell bottom analyses.

Shellfish Habitat/Shell Bottom – The two shellfish bottom mapping areas were first merged together. From there, the following stratum types were selected: Intertidal Firm Nonvegetated Shell, Intertidal Firm Vegetated Shell, Intertidal Hard Nonvegetated Shell, Intertidal Hard Vegetated Shell, Intertidal Soft Nonvegetated Shell, Subtidal Firm Nonvegetated Shell, Subtidal Firm Vegetated Shell, Subtidal Hard Nonvegetated Shell, Subtidal Hard Vegetated Shell and Subtidal Soft Nonvegetated Shell. These shell habitat types were then divided into two groups: closed and open. The layer containing the selected shell types was intersected with the closed shellfish growing areas created earlier. It was also intersected with the open shellfish growing areas created earlier. This created two separate datasets: one with open shell bottom and one with closed shell bottom. Both datasets were converted from polygon to raster. The closed shell bottom was reclassified to receive a value of 5, and the open shell bottom was reclassified to receive a value of 8.

Because shell bottom has not been mapped in Brunswick county, analyses had to be run a little differently there. The Brunswick county boundaries were intersected with the shellfish open growing areas created above (shellfish growing areas subsection). This created a layer containing all the open shellfish growing areas in Brunswick county, although it is not known whether they occur on the types of shellfish habitat selected for the other counties. This layer was converted from polygon to raster and reclassified to receive a value of 8.

Final BWHA Processing

The final rasters from each of the 11 categories created by using cell statistics to determine the maximum value were combined using the combine raster tool. A field was added for the final score. This field was calculated using the following Python script: max([!GUILDS!, !WETLANDS!, !WATERSHEDS!, !NCNHP!, !MARINE!, !IMPERVIOUS_99!, !HARDSHELLBOTT!, !FISHHAB!, !FNA_8!, !DWR!, !IBA_6!]). Using select by attributes all records with an impervious value of 99 were selected, and then field calculator was run to set them all equal to -1.

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