

# ***New Jersey's Landscape Project For the Protection of Rare Species***

**NOTE:** This brochure is out of date (3/01); see [www.njfishandwildlife.com/ensp/landscape/index.htm](http://www.njfishandwildlife.com/ensp/landscape/index.htm).

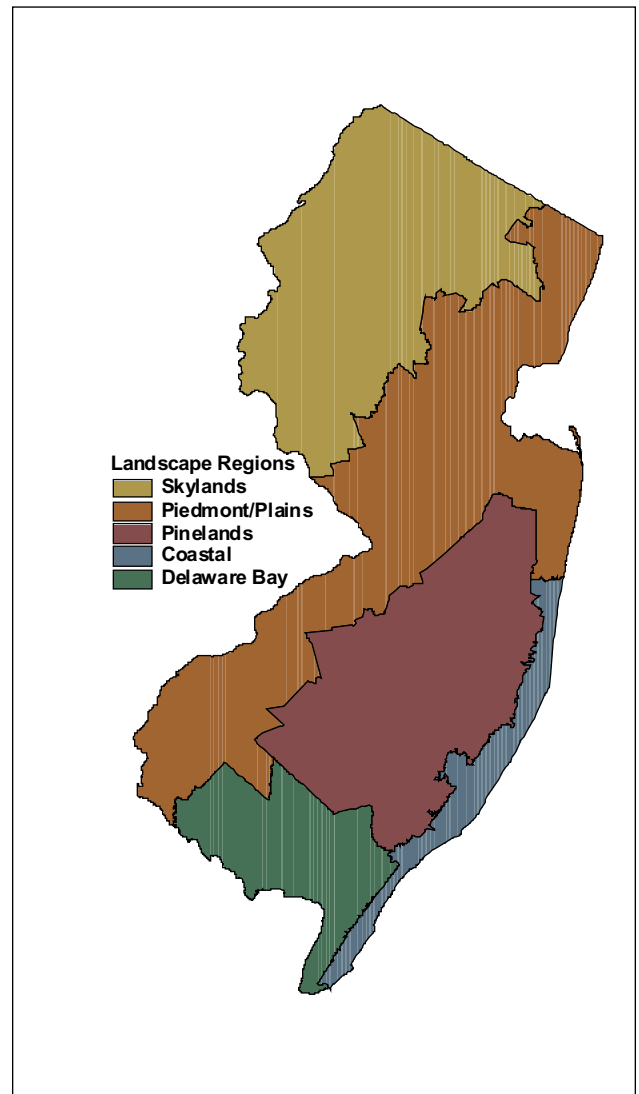
New Jersey is the most densely populated state in the nation. One of the consequences of this distinction is the extreme pressure that is placed on our natural resources. As the population grows, we continue to lose or impact the remaining natural areas of the state. As more and more habitat is lost, people are beginning to appreciate the benefits — and necessity — of maintaining land in its natural state. For example, we now know that wetlands are critical for recharging aquifers, lessening the damage from flooding and naturally breaking down contaminants in the environment. Forests and grasslands protect the quality of our drinking water, help purify the air we breathe and provide important areas for outdoor recreation. Collectively, these habitats are of critical importance to the diverse assemblage of wildlife found in New Jersey, including more than 60 species classified as threatened or endangered.

In 1994 the N.J. Division of Fish and Wildlife's Endangered and Nongame Species Program (ENSP) adopted a landscape level approach to rare species protection. The goal is to protect New Jersey's biological diversity by maintaining and enhancing rare wildlife populations within healthy, functioning ecosystems.

## ***A landscape level perspective***

Since animals require large expanses of natural habitat for their long-term survival, the Landscape Project focuses on large areas called landscape regions that are ecologically similar with regard to their plant and animal communities (*Illustration 1*). Utilizing an extensive database that combines rare species location information with land use/land cover classification data, ENSP has identified and mapped areas of critical habitat for rare species within each landscape region. These landscape maps provide a highly accurate, reliable and scientifically sound basis for habitat protection within each landscape.

One of the Landscape Project's unique features is its focus on the big picture, and not just on individual locations of rare species as they become threatened. The project's protection strategy begins with already conserved areas such as publicly owned areas and regulated wetlands. By identifying and protecting critical habitats adjacent to these already-conserved areas, large, contiguous blocks of habitat will be protected. Thus, within large landscapes, the Landscape Project identifies critical wildlife habitats that must be preserved now if we want to assure the conservation of New Jersey's rare wildlife for future generations.



**Illustration 1.** Landscape project regions.

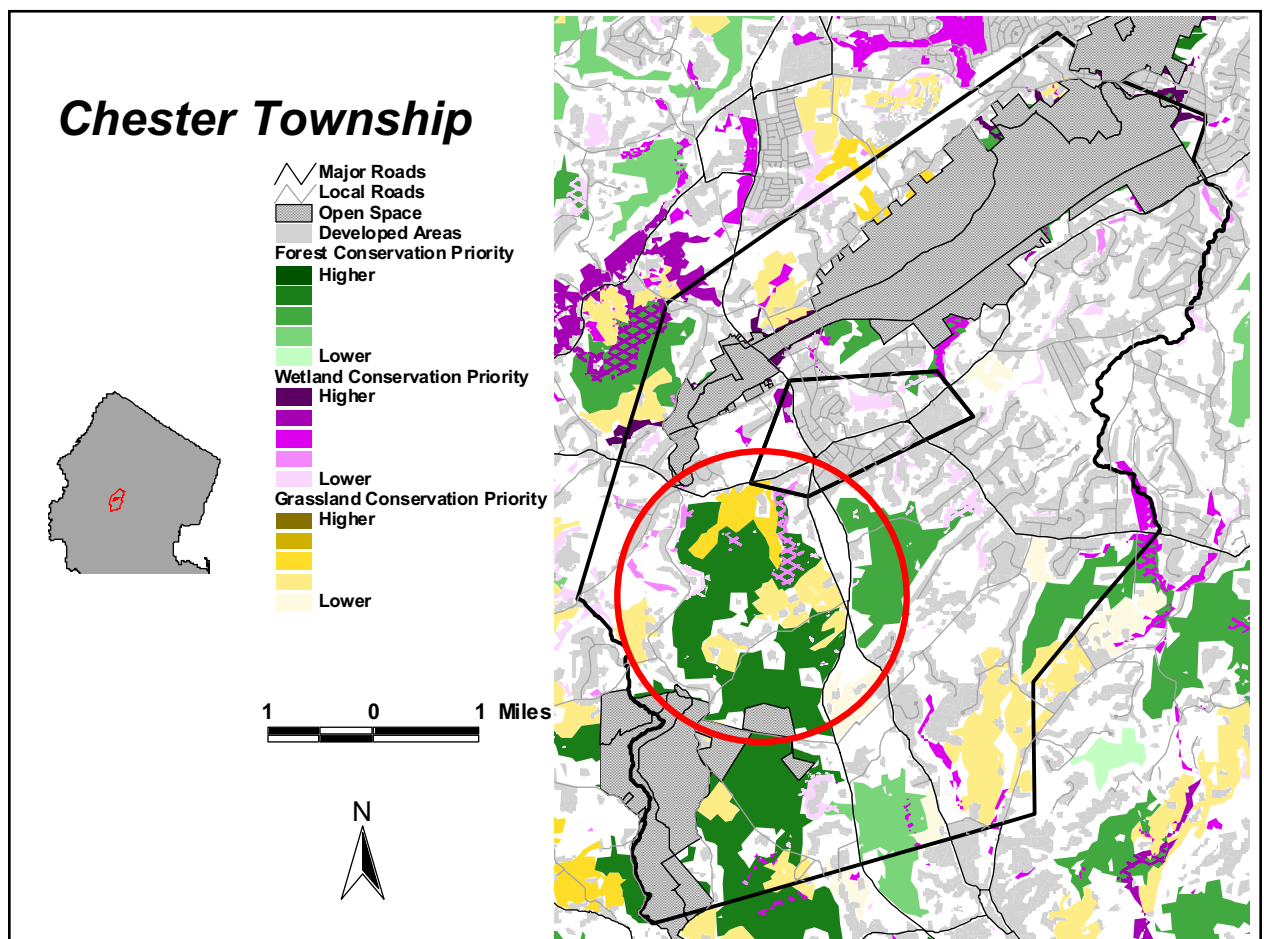
## *The purpose of the Landscape Project*

The Landscape Project has been designed to provide users with peer reviewed, scientifically sound information (see **Appendix V** for reviewers) that is easily accessible and can be integrated with planning, protection and land management programs at every level of government — state, county and municipal, as well as nongovernmental organizations and private landowners. Landscape maps and overlays provide a basis for proactive planning, such as the development of local habitat protection ordinances, zoning to protect critical habitat, management guidelines for rare species protection on public and private lands and land acquisition projects.

Most importantly, the critical habitat information that Landscape Project products provide can be used for planning purposes *before* any actions, such as proposed development, resource extraction (such as timber harvests) or conservation measures, occur. Proper planning with accurate, legally and scientifically sound information will result in less conflict. Less time will be wasted, and less money spent, attempting to resolve endangered and threatened species issues.

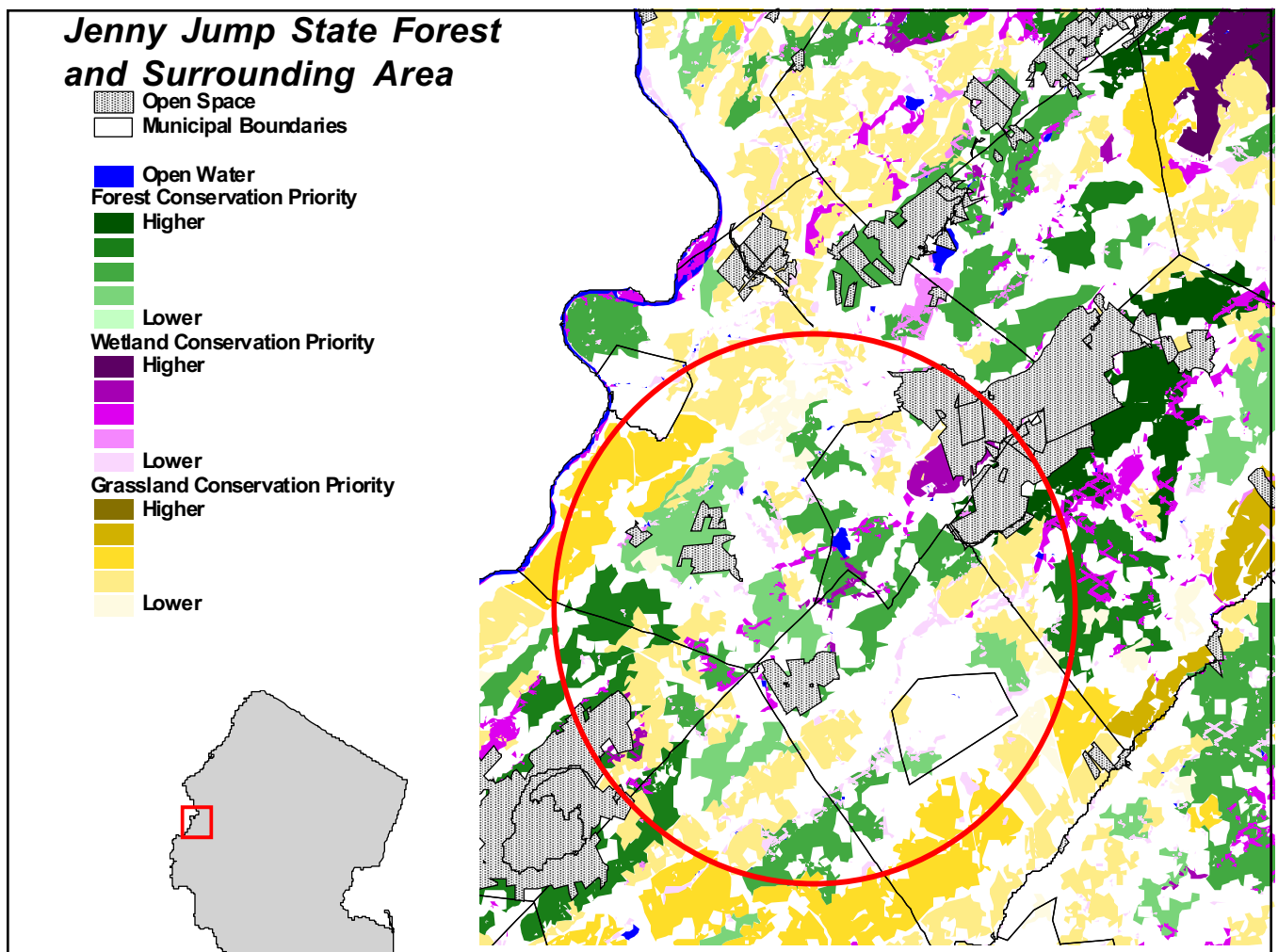
## *Uses for Landscape Project maps*

The ENSP has developed maps that identify critical rare species habitats based on land use classifications and rare species locations. The maps will enable state, county, municipal and private agencies to identify important habitats and protect them in a variety of ways:



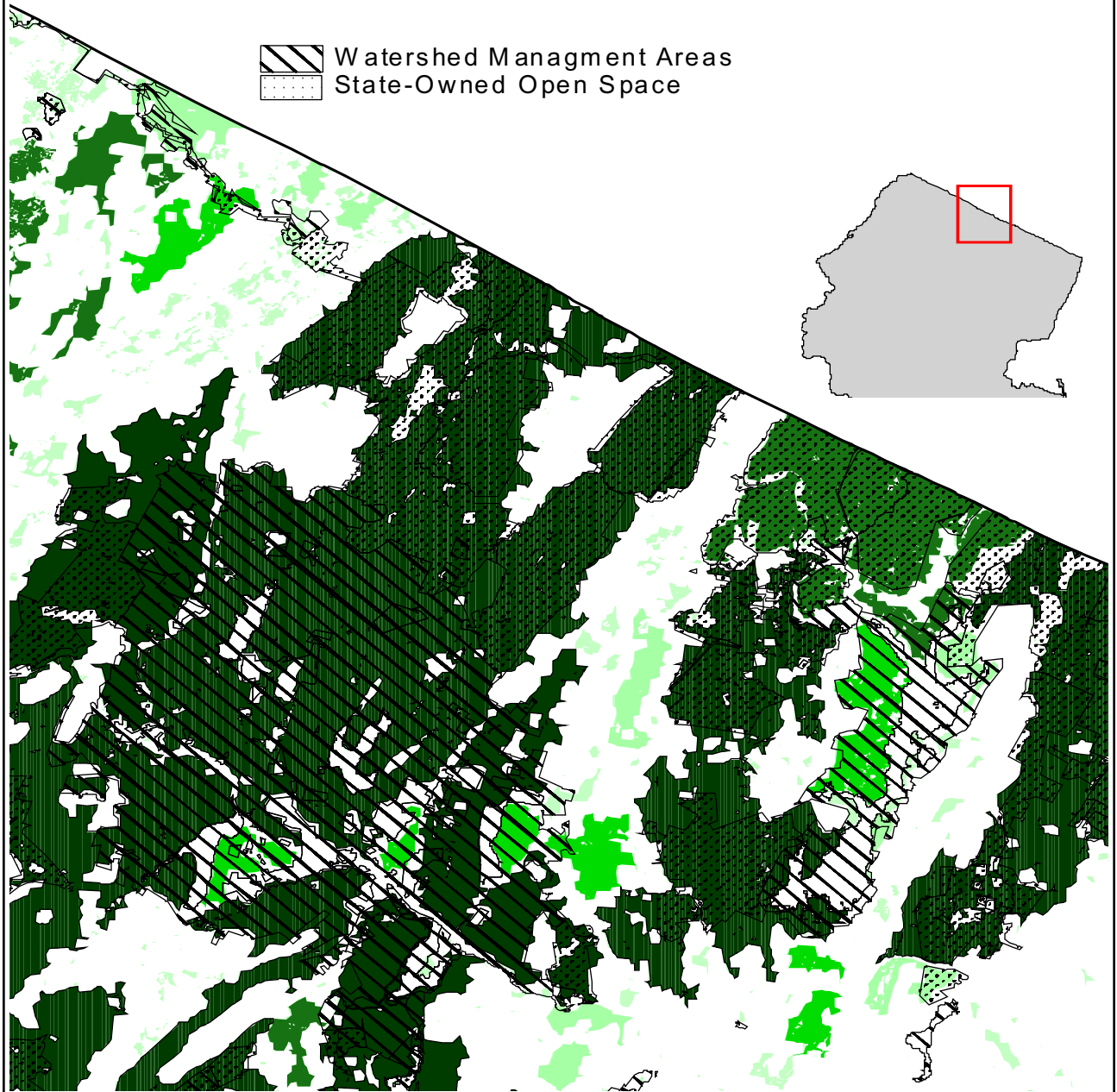
**Illustration 2.** The area within the red circle illustrates critical habitat that would be a valuable acquisition because it ties together two areas of public open space resulting in a much larger contiguous habitat parcel.

- **Prioritize conservation acquisitions:** Critical area maps can be used to prioritize land parcels for purchase through acquisition programs such as GreenAcres, Farmland Preservation and the U.S. Fish and Wildlife Service’s refuge system (*Illustrations 2 and 3*).
- **Guide regulators and planners:** Critical area maps provide land-use regulators and state, county and local planners with the tools they need to enhance protection through the regulatory and planning process.
- **Provide citizens with conservation tools:** Landscape Project products provide the tools to guide citizen actions to protect rare species habitat at the local level. By combining critical area maps with other GIS data layers such as roads, development and publicly owned lands, important areas in need of protection can be easily identified. Chester Township in Morris County provides a good example of how Landscape Project maps can be used to identify important areas in need of protection (*Illustration 2*).
- **Guide stewardship of already-conserved areas:** New Jersey already has nearly 1 million acres of open space. These lands are managed by a variety of agencies and organizations, both public and private. Critical area maps identify important rare species habitats on these lands. ENSP biologists work hand in hand with land managers and landowners to develop appropriate best management practices for the long-term conservation of rare species (*Illustration 4*).



**Illustration 3.** Critical area maps can help identify important rare species habitat where public and private land acquisition can be targeted.

# Pequannock Areas Public Lands



**Illustration 4.** Landscape critical area mapping can assist open space managers reach their management goals without compromising the stewardship of critical habitat for wildlife. The darker green above indicates forest critical areas whose integrity should be preserved, while the lighter green represents forested areas where forest-disturbing activities should be focused.



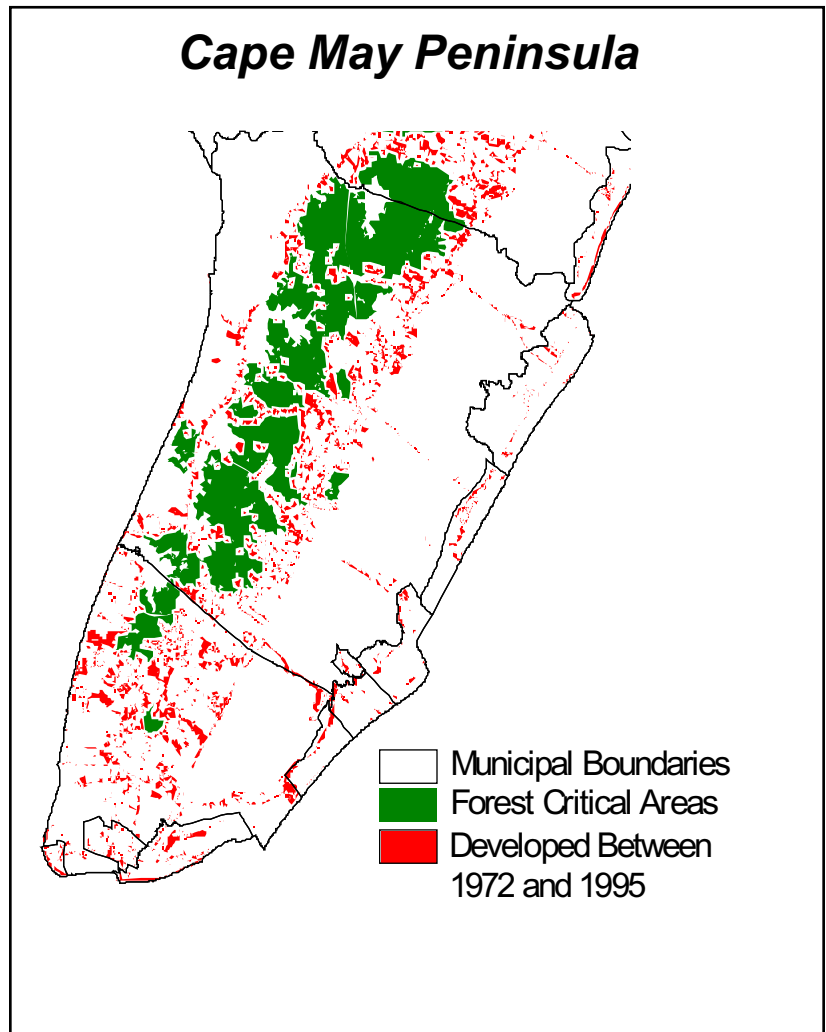
### *Why we need the Landscape Project*

We live in the most densely populated state in the nation. As people leave our cities to live in the “country,” suburban sprawl becomes rampant. Some of the consequences of this rapid suburbanization are the loss and degradation of critically important wildlife habitats, and the fragmentation and isolation of habitats that remain. Many rare species require large contiguous blocks of habitat to survive. Small patches of fields, forests and wetlands interspersed with development provide habitat for some common species, but don’t provide the necessary habitat for most of our rare wildlife. We need to protect large, contiguous blocks of forest, grasslands and wetlands to assure the survival of rare species over the long-term.

Despite New Jersey’s protection efforts, which include strict land use regulations and an aggressive open space acquisition program (GreenAcres), we continue to lose critical wildlife habitat at an alarming rate. In just the last three decades we have lost 40 percent of the remaining critical migratory bird stopover habitat on the lower third of the Cape May Peninsula (*Illustration 5*). During the same period, approximately 50 percent of the state’s bog turtle habitat has disappeared. The Landscape Project serves as a tool to help reverse this trend.

### *Who benefits*

Protecting large expanses of fields, forests and wetlands helps to ensure that rare species will remain a part of New Jersey’s future. In addition to providing habitat for the conservation of rare species, the Landscape Project will result in more open space for outdoor recreation. Recent surveys by the U.S. Fish and Wildlife Service show that more than 60 percent of Americans participate in some form of wildlife-related recreation. Open spaces provide places where people can escape the confines of urban and suburban living. Retaining habitats in their natural state provides other benefits such as reducing the threat of flooding, allowing for the biodegradation of environmental contaminants and recharging ground water reserves. In short, everyone benefits from the Landscape Project.



*Illustration 5. By using satellite imagery from different time periods to develop critical area mapping, planners and managers can visualize habitat changes as well as identify habitat that is being degraded by development or land use changes as illustrated by this map of Cape May peninsula.*

## ***How to obtain additional information and Landscape Project maps***

Landscape Project maps are available via the internet in several ways. GIS coverages will be available for download on the Division of Fish, Game and Wildlife's website at: [www.state.nj.us/dep/fgw](http://www.state.nj.us/dep/fgw). One version is available to users employing ArcView or ArcExplorer, a free GIS program available from Environmental Systems Research Institute, Inc. ([www.esri.com](http://www.esri.com)). For those who do not need to download the maps or do not want to download ArcExplorer, the maps will be viewable over the internet through the NJDEP GIS interactive internet mapping project at: [www.state.nj.us/dep/gis](http://www.state.nj.us/dep/gis).

## ***New Jersey's Landscape Regions***

### ***Delaware Bay Landscape*** (including the Cape May Peninsula)

This landscape encompasses all or parts of Cape May, Atlantic and Cumberland counties. This area features a stable population of bald eagles, tiger salamanders, southern gray treefrogs and 30 other endangered and threatened species. The vast woodland tracts of this region are among the largest in the state and support the majority of New Jersey's Neotropical bird populations. The extensive saltwater marsh and sandy overwash beaches support a shorebird migration that has worldwide ecological implications. Despite the heavy loss of habitat, the Cape May Peninsula remains one of the country's most important migratory "stopovers" for hundreds of bird and insect species.

### ***Pinelands Landscape*** (including pineland habitat located outside the Pinelands Reserve)

This landscape encompasses all or parts of Atlantic, Ocean, Burlington, Camden and Gloucester counties. An internationally recognized ecosystem, the Pinelands supports extremely diverse herptile and invertebrate populations including the pine snake, corn snake, Pine Barrens treefrog and the Pine Barrens bluet, the green darner and the Arogos skipper. Extensive cedar swamps and wetland systems contain numerous insect species, as well as sustainable populations of many Neotropical birds. Its waterways support aquatic communities unique among the Mid-Atlantic States.

### ***Piedmont Plains Landscape***

This landscape encompasses all or parts of Burlington, Gloucester, Mercer, Middlesex, Monmouth and Salem counties. It is dominated by the Delaware and Raritan rivers, and is characterized by heavily farmed areas, extensive grasslands, fragmented woodlands and tidal freshwater marshes that are among the most productive in the world. Priority species within this landscape include the shortnose sturgeon, grassland birds such as the endangered upland sandpiper, and woodland raptors such as the barred owl and cooper's hawk.

### ***Skylands Landscape***

This landscape encompasses all or part of Sussex, Warren, Hunterdon, Passaic, Morris and Somerset counties. This region contains extensive tracts of contiguous upland and wetland forests that support diverse animal populations including red-shouldered hawks, goshawks, cerulean warblers, timber rattlesnakes and long-tailed salamanders. Bog turtles and great blue herons are found throughout the extensive freshwater wetland systems found over this region.

## ***Atlantic Coastal Landscape*** (including salt marsh and barrier beach habitats)

This landscape encompasses parts of Monmouth, Ocean and Atlantic counties. Our Atlantic Coast beaches and marshes are among the most productive coastal habitats in the country. Despite heavy development, they support important portions of Atlantic Coast populations of colonial nesting birds, such as common terns, little blue herons and great egrets, and endangered beach nesting birds such as least terns and piping plovers. Our coastal habitats also support most of the state's ospreys and peregrine falcons, as well large numbers of northern harriers, black rails, and many other nongame species.

### ***Landscape Priority Species***

Priority species for the Landscape Project include all state and federally listed wildlife. Location data for each priority species are used to develop critical area maps and to prioritize habitat parcels. Within certain landscape regions, location data for a select group of non-listed, area-sensitive neotropical migrant landbirds are included as priority species, but carry somewhat less weight when used to prioritize habitat parcels. For a complete list of priority species for each landscape region refer to **Appendix I**.

## ***Critical Area Mapping***

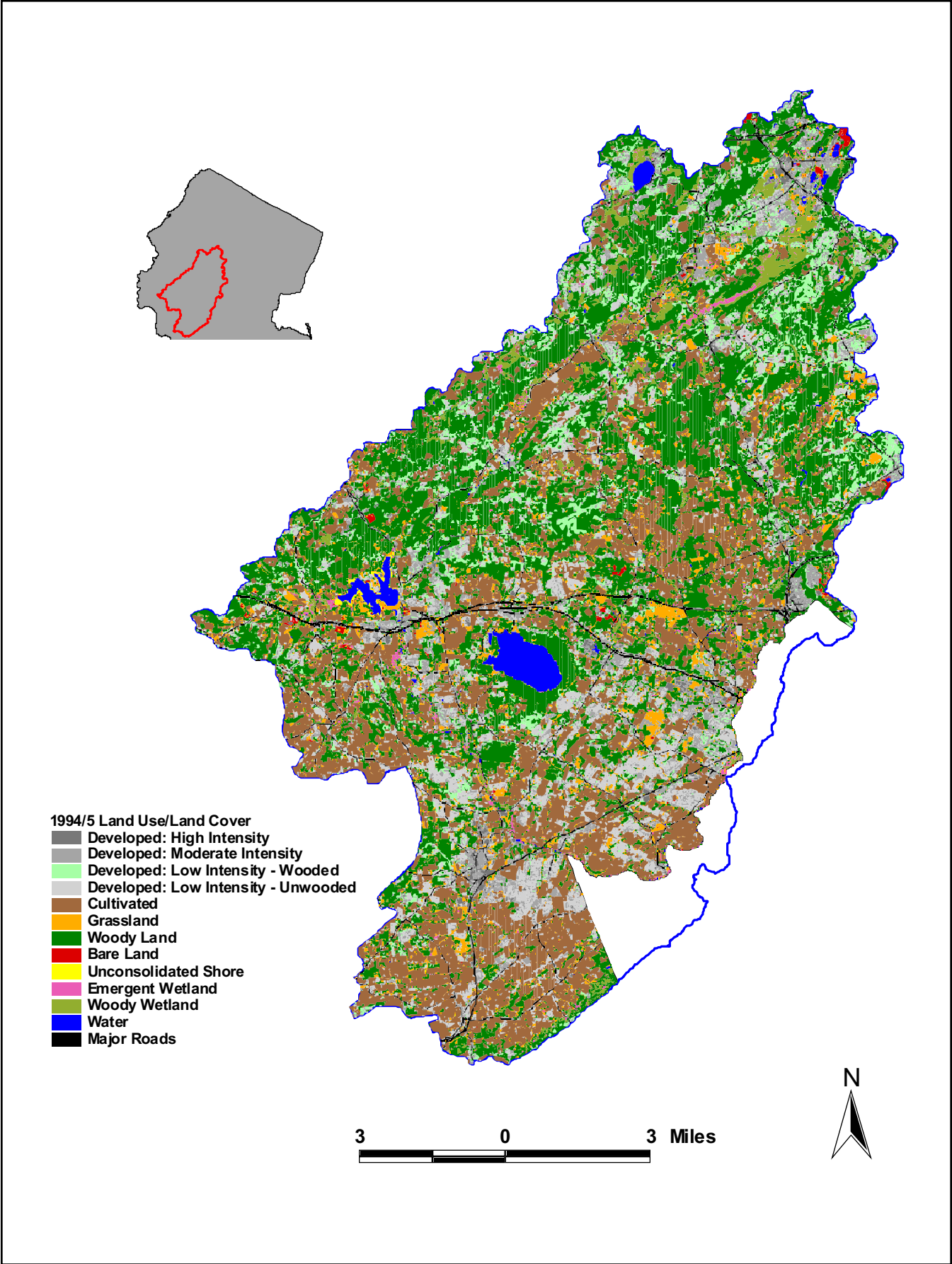
The Landscape Project provides mapping for three distinct land cover types: forest, wetlands and grasslands.

Please note: there is overlap between the forest and the wetland coverages. Forested wetlands are ranked as both wetlands and forest. This is warranted by differences in species' affinities towards the different habitat types. Those species that require forested wetlands for survival have been included in the wetlands mapping and ranking. Species that require forest habitat, but not necessarily forested wetlands, are included in the forest mapping and ranking.

### ***Forests***

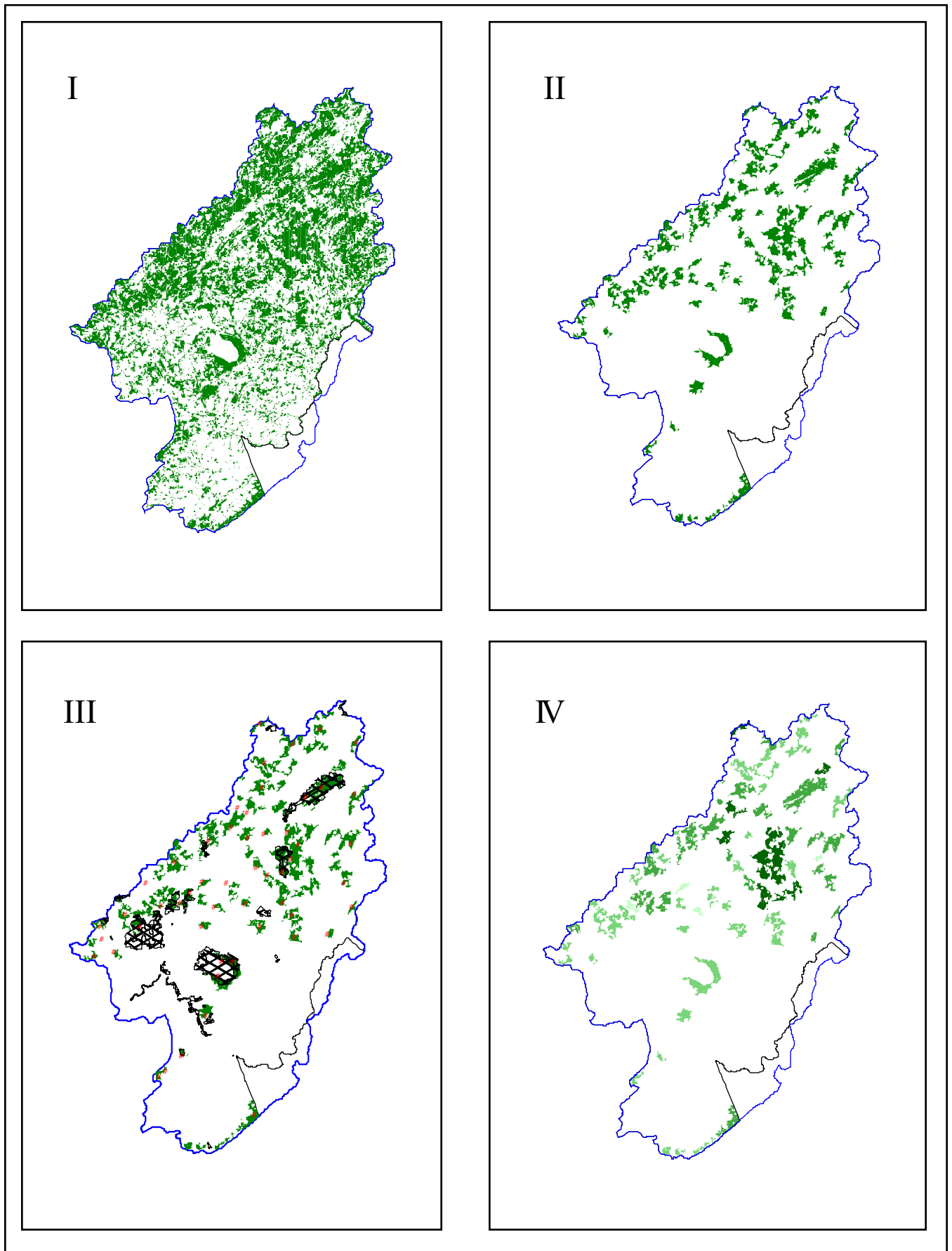
Critical area maps for forest-dependent species are generated by selecting specific features from the Department of Environmental Protection's GIS and remotely sensed land use/land cover data from Rutgers University's Center for Remote Sensing and Spatial Analysis (CRSSA) (*Illustration 6*). Using ArcInfo and ArcView GIS software the ENSP has developed a protocol to identify critical forest habitats within each landscape area (*Illustrations 7 and 8*). The methodology includes:

- Combining all of the forest types included in the land use/land cover data into one forest coverage category. This newly created data layer shows all forested habitat.
- Overlaying priority species location information on the forest coverage and ranking each parcel on a number of factors (See **Appendix IV**), such as the number of priority species found within the area and its proximity to already conserved areas.
- Delineating a 90-meter buffer surrounding all developed areas, which is then excluded from consideration since development and disturbance is likely to occur within these areas.
- Identifying core forested areas: contiguous forests undivided by major roads (county-level roads or higher) that are larger than 10 hectares, or 24.7 acres. All of this core forest is farther than 90 meters from any edge. Many of the forest priority species need large expanses of interior forest for survival. Being close to a forest edge has negative consequences for the survival and reproduction of these "area sensitive" target species. Parcels that do not meet the minimum area requirements are included in the forest coverage only if

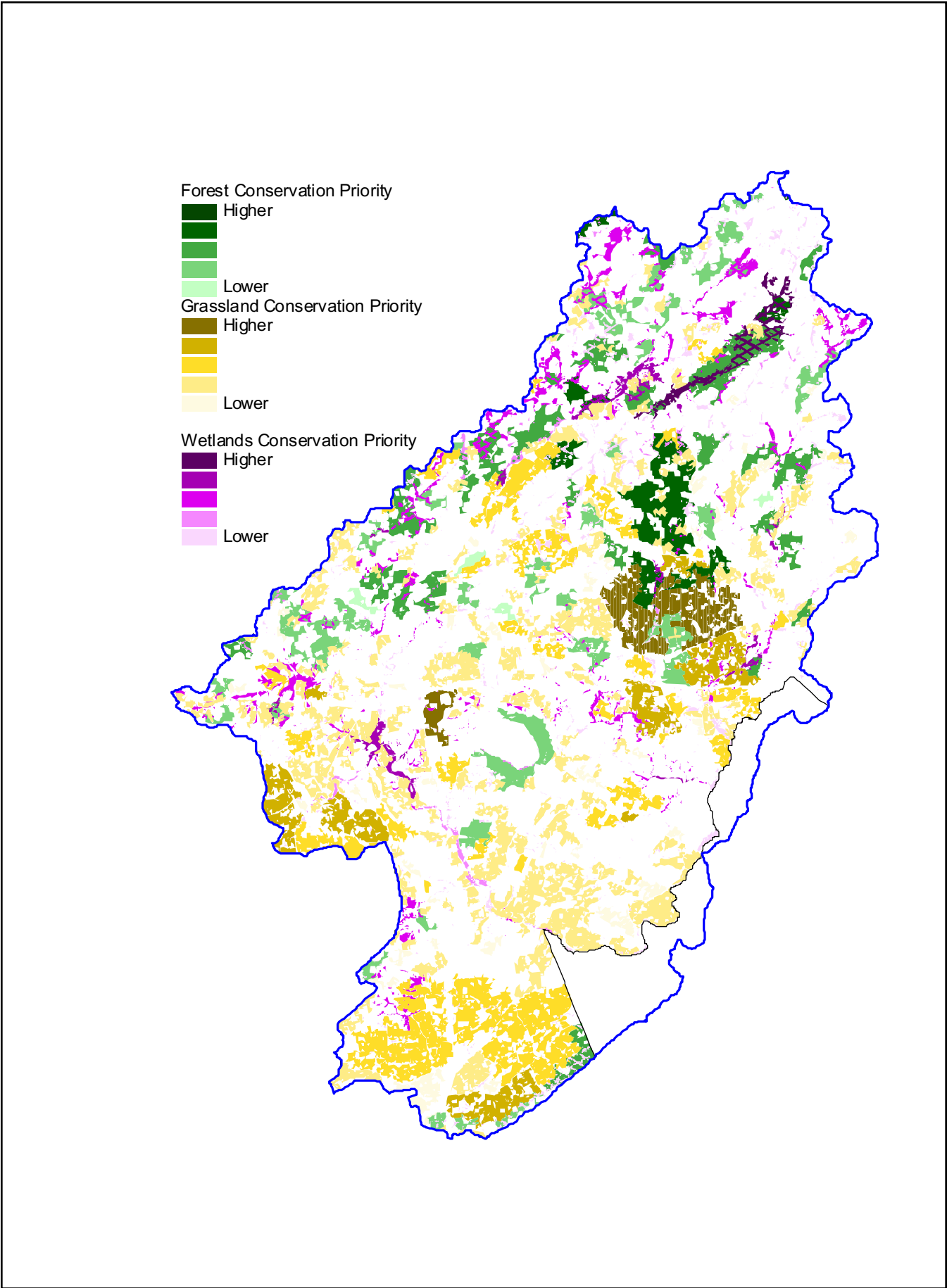


*Illustration 6. 1994-1995 land use/land cover map of Watershed Management Area 8, the North and South Branch Raritan watershed.*





**Illustration 7.** A multi-step process is used to delineate critical forest areas. (I) indicates the process of extracting forests from the land use/cover data. (II) shows the selection of forest patches meeting the minimum core size. In (III) open spaces and species data are added to the coverage. (IV) shows each parcel's priority rank.



**Illustration 8.** Landscape Project critical areas within Watershed Management Area 8, showing critical grasslands, wetlands and forests.

- they contain records of priority species. In these cases the 90 m buffer is not excluded from the parcel.
- Identifying conserved areas of forest that currently have some form of protection from development - either through ownership or regulation. These include public lands, non-government organization (NGO) conservation lands, wetlands with appropriate buffers, water supply management areas, GreenAcres properties and easements.
- Combining the previously created forest coverage with the conserved area coverage to provide a picture of all forested habitats, both protected and unprotected.

Together, key critical and conserved areas will result in large blocks of contiguous forest habitat essential to the preservation of endangered and threatened species within the landscape regions.

Exceptions to this methodology occur in the Atlantic Coastal Landscape and, within the Delaware Bay Landscape, on the lower 10 kilometers of the Cape May Peninsula. In the Atlantic Coastal Landscape, all forests (including scrub/shrub), regardless of size, are mapped as critical habitat. This is due to the importance of these habitat types to migrating birds. Within the lower 10 kilometers of the Cape May Peninsula, all forest, wetland and grassland habitats are designated as critical areas.

### ***Wetlands***

Critical area maps for wetland-dependent species are generated by selecting specific features from the Department of Environmental Protection's GIS and remotely sensed land use/land cover data from Rutgers University's CRSSA. Using ArcInfo and ArcView GIS software the ENSP has developed a protocol to identify critical wetland habitats within each landscape area. The methodology includes:

- Wetlands are divided into two basic habitat types: forested and emergent. The forested wetland coverage includes all forested and scrub/shrub wetlands. The emergent wetland coverage includes all herbaceous wetlands. These represent the vast majority of freshwater wetland habitats for priority threatened and endangered species.
- Conserved areas are then overlaid on the wetland maps. Conserved areas include the legislated 150-foot (46-meter) buffer on all wetlands that have documented occurrences of endangered and threatened species.
- A 50-foot (15-meter) buffer is placed around all other wetlands. The resulting maps identify critical wetland habitats and their proximity to other (upland) conserved areas.
- Priority species location information is then overlaid on the wetland coverage maps. Each wetland parcel is ranked by several criteria, including the number of priority species found within it and its proximity to already-conserved areas (See **Appendix IV**).
- The 150-foot buffer is often inadequate in protecting a sufficient amount of upland habitat for some wetland species. *Table 1* lists those wetland species that require a larger upland habitat buffer. A 300-meter buffer is used around wetlands where these species occur. *Table 1* includes the wetland and upland habitat type(s) required by each of these species.
- Upland habitats that are listed in *Table 1*, regardless of size, that intersect with a 300-meter buffer are considered critical. These parcels are ranked the same as any other critical area (See **Appendix IV**)

*Table 1. Wetland species that require a 300-meter buffer.*

<u>Species</u>	<u>Wetland Habitat Requirements</u>	<u>Upland Habitat Requirements</u>
Wood turtle	Forest and emergent	Forest and grassland
Blue-spotted salamander	Forest	Forest
Tremblay's salamander	Forest	Forest
Eastern tiger salamander	Forest	Forest and barren land
Southern gray treefrog	Forest	Forest
Pine Barrens treefrog	Forest	Forest

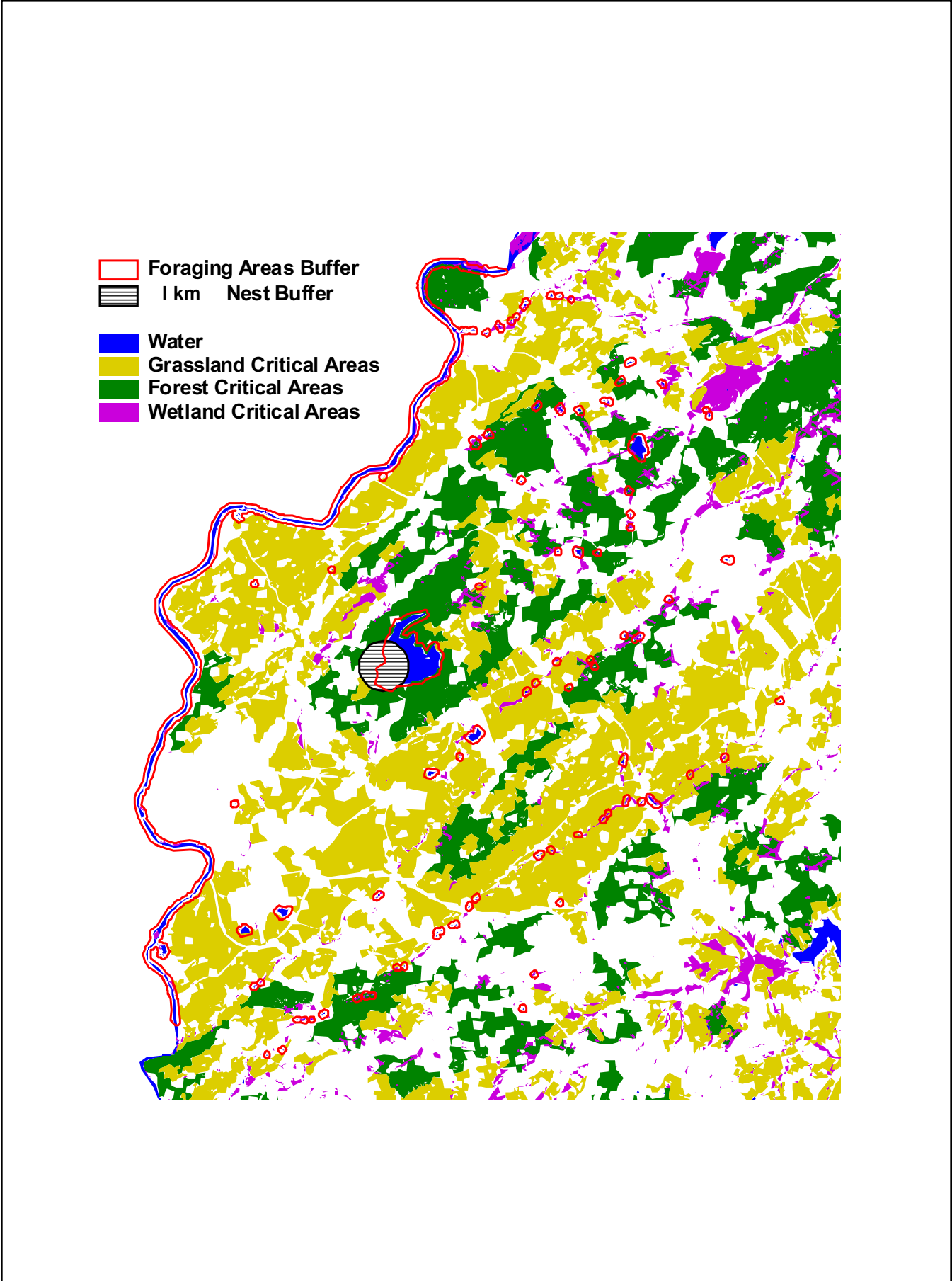
- Within the Delaware Bay and Atlantic Coastal Landscape Regions high marsh and low marsh habitats are differentiated from basic wetlands. This allows for a higher ranking to be applied to high marsh habitats based on their importance to nesting marsh species such as northern harriers, short-eared owls and black rails.

### ***Grasslands***

Critical area maps for grassland-dependent species were generated by selecting specific features from the Department of Environmental Protection's GIS and remotely sensed land use/land cover data from Rutgers University's CRSSA. Using ArcInfo and ArcView GIS software the ENSP has developed a protocol to identify critical grassland habitats within each landscape area. The methodology includes:

- Combining all open habitat types — grassland and other open habitat classifications in the agriculture data layer of the GIS — into one grassland coverage category.
- Eliminating all grassland parcels less than 18 hectares, or about 45.5 acres. Ten hectares, or 24.7 acres, is the minimum size grassland parcel needed to support viable populations of several of the priority grassland species. However, the literature also reports that significant predation losses occur within 50 to 55 meters of grassland edges. Therefore, this area of increased predation was added to the 10-hectare-minimum area requirement, resulting in the 18 hectare minimum. Grassland parcels that do not meet the minimum area requirement are included in the coverage only if they contain records of priority species.
- Overlaying priority species location on the grassland coverage maps. Each grassland parcel was ranked by several criteria, including the number of priority species found within each grassland area and its proximity to already conserved areas.

This procedure was completed for each of the three habitat types and resulted in map products that depict critical areas ranked by priority (*Illustrations 8, 10 and 11*). In determining critical habitat areas, some species-specific exceptions were utilized to account for their particular habitat and/or area requirements (See **Appendix III**). For example, to avoid undue disturbance, all parcels within a one-kilometer radius around each active bald eagle nest are considered critical habitat, and bald eagle foraging areas also receive special consideration (*Illustration 9*). Previously, only habitat within a 1/2 mile of a nest was given consideration for disturbance.



*Illustration 9. Bald eagle nest disturbance buffer and foraging habitat.*



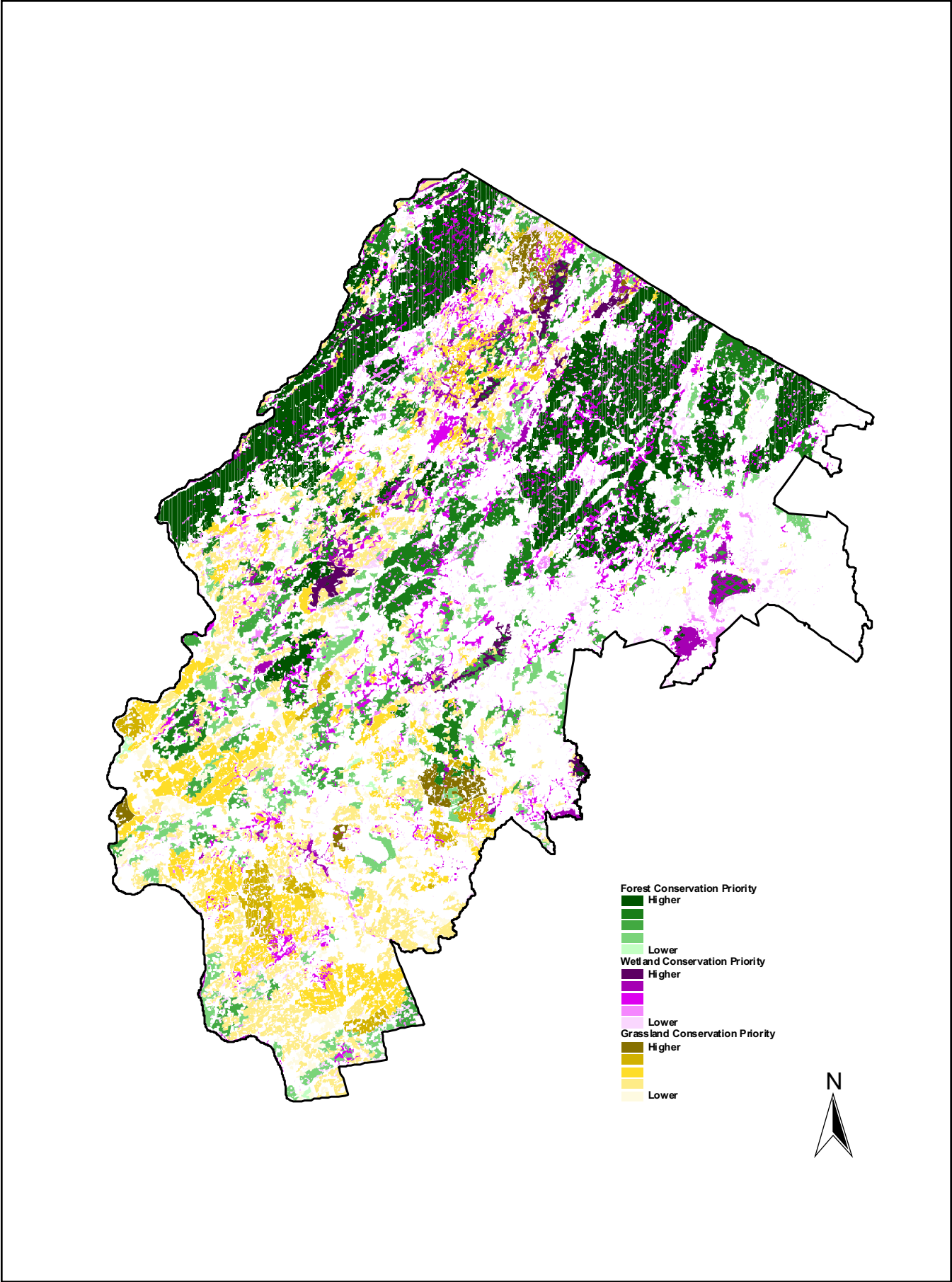
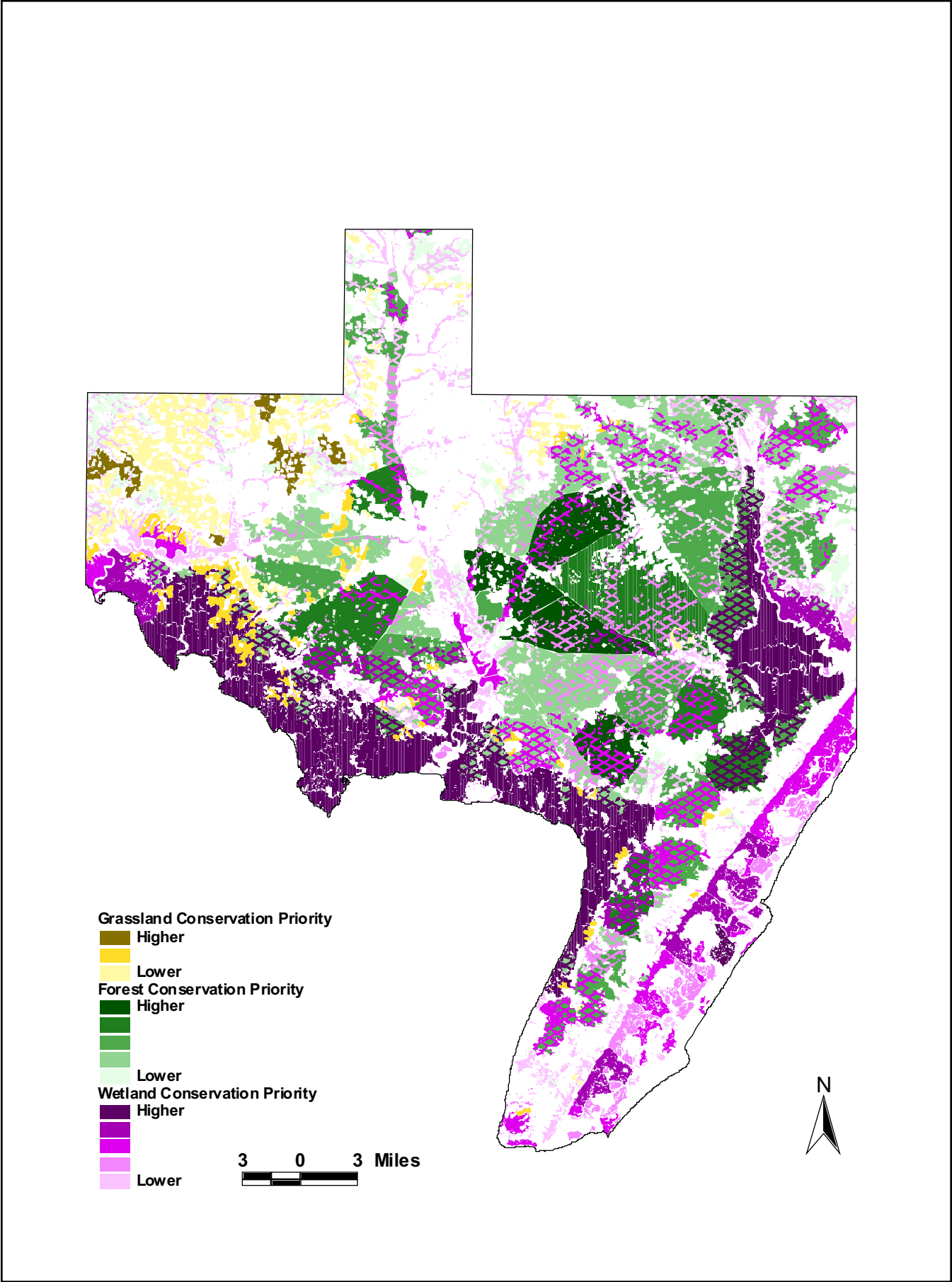


Illustration 10. Skylands Landscape Region critical areas map.



*Illustration 11. Delaware Bay Landscape Region critical areas map.*

## Appendix I. Target Species for the Landscape Regions

<u>Species</u>	<u>Delaware</u>	<u>Highlands</u>	<u>Pinelands</u>	<u>Coastal</u>
<u>Birds</u>	<u>Bay</u>			<u>* migration</u>
				<u>**winter</u>
<b>Neotropical Migrants</b>				
Acadian Flycatcher	x	x	x	x*
Blackburnian Warbler		x		x*
Black-billed Cuckoo	x	x	x	x*
Black and White Warbler	x	x	x	x*
Black-throated Blue Warbler		x		x*
Black-throated Green Warbler		x	x	x*
Blue-gray Gnatcatcher	x	x	x	x*
Broad-winged Hawk	x	x	x	x*
Canada Warbler		x		x*
Cerulean Warbler		x		x*
Eastern Wood-peewee	x	x	x	x*
Great-crested Flycatcher	x	x	x	x*
Hermit Thrush		x		x*
Hooded Warbler	x	x	x	x*
Kentucky Warbler	x	x	x	x*
Least Flycatcher		x		x*
Louisiana Waterthrush	x	x	x	x*
Northern Parula Warbler		x		x*
Northern Waterthrush		x		x*
Ovenbird	x	x	x	x*
Pine Warbler	x	x	x	x*
Prothonotary Warbler	x	x	x	x*
Red-eyed Vireo	x	x	x	x*
Rose-breasted Grosbeak		x		x*
Ruby-throated Hummingbird	x	x	x	x*
Scarlet Tanager	x	x	x	x*
Solitary Vireo		x		x*
Summer Tanager	x		x	x*
Veery		x		x*
Wood Thrush	x	x	x	x*
Worm-eating Warbler	x	x	x	x*
Yellow-billed Cuckoo	x	x	x	x*
Yellow-throated Vireo	x	x	x	x*
Yellow-throated Warbler	x		x	x*
Osprey - Threatened	x			x
Savannah Sparrow - Threatened	x	x	x	x*
Grasshopper Sparrow - Threatened	x	x	x	x*
Bobolink - Threatened		x	x	x*
Upland Sandpiper - Endangered	x	x	x	x*

**Species (cont'd.)**

	<b><u>Delaware</u></b> <b><u>Bay</u></b>	<b><u>Highlands</u></b>	<b><u>Pinelands</u></b>	<b><u>Coastal</u></b> <b><u>* migration</u></b> <b><u>**winter</u></b>
<b><i>Birds (cont'd.)</i></b>				
<b><i>Short-distance Migrants</i></b>				
Bald Eagle - Endangered	x	x	x	
Black Rail - Threatened	x			x*
Cooper's Hawk - Endangered	x	x	x	x*
Great Blue Heron	x	x	x	x*
Little Blue Heron - Threatened	x	x		x*
Long-eared Owl - Threatened	x	x	x	
Pied-billed Grebe - Endangered	x	x	x	x*
Northern Goshawk - Threatened		x		
Northern Harrier – Endangered	x		x	x
Red-headed Woodpecker - Threatened	x	x	x	
Red-shouldered Hawk - Endangered	x	x	x	
Sedge Wren - Endangered	x	x		
Sharp-shinned Hawk	x	x		x*
Short-eared Owl - Endangered	x			x* x**
Winter Wren		x		
Yellow-crowned Night Heron- Threat.		x		x*
Vesper Sparrow - Endangered	x	x		
Henslow's Sparrow - Endangered	x	x	x	
<b><i>Resident</i></b>				
Barred Owl - Threatened	x	x	x	
<b><i>Reptiles</i></b>				
Bog Turtle - Endangered		x	x	
Wood Turtle - Threatened	x	x	x	
Northern Pine Snake - Threatened	x		x	
Corn Snake - Endangered	x		x	
Timber Rattlesnake - Endangered	x	x	x	
<b><i>Amphibians</i></b>				
Blue-spotted Salamander - Endangered		x		
Long-tailed Salamander - Threatened		x		
Eastern Tiger Salamander - Endangered	x		x	
Southern Gray Treefrog - Endangered	x		x	
Pine Barrens Treefrog - Endangered	x		x	
<b><i>Mammals</i></b>				
Bobcat - Endangered	x	x	x	
Indiana Bat - Endangered		x		
Eastern Woodrat - Endangered		x		

## **APPENDIX II. Wetland Species habitat requirements**

<u>Species</u>	<u>Wetland type</u>	
	<u>Forest</u>	<u>Emergent</u>
Bald Eagle	X	X
Red-shouldered hawk	X	
Northern harrier		X*
Short-eared owl		X*
Barred owl	X	
Bobolink		X
Sedge wren		X
Henslow's sparrow		X
Black rail		X*
Great blue heron	X	X
Little blue heron		
Yellow-crowned night heron		
Wood turtle	X	X
Timber rattlesnake	X	
Blue-spotted salamander	X	
Tremblay's salamander	X	
Long-tailed salamander	X	
Eastern tiger salamander	X	
Southern gray treefrog	X	
Pine barrens treefrog	X	
Bobcat	X	X

\*Species uses high marsh habitat in the coastal area.



### **APPENDIX III. Critical area designation for select species**

#### **Bald Eagle**

**Nest Sites** – All habitat within a 1 Km radius around each active bald eagle nest is designated as critical habitat in order to protect it from disturbance. This is applied to any nest that has been active within the previous five years.

**Foraging Areas** –a radius around the nest site is incrementally increased, one cell (30 m) at a time, until an area of 660 ha of foraging habitat has been identified. Foraging habitat is defined as shoreline, a 100 m wide upland buffer and out to a point 1 km from the shoreline. Foraging habitat is only calculated on bodies of water with a minimum area of 3 km<sup>2</sup>. This 660 ha of foraging habitat is designated as acritical area. Bodies of water less than 3 km<sup>2</sup> will not be included in the calculation of foraging habitat.

#### **Great Blue Heron**

All active heron colonies, including a 0.5 km wide area around its perimeter, are designated as critical to protect nesting birds from disturbances.

#### **Red-shouldered Hawk and Barred Owl**

All records in the database represent breeding season locations. Therefore, a 1 km radius around each sighting location is designated as critical area.

#### **Timber Rattlesnake**

##### *Skylands Landscape*

Timber rattlesnake den locations plus a 2 km radius around their perimeter are designated as critical habitat. A 2 km radius of habitat is adequate in protecting the vast majority of female gestating and birthing areas, transient habitat, and some foraging habitat. Most gestating and birthing areas in this part of the state occur within a few to several hundred meters of the den location.

##### *Pinelands and Delaware Bay Landscapes*

Any portion of a stream (including intermittent) within 2.5 km of a timber rattlesnake occurrence (seconds precision only) is considered “potential hibernacula.” The “critical area” will be the “potential hibernacula” plus a 1 km wide area of habitat along the designated stream corridors.

#### **Bog Turtle**

Intensive research by the ENSP during the past five years has resulted in a very strong data set for wetland polygons where bog turtles are known to occur, and where suitable habitat exists but presence has not yet been confirmed. These identified polygons have been digitized and form the basis for our bog turtle critical wetland habitat mapping. We are currently tracking bog turtle populations by metapopulations or PAS's (population analysis sites). PAS's are defined by a national peer group approved set of criteria. Basically, a PAS is a single or multiple sites within the same stream drainage where turtles can potentially move between sites that are not isolated by major roads, water bodies, large streams, etc. Sites within the same drainage that are isolated by these barriers are considered separate PAS's. We have included potentially suitable habitats where presence has not yet been documented within PAS's where turtles are known to occur for two reasons. First, there is a good possibility these sites support bog turtles. Secondly, they provide alternative habitats for turtles migrating away from occupied sites in the same drainage that become unsuitable.

Bog turtle critical habitat will be defined as follows:

- All wetland polygons where turtles have been found within the last 15 years.
- Potentially suitable habitats within PAS's that have known occurrences.
- In PAS's containing multiple sites, (both occupied and suitable habitat) travel corridors are delineated in an attempt to give conservation priority to dispersal routes important to long term population viability. Palustrine emergent, scrub-shrub, modified agricultural wetland polygons and stream corridors that serve as dispersal corridors between sites within a PAS are delineated as bog turtle habitat.
- Delineated habitat (both the actual site and connecting corridors) within PAS's that contain multiple sites is given additional weight under the ranking system.

### **Indiana Bat**

Known Indiana bat hibernacula, including a 2 km radius around it, are designated as critical habitat to protect the integrity of the forests around the portal.

### **Red-headed Woodpecker**

Only point location data is used for this species. However, due to its habitat preference the red-headed woodpecker is considered as a target species in both the forest and grassland habitat coverages.

### **Colonial Waterbirds and Wading Birds** (Black Skimmer, Terns, Piping Plover and Coastal Herons)

Delineated nesting areas plus a 150 m area around their perimeters are designated as critical habitat in the Atlantic Coastal Landscape.

### **Peregrine Falcon**

All tower nesting locations with a 1 km radius are designated as critical areas.

### **Northern Harrier**

All breeding locations with a 1 km radius are designated as critical areas.

### **Osprey**

All nesting locations with a 1 km radius are designated as critical areas.

### **Black Rail**

All breeding locations with a 75 m radius are designated as critical areas.

### **Lower 10 Km of Cape May Peninsula**

All forest, wetland, scrub/shrub and grassland habitats located on the lower 10 km of the Cape May peninsula are designated as critical areas.

## **Appendix IV. Critical Area Ranking**

All habitat parcels that were selected as critical will be ranked according to the following criteria: The rankings will provide a means of prioritizing protection for critical areas.

- Species location data are overlaid on the critical area (forests, wetlands and grasslands) maps. Each critical area is assigned a value based on the number of priority species that fall within its boundaries. A point value of 1 is added for each species that falls within a critical area polygon.

### **EXCEPTIONS:**

Bald eagles: Due to the need to protect both the area around the nest site and critical foraging habitat, a nest will add 1 ranking point and the foraging area will add another ranking point if they occur in the same critical area polygon.

Northern Pine Snakes: The ENSP has developed a habitat model for northern pine snakes based on soils and vegetation resulting in the designation of primary habitat type. If mapped primary habitat types intersect with forest polygons they receive an additional ranking point. A sighting location also adds a ranking point to a forest polygon but they are not cumulative. A parcel can receive only one ranking point for northern pine snakes – either through the occurrence of a sighting location in a critical forest polygon or the intersection of a mapped primary habitat type and a critical forest polygon.

Bog turtles: The following criteria adds one ranking point to a critical area polygon:

A wetland polygon where turtles have been found within the last 15 years.

Potentially suitable habitats within Population Analysis Sites (PAS's) that have known occurrences.

The following criteria adds an additional ranking point to a critical area polygon:

All PAS's containing multiple sites, (both occupied and suitable habitat) and travel corridors are delineated in an attempt to give conservation priority to dispersal routes important to long-term population viability.

Palustrine, emergent, scrub-shrub, modified agricultural wetland polygons and stream corridors that serve as dispersal corridors between sites within a PAS are delineated as bog turtle habitat.

- The occurrence of three or more neotropical migrant bird species in one critical area polygon adds one ranking point.
- Conserved areas are defined as state open space and land protected through regulation. Proximity of a critical area polygon to a conserved area imparts a greater value to that parcel. However, state open space lands are considered more secure than those receiving only protection through state regulations are. Therefore, after critical area polygons have been ranked according to the criteria above, all polygons that are directly adjacent (within 2 pixels or 60 m) to state open space conserved areas are multiplied by 1.5 to increase their ranking and priority for protection. Critical area polygons adjacent to conserved areas protected through state regulations will be multiplied by 1.2 to increase their ranking and priority for protection. Justification for this lies in the basic strategy of the landscape project, which is to build on existing conserved areas.

Each mapped critical area appears on the map as a shaded color from light to dark (5 categories) indicating its relative priority ranking. Category 1 parcels correspond to the lightest shade and thus the lowest priority ranking. Parcels in categories 2 through 5 are progressively darker shades and represent a higher priority ranking. The categories are defined as follows:

Category 1 parcels meet the minimum area requirement, but no data exists for the presence of priority species.

Category 2 parcels meet the minimum area requirement and are proximate to a conserved area, but no data exists for the presence of priority species.

Category 3 parcels may have one or two priority species present and may or may not meet the minimum area requirement or be proximate to a conserved area.

Category 4 and 5 parcels have at least two species present and may or may not meet the minimum area requirements or be proximate to a conserved area.

## ***Appendix V. Landscape Project Peer Review Group***

<b><i>Name</i></b>	<b><i>Affiliation</i></b>
Dr. James Applegate	Rutgers University
Dr. Joanna Burger	Rutgers University
Dr. Tim Casey	Rutgers University
Dr. David Ehrenfeld	Rutgers University
Dr. Joan Ehrenfeld	Rutgers University
Dr. David Fairbrothers	Rutgers University
Ernie Hahn	NJDEP, Office of Natural Resource Damage
Marjorie Kaplan	NJDEP, Division of Science and Research
Dr. Michael Klemmens	Wildlife Conservation Society, Bronx Zoo
Kim Laidig	NJ Pinelands Commission
Dr. Richard Lathrop	Rutgers University
Trish Maggio	NJ Office of State Planning
Kristie McDonald	Wildlife Conservation Society, Bronx Zoo
Dr. Peter Morin	Rutgers University
Dr. Burt Murray	Rutgers University
Joan Walsh	New Jersey Audubon
Dr. Robert Zampella	NJ Pinelands Commission

## ***Appendix VI. Land Management and Land Use Regulation Working Group***

<b><i>Name</i></b>	<b><i>Affiliation</i></b>
Jeanette Bowers-Altman	NJDEP, Endangered & Nongame Species Prog.
Tom Breden	NJDEP, Natural Heritage Program
Robert J. Cartica	NJDEP, Office of Natural Lands Mgmt.
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Terry Fowler	NJDEP, Office of Environmental Planning
Jim Haase	NJDEP, Division of Parks and Forests
Rich Hall	NJDEP, Division of Fish, Game & Wildlife
Anne Heasley	The Nature Conservancy
Jay Laubengeyer	Cumberland County Planning Office
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Larry Torok	NJDEP, Land Use Regulation
Audrey Wendolowski	NJDEP, Land Use Regulation
Kelly Wolcott	USFWS, Cape May National Wildlife Refuge

## ***Appendix VI. Land Use/Land Cover Report***

### **Mapping New Jersey's Changing Landscape**

**Project leader: Rick Lathrop, Rutgers University Center for Remote Sensing and Spatial Analysis**

The land use/land cover data that forms the basis of the Landscape Project's critical area mapping efforts was produced by the Rutgers University Center for Remote Sensing and Spatial Analysis (CRSSA). A variety of remotely sensed and geographic information system (GIS) data sets were used to map the land cover across New Jersey during the mid-1990's.

Digital color infrared orthophotography acquired by the U.S. Geological Survey in 1995 and 1997 was used to update the NJ Department of Environmental Protection's 1986 land use maps. Areas of new development (subsequent to 1986) were then interpreted and digitized on-screen. The original 1986 methodology was used as a guideline for both the digitizing and quality control processes to ensure consistency. The land use data was then integrated with satellite remotely sensed data to map land cover. Landsat Thematic Mapper (TM) imagery were acquired for cloud-free dates in 1994 and 1995 (November 4, 1994 and September 4, 1995). The November "leaf-off" imagery was taken after normal deciduous plant leaf fall, allowing the clearer differentiation of evergreen vs. deciduous forests. The September "leaf-on" imagery permits the further discrimination of cultivated, wetland and developed areas. The ground resolution cell for Landsat TM imagery is 30 meters x 30 meters. A combination of computer classification approaches were used to classify the Landsat TM image using the ERDAS IMAGINE image processing software. One channel from the visible, near infrared and middle infrared spectral wavelengths was used to adequately characterize the vegetation. Incorporation of additional GIS mapped data was used to provide further improve the delineation of wetland areas. Existing digital data sets such as U.S. Fish and Wildlife Service National Wetland Inventory, New Jersey Department of Environmental Protection Freshwater Wetlands and Soil Conservation county soils data were incorporated into the classification process as either pre-classification stratification or post-classification modification. The final New Jersey land cover map includes over 30 different classes of land cover/habitat types. The minimum mapping unit is approximately 0.5 acre.



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