2. Maurice River Watershed

a. Habitats
b. Wildlife of Greatest Conservation Need
c. Threats to Wildlife and Habitats
d. Conservation Goals
e. Conservation Actions
f. Potential Partnerships to Deliver Conservation
g. Monitoring success

a. Habitats

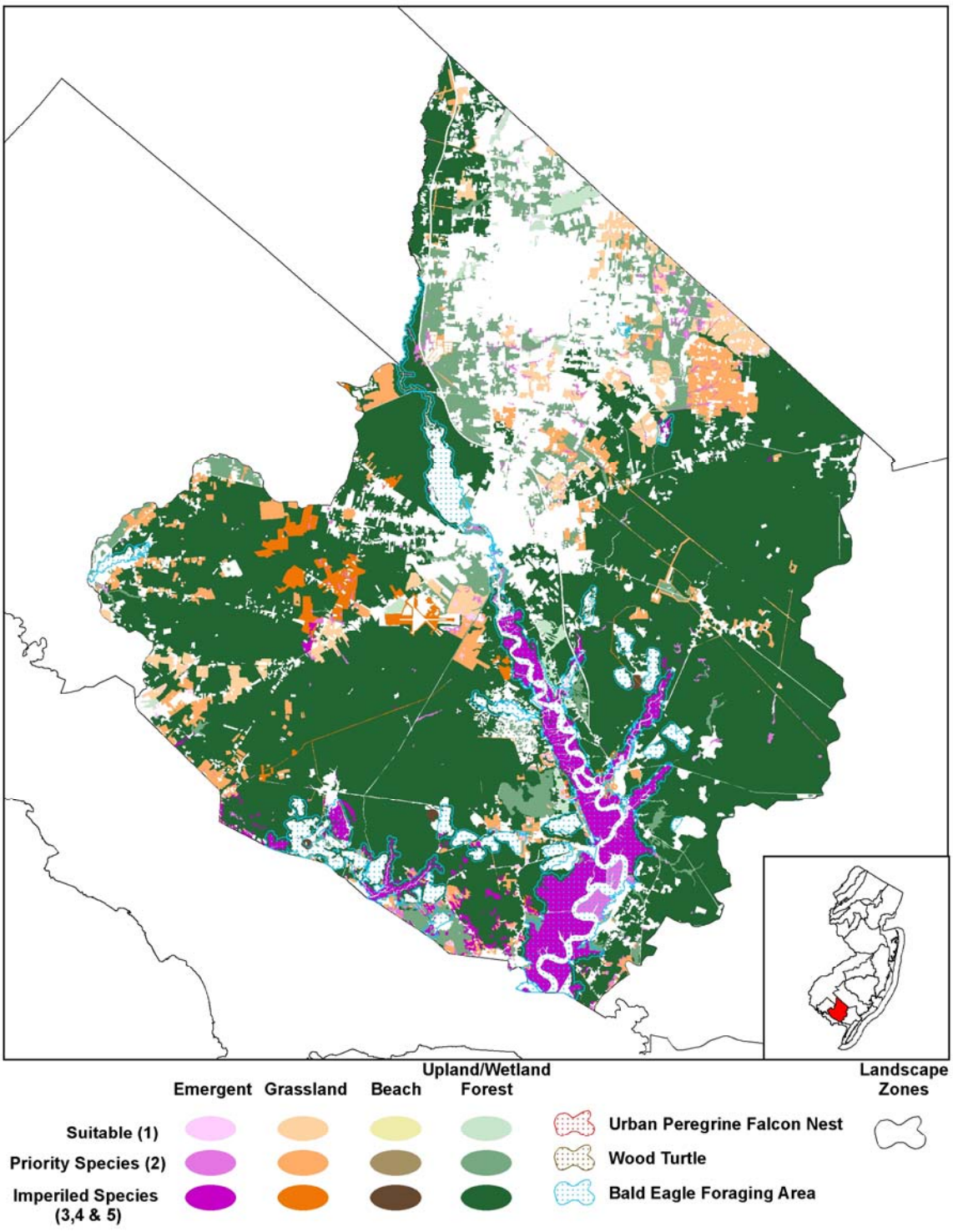
The nationally designated Wild and Scenic Maurice River is the western edge of the Pinelands National Reserve and is an important link between Pinelands and estuary habitats of Delaware Bay (Figure 13). Marshes of the Maurice River and its tributaries include the largest tidal, freshwater emergent marshes in New Jersey. Large tracts of undeveloped wetland forest and pine and oak upland forest characteristic of the Pinelands are found along the banks of the Maurice River. The Maurice River and its tributaries (the Manumuskin, Menantico, and Muskee creeks) hold habitats that are significant for many rare wildlife and plant populations.

This zone is most notable for large forest tracts, both upland and wetland, that are critical to the continuation of much of southern New Jersey's forest-interior wildlife populations. Fortunately for many rare species, large areas of state and conservation lands are found in this zone, including Union Lake WMA, Peaslee WMA, Buckshutem WMA, Clarks Pond WMA, Menantico Pond WMA, Millville WMA, Bear Swamp East Natural Area, and parts of Heislerville and Nantuxent WMAs. Manumuskin River Preserve and the Glades Wildlife Refuge are major holdings of conservation organizations.

b. Wildlife of Greatest Conservation Need

This zone is most notable for large forest tracts that support southern New Jersey's forest-interior bird populations, including barred owls and red-shouldered hawks, as well as northern pine snakes and forest-dwelling bats. The Maurice River, its tributaries, and the associated forests form the center of one of the densest nesting and wintering populations of bald eagles in the state. Indeed, Bear Swamp Natural Area hosts the oldest continuously-occupied eagle nest in the state, and the Maurice River has supported the state's most significant eagle wintering population since the 1970s. The Maurice River marshes host one of the largest fall populations of sora rails in the Atlantic Flyway and also serve as a key spring staging area for northern pintails. Wetlands associated with the river and its tributaries are important for rare amphibian populations such as the eastern tiger salamanders, Southern gray treefrogs, and Pine Barrens treefrogs. Rare butterfly, moth, dragonfly, and damselfly populations are found in microhabitats of the riverine system as well as in upland forests and rights-of-way, the benefactors of land dedicated to conservation. Tables DB15 – DB21 identify the species of greatest conservation need within this zone.

Figure 13. Critical landscape habitats within the Maurice River Watershed conservation zone, as identified through the Landscape Map (v2).



Wildlife Species and Associated Habitats of Maurice River Watershed

Table DB15. Federal Endangered Species*

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Indiana bat				X**

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife
**Potential presence.
X: Species occurs within the identified habitat.

Table DB16. State Endangered Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Bobcat				R
Birds				
American bittern		R		
Bald eagle		X	X	X
Least tern		X		
Northern harrier		X	X	
Peregrine falcon		X		
Red-shouldered hawk				X
Vesper sparrow			X	
Reptiles				
Corn snake				X
Timber rattlesnake				X
Amphibians				
Cope's gray treefrog		X		X
Eastern tiger salamander				X
Insects				
Bronze copper		X		

R: Research and possible restoration.
X: Species occurs within the identified habitat.

Table DB17. State Threatened Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
Barred owl				X
Black rail		X		
Black-crowned night heron		X		
Bobolink			X	X
Cooper's hawk				X
Grasshopper sparrow			X	
Long-eared owl				R**
Osprey		X		
Red knot		X		
Red-headed woodpecker				X
Savannah sparrow			X	
Reptiles				
Northern pine snake				X
Amphibians				
Pine Barrens treefrog		X		X
Insects				
Frosted elfin		X		X

**Suspected presence.
R: Proposed reintroduction of species.
X: Species occurs within the identified habitat.

Table DB18. Nongame Species of Conservation Concern

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Eastern red bat				X*
Eastern small-footed myotis				X*
Hoary bat				X*
Silver-haired bat				X*
Southern bog lemming			X	X
Birds				
Acadian flycatcher				X
American kestrel			X	
Baltimore oriole				X
Black-and-white warbler				X
Black-billed cuckoo				X
Blackburnian warbler				X
Black-throated green warbler				X
Blue-winged warbler				X
Broad-winged hawk				X
Brown thrasher				X
Canada warbler				X
Chimney swift			X	
Chuck-will's-widow				X
Common barn owl			X	
Eastern kingbird			X	X
Eastern meadowlark			X	
Eastern screech-owl				X
Eastern towhee				X
Eastern wood-peewee				X
Field sparrow			X	
Gray catbird			X	X
Great blue heron		X		
Great crested flycatcher				X
Great egret		X		
Green heron		X		
Hooded warbler				X
Horned lark			X	
Kentucky warbler				X
King rail		X		
Least bittern		X		
Least tern		X		
Little blue heron		X		
Louisiana waterthrush				X
Marsh wren		X		
Northern flicker				X
Northern parula				X
Pine warbler				X
Prairie warbler				X
Prothonotary warbler				X
Saltmarsh sharp-tailed sparrow		X		
Scarlet tanager				X
Seaside sparrow		X		
Semipalmated sandpiper		X		
Sharp-shinned hawk				X
Snowy egret		X		
Spotted sandpiper		X		
Veery				X
Whip-poor-will				X
Willet		X		
Willow flycatcher				X
Wood thrush				X
Worm-eating warbler				X
Yellow-billed cuckoo				X
Yellow-breasted chat				X
Yellow-throated vireo				X

Nongame Species of Conservation Concern (continued)

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds (continued)				
Yellow-throated warbler				X
Reptiles				
Eastern box turtle				X
Eastern king snake				X
Northern diamondback terrapin		X		
Spotted turtle		X		X
Amphibians				
Carpenter frog		X		X
Fowlers toad		X		X
Marbled salamander		X		X
Insects				
Dotted skipper		X	X	
Hessel's hairstreak				X
A geometrid moth, Idaea violacearia				X
A noctuid moth, *Apamea inebriata*			X	
A noctuid moth, *Macrochilo santerivalis*			X	
A noctuid moth, *Macrochilo sp 1*			X	
Half yellow moth, *Tarachidia semiflava*			X	
Pine Barrens bluet, *Enallagma recurvatum*		X		
Precious underwing, *Catocala pretiosa pretiosa*				X
Rare skipper, *Problema bulenta*				X
Rippled wave, *Idaea obfusaria*			X	
Scarlet bluet, *Enallagma pictum*		X	X	
The consort, or consors underwing, *Catocala consors sorsconi*				X

*Potential presence.
X: Species occurs within the identified habitat.

Table DB19. Game Species of Regional Priority

Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
American black duck	X	X		
American woodcock				X
Canada Goose (Atlantic population)	X	X		
Clapper rail		X		
Northern bobwhite			X	X
Northern pintail	X	X		
Virginia rail		X		
Sora		X		
Wood duck		X		

X: Species occurs within the identified habitat.

Table DB20. Fish Species
Note: Species identified within the table are nongame species within New Jersey, currently without state or regional status.

Common Name	Water
Fish	
Margined madtom (*Noturus insignis*)	X

X: Species occurs within the identified habitat.

Table DB21. Game Species
Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJDFW to be species of concern.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
River otter	X	X		
Birds				
Sora rail		X		

X: Species occurs within the identified habitat.

c. Threats to the Wildlife and Habitats of the Maurice River Watershed

For complete literature review on the impacts of habitat loss and fragmentation, please see New Jersey's Landscape Project Report, Attachment A or visit our website: www.njfishandwildlife.com/ensp/landscape/lp_report.pdf

The Maurice River area is notable for large contiguous forest tracts that support populations of endangered and threatened forest wildlife, and much of that land is in conservation ownership. Threats, however, exist in the form of forest fragmentation due to development, primarily by the residential and industrial expansion of Millville and Vineland. Those two municipalities have the least amount of wildlife habitat remaining, while the townships of Downe, Lawrence, Commercial and Maurice River still contain larger forested areas. Forest interior wildlife species are particularly sensitive to fragmentation that opens the forest canopy and improves conditions for predators and competing edge species. Thus widening roads, creating power lines and converting forests to nursery operations are all threats. Sand and gravel operations have created large gaps in habitats, and most continue to impinge further on upland and swamp forests. The river ecosystem may be threatened by invasive species such as phragmites, and contaminants from nearby industry and oil spills. Also see Section I-E "Threats to Wildlife and Habitats" (page 17) of this document.

d. Conservation Goals

- Identify, protect, enhance and/or restore endangered, threatened and special concern wildlife and fish populations and their habitats through full implementation of Landscape Project.
- Protect and enhance large, contiguous forest habitats identified by the Landscape Project for forest dependent species such as bald eagles and interior-forest passerines and raptors (especially red-shouldered hawks and barred owls).
- Protect and enhance freshwater wetland and open water habitats and water quality for ospreys, Cope's (Southern) gray treefrogs, eastern tiger salamanders, Pine Barrens treefrogs, foraging colonial waterbirds and waterfowl, and rare fish.

- Protect and enhance the tidal wetlands and open waters of the Maurice River and its tributaries for ospreys, foraging colonial waterbirds and waterfowl**.**
- Protect and enhance patch habitats for bronze copper and frosted elfin populations, and scrub-shrub bird communities where possible. Scrub-shrub habitats consist of areas with >25% woody vegetation <20 feet in height.
- Inventory and monitor endangered, threatened, and special concern wildlife in the Maurice River, its tributaries, and Bear Swamp forests, particularly forest-interior and forest-dependent wildlife, and rare fish, in addition to rare Lepidoptera and Odonata species.
- Prevent, stabilize, and reverse declines of interior-forest raptors and passerines (primarily), and stabilize populations of northern pine snakes, corn snakes, freshwater wetland birds, frosted elfins, special concern reptiles and amphibians, rare dragonflies and damselflies, butterflies and moths, and stabilize and reverse declines of rare fish populations such as the margined madtom.
- Maintain and enhance populations of nesting and wintering bald eagles, ospreys and northern harriers associated with the Maurice River and its tributaries.
- Monitor, maintain, and enhance populations of breeding, migratory and wintering waterfowl of conservation concern.
- Identify and survey habitats for presence of rare invertebrate wildlife, including damselflies, dragonflies, butterflies and moths.
- Maintain ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife
- Prevent illegal collection of rare reptiles and amphibians.
- Protect and enhance important and unique natural communities.
- Assess large-scale habitat change (every five to 10 years).
- Promote public education and awareness, wildlife conservation, and viewing opportunities.

e. Conservation Actions

The actions below are identified as primary (1° or priority) and secondary (2°). Prioritization was determined by the Delaware Bay Regional Landscape stakeholders during a meeting held on September 12, 2007 (see *Attachment J*). These actions, with a focus on the priority actions, should be incorporated in planning and project development in conjunction with the priority state-level objectives (goals) and strategies (actions).

Priority	Conservation Actions
Protect wildlife habitat through implementation of Landscape Project mapping	
1º	Revise existing Landscape Project species occurrence areas through research and, where lacking, develop new species occurrence areas as data on species habitat requirements become available. Develop, review, and improve species-habitat associations as new land use/land cover data become available. *(Protect habitat – Landscape Project)*

Priority	Conservation Actions (continued)
1º	Identify, prioritize, and reclaim degraded rare species habitats by working with land management agencies to determine the appropriate actions needed to restore habitat value for the documented species. Appropriate actions might include the control of harmful, invasive, vegetation, restoring natural stream flows, revegetation with native plants or restoring habitat structure. *(Evaluate restoration – invasives)*
2º	Use GIS, other remote sensing tools, and surveys to identify and map significant natural vegetative communities that may host wildlife species of conservation need, particularly on public lands and lands that serve as wildlife corridors. *(Conserve wildlife – rare wildlife)*
Protect critical forest habitats identified by the Landscape Project	
1º	Increase the area of forest managed to contain a mix of seral (successional) stages to provide habitat for a wide range of forest-dwelling species (e.g., woodland raptors, pine snakes, corn snakes, black-throated green warbler, ruffed grouse, and woodcock) within large contiguous tracts while maintaining suitability for area-sensitive species per the Forest Management Guidelines for Nongame Species in New Jersey (in prep). • The primary goal being to maintain or manage for large and contiguous areas of mature and near-mature forests with large trees and an uneven-age structure that is suitable for woodland nesting raptors (forest raptors). • Selected areas of second-growth forested wetlands of moderate wildlife value should be allowed to mature to create optimal habitat for barred owl and red-shouldered hawk. • Take action to minimize loss of older forest stands with large trees in large, contiguous tracts by protecting, maintaining, enhancing, and/or restoring habitat on public and private lands through programs such as fee purchases, conservation easements, landowner incentives, and/or forest management and stewardship plans. • These forest types to also include but are not limited to: an uneven-age structure; mature forests and near-mature forest with >80% canopy closure, 65-80% canopy closure and structural diversity; limited areas of pine-oak with < 25% canopy closure; scrub-oak communities; and regenerating stands of forests (e.g., Atlantic white cedar). *(Silviculture – Land management; Protect habitat – Landscape Project, migratory birds, rare wildlife)*
1º	Develop, implement, and evaluate best management practices and guidelines to maintain and enhance public and private lands along the Maurice River as a significant bald eagle and raptor wintering area, nesting ospreys, and in the entire zone for forest-interior passerines and raptors. *(Conserve wildlife – rare wildlife)*

Priority	Conservation Actions (continued)
2º	Use GIS, other remote sensing tools, and surveys to identify critical habitats supporting local bald eagle nesting, summering and wintering populations and assess their condition. Take action to minimize habitat loss and maintain contiguous habitats by restoring, enhancing, and/or protecting woodland and riverine habitats, riparian edge forests associated with the Maurice River, and waterways on public and private lands through direct purchase or easements. Enlist private lands in preservation programs that will maintain forest free of human disturbance during key periods. *(Conserve wildlife – rare wildlife; Enhance habitat – private lands; Protect habitat – Landscape Project)*
2º	Use GIS, other remote sensing tools, and surveys to identify critical core forests and assess their condition for forest-nesting birds and bald eagles, maintain information, and incorporate all new survey and mapping data into the Landscape Project and Biotics database. Identify protection strategies (e.g., landowner incentives and acquisition) to maintain large core areas in perpetuity. Identify adjacent habitats that can be managed to enhance the total size of forest habitat. *(Conserve wildlife – rare wildlife; Protect habitat – Landscape Project)*
2º	Increase the effective size and connectivity of forests on permanently protected public lands and surrounding private lands through incentive programs and targeted land acquisition. Use GIS measures, other remote sensing tools, and surveys to identify important corridors that connect large, contiguous tracts of forest and target these areas for acquisition to maintain a system of large, connected tracts of forest within and between conservation zones. Where appropriate, enhance and restore forested habitat through reforestation, revegetation, forest improvement cuts, and other forest management prescriptions. *(Enhance habitat – private lands; Corridors – sprawl, migratory birds; Protect habitat – Landscape Project)*
2º	Protect habitats through innovative public and private partnerships. Promote existing landowner incentives for protecting and managing wildlife habitat and develop landowner cooperative agreements to protect significant populations of bald eagles, forest-interior wildlife, and rare amphibian and invertebrate populations. *(Protect habitat – migratory birds, Landscape Project; Conserve wildlife – rare wildlife; Enhance habitat – private lands)*
Protect and enhance wetland and open water habitats and water quality	
1º	Use GIS, other remote sensing tools, and surveys to identify waterfowl and snow goose concentration areas and finfish and shellfish populations; incorporate into habitat protection and enhancement programs. *(Conserve wildlife – game species)*
1º	Locate potential vernal pools through aerial imagery and surveys, conduct species surveys, and integrate certified vernal pool data into the NJ DEP regulations database and Landscape Project. *(Protect habitat – Landscape Project)*

Priority	Conservation Actions (continued)
1º	Enhance fisheries and fish habitat by removing obstructions to fish passage in rivers and streams. *(Protect habitat – fish)*
1º	Identify and protect habitat for fish by plotting distributions of special concern fish species, and integrate those data into the Biotics database. *(Monitor wildlife – fish; Protect habitat – Landscape Project)*
1º	Restore and protect NJ's critical non-trout streams through the use of protection strategies (e.g., acquisition of adjacent riparian habitats, working with municipality planning boards to require ecologically-sound buffers, easements).
1º	Develop, implement, and evaluate best management practices to enhance and/or restore aquatic and adjacent riparian habitats supporting populations of special concern and rare fish. *(Native wildlife – fish; Protect habitat – fish, Monitor wildlife - fish)*
1º	Maintain optimal biological buffers (beyond regulatory requirements) around wetlands, riparian, and floodplain areas and minimize destruction per the NJ DEP Wetland Buffer Guidelines for Species of Conservation Concern in New Jersey (in prep). Stabilize wetland buffers and streambanks by encouraging plantings of native vegetation through public education, volunteer programs, and land managers to stabilize wetland buffers and stream banks and prevent erosion. *(Protect habitat – Landscape Project, sprawl, rare wildlife, fish; Enhance habitat – private lands)*
1º	Protect water quality and aquatic-dependent species by appropriately designating Category One waters. *(Protect habitat – rare wildlife, fish)*
1º	Seek appropriate classifications for stream segments based on IBI results that do not fulfill Category One requirements. *(Protect habitat – rare wildlife, fish)*
1º	Prevent chemical contamination, siltation, eutrophication, and other forms of pollution/contamination to wetlands used by wildlife especially as breeding sites that could directly harm breeding species or their food supply (including birds, amphibians, and invertebrates). Evaluate protection efforts through regular monitoring of water quality. *(Conserve wildlife – contaminants)*
2º	Use GIS measures, other remote sensing tools, and surveys to identify and assess core forested wetland and riparian/floodplain habitat for forest-dependent breeding species: forest raptors (red-shouldered hawk, long-eared owl, and barred owl) and forest-interior songbirds. Take action to minimize habitat loss by restoring, enhancing and/or protecting habitat on public and private lands through programs such as fee purchases, conservation easements, landowner incentives, and/or forest management and stewardship plans. *(Silviculture – land management; Protect habitat – Landscape Project, development; Enhance habitat – private lands)*
2º	Identify threats to vernal pools through systematic monitoring and devise strategies to protect vernal pool dependent species. *(Conserve wildlife – rare wildlife)*

Priority	Conservation Actions (continued)
2º	Maintain water chemistry/ water quality important for aquatic-dependent or semi-dependent species native the Pinelands. For example, maintain low pH waters important for breeding populations of Pine Barrens treefrogs and carpenter frogs. *(Conserve wildlife – rare wildlife; Protect habitat – rare wildlife)*
Protect and enhance tidal wetlands and open water habitats.	
1º	Identify and protect critical areas of submerged aquatic vegetation to benefit waterfowl, finfish, and shellfish species through surveys, GIS measures and other remote sensing tools, expert opinion, and historical records. Restablish/restore historically important submerged aquatic vegetation beds in Delaware Bay tributaries to benefit waterfowl and waterbirds. *(Conserve wildlife – game species)*
2º	Investigate and improve current marsh management techniques to benefit critical wildlife species, in particular high marsh nesting birds and waterfowl, and include in marsh BMPs and species dependent on mudflats and impoundments. *(Conserve wildlife – rare wildlife, game species)*
2º	Identify areas that may benefit from marine conservation zone status to protect sensitive habitats and species from human disturbance. Develop and implement protection measures in marine and riverine habitats. *(Protect habitat – humans)*
Protect and enhance habitats for scrub-shrub communities	
1º	Use GIS measures, other remote sensing tools, and surveys to identify critical scrub-shrub (areas with >25% woody vegetation <20 feet in height) and open field habitats, assess their condition for local populations of frosted elfins (e.g., on powerlines), nesting birds (e.g., yellow-breasted chat, blue-winged warbler, brown thrasher), marsh-edge birds (e.g., sedge wrens), and other wildlife, maintain information, and incorporate all new survey and mapping data into the Landscape Project and Biotics database. Identify protection (e.g., landowner incentives, farmland preservation, and acquisition) and management strategies (e.g., timing restrictions for management, cooperative agreements with utility companies for maintenance of rights-of-ways) to maintain, enhance, and/or create them. *(Conserve wildlife – rare wildlife; Enhance habitat – private lands; Agriculture – land management Protect habitat – sprawl, Landscape Project, development)*
2º	Develop, implement, and evaluate best management practices for rights-of-way that benefit species with small area requirements (e.g., frosted elfin and early-successional birds). BMPs should focus on maintaining existing early succession habitats and work to establish new grassland and scrub-shrub habitats along utility line rights-of-way, at field/forest edges, and adjacent to fire breaks where appropriate for small-area species. *(Conserve wildlife – rare wildlife; Protect habitat –Landscape Project)*
2º	Develop, implement, and evaluate best management practices to protect, maintain, and/or enhance habitats (other than rights-of way) that support populations of bronze copper, frosted elfin, and scrub-shrub birds, particularly at locations where early-successional habitats are maintained for (other) primary purposes. *(Conserve wildlife – rare wildlife)*

Priority	Conservation Actions (continued)
2º	Promote landowner incentives and manager cooperation to protect and enhance local populations of frosted elfins (e.g., on powerlines), and scrub-shrub/open field birds (e.g., on airports). *(Conserve wildlife – rare wildlife; Other practices – land management)*
Inventory, determine distribution, and monitor rare fish and wildlife	
1º	Use the Biotics database and Landscape Project to identify where species location data and monitoring gaps exist. Design and implement coordinated presence/absence surveys and monitoring to acquire data in those areas.
1º	Survey suitable habitats to determine distribution of forest wildlife of greatest conservation need and establish baseline information and long-term trends. Annually survey and monitor bald eagle nesting and production. Survey and monitor ospreys every two years, woodland raptors and passerines every four years. *(Conserve wildlife – rare wildlife; Monitor wildlife – long-term monitoring)*
1º	Conduct concentrated field sampling for listed or special concern fish species (e.g., margined madtom) in areas indicated by Fish Track Database queries and incorporate data into the Biotics database. *(Status – fish; Monitor wildlife – fish; Native wildlife – fish)*
1º	Identify and research water quality parameters for rare species such as bald eagle, osprey, spotted turtle, special concern amphibian, and rare dragonfly and damselfly populations. *(Conserve wildlife – rare wildlife; Protect aquatic wildlife - humans, development)*
1º	Identify and research water quality parameters for spotted turtle, special concern amphibian, and rare dragonfly and damselfly populations. *(Conserve wildlife – rare wildlife; Protect aquatic wildlife - humans, development)*
1º	Investigate habitat parameters of rare fish (e.g., margined madtom) and recommend management and protection guidelines. *(Native wildlife – fish; Protect habitat – fish; Monitor wildlife - fish)*
1º	Conduct surveys in suitable, previously un-surveyed areas to determine if listed or special concern freshwater mussel species are present. Repeat surveys every four years to monitor populations. Incorporate freshwater mussel survey results into the Biotics database and determine critical areas for listed species. *(Protect habitat - mussels)*
2º	Survey suitable habitats to determine presence and distribution of timber rattlesnakes. Encourage landowners to report timber rattlesnake sightings for inclusion in the distribution mapping and potential inclusion in a telemetry study. Monitor habitat use and survival of encountered animals using radio-telemetry to locate dens and identify critical habitats. *(Conserve wildlife – rare wildlife; Monitor wildlife – long-term monitoring)*
2º	Develop and conduct nighttime surveys to inventory nightjars (whip-poor-wills, chuck-will's-widows, common nighthawks), northern saw-whet owls, and eastern screech-owls. *(Conserve wildlife – rare wildlife; Monitor wildlife – long-term monitoring)*

Priority	Conservation Actions (continued)
2º	Conduct sampling (e.g., mist netting) to determine distribution, range, and habitat use of summer bats. Long-term sampling of forest dwelling bat species should be conducted to determine population trends and species response to changes in habitats. *(Protect habitat - Landscape Project; Monitor wildlife – long-term monitoring)*
2º	Continue volunteer-based summer bat concentration surveys to locate maternity sites and determine roost characteristics. Trap bats at summer concentration sites to identify bat species; apply colored, plastic bands to Indiana bats to aid in recognition during hibernation surveys. *(Monitor wildlife – long-term monitoring)*
2º	If Indiana bats are found, conduct telemetry study during summer months to determine roost characteristics and habitat requirements for Indiana bat maternity colonies. *(Protect habitat – Landscape Project)*
2º	Investigate the habitat suitability and techniques for restoring bobcats to this zone. Conduct presence/absence surveys for bobcat using scent-post surveys within suitable habitat. *(Conserve wildlife – rare wildlife)*
2º	Continue ground surveys of all known great blue heron rookeries every 3-5 years. Improve census methods to capture population and reproductive success metrics at a finer scale. *(Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife)*
2º	Establish a formal ground survey for inland colonies of colonial waterbirds, with a particular emphasis on black and yellow-crowned night herons. Once the survey is instituted, continue on a rotation of once every other year. *(Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife)*
Prevent, stabilize, and reverse declines of rare terrestrial and aquatic wildlife and fish	
1º	ENSP biologists will be responsible for notifying the NJ Division of Fish and Wildlife's Bureau of Law Enforcement and the Division of Parks and Forestry Bureau of Law Enforcement and managers, where and when appropriate, of critical sites (nesting, basking, gestation, dens) to implement stringent enforcement of endangered species laws, including protection of wildlife from illegal collection (northern pine snakes, corn snakes, timber rattlesnakes) and human disturbance (off-road vehicles). *(Protect wildlife – humans, recreational vehicles)*
1º	Research the intensity and characteristics of threats to wildlife species of conservation concern and their habitat, including causes and effects of habitat loss, degradation, and alteration, edge, disturbance, impacts of roads, predation, competition by invasive plants and animals, disease, contaminants, food availability, hybridization, and how water quality degradation and contaminants affect rare species. *(Protect habitat – sprawl, recreational vehicles, humans; Conserve wildlife – contaminants, invasives, rare wildlife, subsidized predator; Evaluate restoration – roads)*

Priority	Conservation Actions (continued)
1º	Develop and implement proactive habitat conservation goals that will meet and maintain the recovery needs of all endangered and threatened wildlife and fish populations, particularly for forest-interior species and bald eagles. These include guidelines for forest silviculture on public and private lands to enhance forest maturity and canopy, and replanting to reduce fragmentation. *(Protect habitat – Landscape Project; Silviculture – land management; Enhance habitat – private lands; Conserve wildlife – rare wildlife)*
1º	Develop a fish Index of Biotic Integrity (IBI) to better assess the presence and distribution of fish species within the area's streams. *(Monitor wildlife - fish)*
1º	Research the habitat requirements for species of conservation concern (e.g., forest passerines and woodland raptors, corn snakes, northern pine snakes, Cope's gray treefrogs, and Pine Barrens treefrogs) and implement planned silviculture practices to enhance forests for forest-dependent species. *(Protect habitat – Landscape Project; Silviculture – land management)*
1º	Protect wildlife species of conservation concern, especially slow moving terrestrial-bound species (e.g. reptiles, amphibians) and sensitive forest nesters (e.g. red-shouldered hawks, barred owls) by prohibiting off-road vehicles from all public and private conservation lands except where authorized by the governing agency by working with law enforcement agencies and implementing other means as they are developed. *(Protect habitat – recreational vehicles; Conserve wildlife - recreational vehicles)*
1º	Conduct surveys determine locations of, and identify habitat management requirements for, secretive marsh nesting birds. *(Conserve wildlife – rare wildlife)*
2º	Research the impact of land use patterns on Pine Barrens treefrog, northern pine snake and corn snake populations. *(Protect habitat – sprawl; Corridors - sprawl)*
2º	Work with state and non-government agencies to evaluate the impacts of enduro events on listed species and species of special concern. If such events are to be permitted in the future, work with the Divisions of Parks & Forestry and Fish & Wildlife to designate riding areas develop/implement BMPs. *(Conserve wildlife – rare wildlife; Protect habitat – humans)*
2º	Evaluate the impacts of roads on endangered and threatened species and other nongame wildlife. Research, develop, and implement methods to reduce roadside mortality of wildlife (e.g., implementing wildlife underpasses, road closures). *(Corridors – roads, sprawl; Protect habitat – roads, fish, mussels)*
Maintain and enhance bald eagles, ospreys and northern harriers	
1º	Develop and implement proactive habitat conservation plans that will help meet and maintain recovery goals for bald eagle and osprey. *(Conserve wildlife – rare wildlife; Protect habitat – Landscape Project)*
1º	Develop and implement proactive habitat conservation plans that will help meet and maintain recovery goals for northern harrier and other high-marsh species. *(Conserve wildlife – rare wildlife; Protect habitat – Landscape Project)*

Priority	Conservation Actions (continued)
1º	Identify and research water quality parameters for bald eagle and osprey populations. Maintain data on those parameters to track trends and identify potential threats. *(Conserve wildlife – rare wildlife; Protect aquatic wildlife - humans, development)*
Monitor, maintain, and enhance populations of breeding, migratory and wintering waterfowl of conservation concern	
1º	Use GIS, other remote sensing tools, and surveys to identify critical aquatic and wetland habitats and assess their condition for migratory and wintering waterfowl finfish, and shellfish populations of conservation concern. Take action to minimize habitat loss by restoring, enhancing, and/or protecting habitat on public and private lands through protection strategies (e.g., acquisition, landowner incentives) and to maintain/ enhance existing waterfowl habitat where such management complements rare species management. *(Conserve wildlife – game species; Protect habitat – Landscape Project)*
2º	Conduct the annual Mid-Winter Waterfowl Survey to monitor population trends. *(Conserve wildlife – game species; Monitor wildlife – long-term monitoring)*
2º	Conduct the Atlantic Flyway Breeding Waterfowl Survey annually to monitor population trends. *(Conserve wildlife – game species; Monitor wildlife – long-term monitoring)*
2º	Determine carrying capacity of area marshes for wintering American black ducks to inform decisions in setting Atlantic Flyway population objectives and to guide management actions. *(Conserve wildlife – game species)*
Identify and survey habitats for rare invertebrate wildlife	
1º	Identify and research water quality parameters for rare dragonfly and damselfly populations. *(Conserve wildlife – rare wildlife; Protect aquatic wildlife - humans, development)*
2º	Conduct surveys in appropriate habitats for frosted elfins, bronze coppers, and Hessel's hairstreaks and work with partners in conservation to determine species distribution and identify critical habitats and protection needs. *(Conserve wildlife – rare wildlife; Protect habitat – Landscape Project)*
Maintain natural biodiversity, community integrity and structure and ecosystem function by controlling invasive and overabundant species	
1º	Identify areas where invasive, non-indigenous plants and animals are either already established or are becoming established through GIS, other remote sensing tools, surveys, public participation, and creating a system for reporting and qualifying new locations of invasive species. Prioritize areas in need of control projects according to the potential level of impact on the ecosystem and species of conservation concern and the likelihood of success. *(Conserve wildlife – invasives; Evaluate restoration – invasives)*

Priority	Conservation Actions (continued)
1º	Work with appropriate government agencies to survey and monitor the spread of invasive insect species that jeopardize forest health. The species of primary concern include the southern pine beetle, orange-striped oakworm, gypsy moth, and oak lace bug. Take appropriate control methods to reduce tree damage and limit the spread of infestations, provided such methods avoid excessive direct or indirect harm to non-target species. *(Conserve wildlife – invasives)*
1º	Use appropriate measures to control the spread of Phragmites in the tidal Maurice River. *(Conserve wildlife – invasives)*
1º	Work with public and private landowners and managers and regulatory agencies to employ physical, chemical, or biological control measures, or a combination of these, to reduce invasive, non-indigenous plants in areas that are identified as providing critical habitat for endangered, threatened, or priority wildlife species that are being threatened by such plants. *(Conserve wildlife – invasives)*
1º	Monitor and evaluate the impacts of vegetative damage to the wild rice marshes by resident Canada geese. Develop, implement, and evaluate management strategies to maintain and enhance the wild rice marshes by minimizing goose damage and controlling resident Canada goose populations. *(Conserve wildlife – invasives; Evaluate restoration – invasives)*
1º	Develop, implement, and evaluate management strategies to reduce the impacts of mute swan herbivory on native vegetation in impoundments and marshes of the Cohansey River supporting species of conservation concern. *(Conserve wildlife – invasives)*
2º	Develop area-specific deer density or percent-reduction targets to reduce herd size to a sustainable level where forest regeneration of native vegetative communities is possible and to enhance forest health and biodiversity. *(Evaluate restoration – deer; Conserve wildlife – deer, rare wildlife)*
2º	The NJ Division of Fish and Wildlife, Bureau of Wildlife Management will consider forest health and biodiversity as one of the primary determinants in making deer management decisions regarding deer densities. Forest health and biodiversity will be determined by using long term monitoring of forest regeneration via a system of exclosures and vegetative sample plots (or other methods that will empirically and objectively measure the effect of deer herbivory) throughout New Jersey in order to evaluate habitat health in response to changing deer densities. DFW will recommend adjustments to existing Deer Management Zone deer densities goals and recommend changes to zone specific deer harvest and control strategies, as required in order to meet this objective. *(Conserve wildlife – deer; Evaluate restoration - deer)*
2º	Where appropriate, continue to develop and expand incentives for harvesting antlerless deer. *(Conserve wildlife - deer)*

Priority	Conservation Actions (continued)
Prevent illegal collection of rare reptiles and amphibians	
1º	ENSP biologists will be responsible for notifying the NJ Division of Fish and Wildlife's Bureau of Law Enforcement and the Division of Parks and Forestry Bureau of Law Enforcement and managers, where and when appropriate, of critical sites (nesting, basking, gestation, dens) to implement stringent enforcement of endangered species laws, including protection of wildlife from illegal collection (northern pine snakes, corn snakes, timber rattlesnakes) and human disturbance (off-road vehicles). *(Protect wildlife – humans, recreational vehicles)*
2º	Recruit and provide training for local law enforcement personnel that are willing to assist in the enforcement of endangered species laws. Develop a partnership between local law enforcement, the NJ Division of Fish and Wildlife's Bureau of Law Enforcement, and the Division of Parks and Forestry Bureau of Law Enforcement to enforce protection of native wildlife from illegal collection (northern pine snakes), and human disturbance (off-road vehicles). *(Protect wildlife – humans, recreational vehicles)*
Protect and enhance important and unique habitats	
1º	Identify (through Landscape Project, radar studies, IBAs, and surveys), protect (through incentive programs and land acquisition), and enhance (through incentive programs and best management practices) unique habitats such as Pinelands-ecotype forest and streams in the Manumuskin and Menantico tributaries, the older swamp forests of east and west Bear Swamps, and the drainages of the Maurice River. *(Protect habitat – migratory birds; Corridors – migratory birds)*
2º	Incorporate ENSP approved sightings data from nominated and approved Important Bird Areas into the Biotics database and Landscape Project mapping providing the sightings meet the ENSP Biotics and Landscape Project standards. *(Corridors – migratory birds; Protect habitat – migratory birds, Landscape Project)*
Assess large-scale habitat change every five years	
1º	Collaborate with NJ DEP's Bureau of Geographic Information and Analysis and Rutgers Center for Remote Sensing and Spatial Analysis to develop methods to update DEP's land use/land cover data every five years and perform critical habitat change analysis to assess trend in habitat loss and conversion.
Promote public education and awareness and wildlife conservation	
1º	Raise public awareness of the Maurice River as a significant bald eagle and raptor wintering area through newletters, press releases, brochures, presentations, and web pages. *(Education – humans)*
1º	Preventing establishment of non-indigenous species is the simplest and most cost-effective means of stopping invasions. Encourage native plant use in landscaping through public awareness and discouraging sales of non-native ornamental plants which are often a major source of non-indigenous species that invade natural plant communities. *(Education – humans)*

Priority	Conservation Actions (continued)
1º	Educate public about the importance of keeping cats indoors through newsletters, press releases, brochures, presentations, web pages, etc. Work to develop a statewide policy for local communities to discourage managed cat colonies and trap, neuter and release programs; encourage academic research that examines the full range of impacts of feral cat colonies on local wildlife populations and of feral cat colony management (including TNR) on local wildlife populations and local feral cat populations. *(Education – humans)*
1º	Engage landowners and NJ citizens in protection and survey efforts for endangered species by increasing enrollment in landowner incentives, forest stewardship, backyard habitat management, and Citizen Science Program. *(Education – humans; Conserve wildlife – rare wildlife)*
1º	Develop brochures and posters regarding the most aggressive, invasive non-indigenous plants to educate and involve the public in detecting problem areas early while they are still manageable. Early recognition of the establishment of new populations is the key to successful control. *(Education – humans; Conserve wildlife – invasives)*
2º	Develop and maintain education brochures and posters and viewing opportunities for the public consistent with species recovery goals to enhance public awareness of wildlife conservation and environmental issues by cooperating with federal, state, and local government, and non-governmental organization partners. *(Education – humans)*
2º	Develop brochures and posters to educate the public and increase awareness of New Jersey's indigenous nongame fish species. *(Education – humans)*
2º	Educate the public about the importance of the habitats within this zone to the Atlantic coast bird, bat, and Lepidopteran species' migration through newsletters, press releases, brochures, presentations, and web pages. *(Education – humans)*
2º	Educate homeowners, through newsletters, press releases, brochures, presentations, etc., on the proper eviction of house-dwelling bat populations and the importance of providing alternative roosting structures for maternity colonies. *(Education – humans)*
2º	Preventing establishment of non-indigenous species is the simplest and most cost-effective means of stopping invasions. Encourage native plant use in landscaping through public awareness and discouraging sales of non-native ornamental plants which are often a major source of non-indigenous species that invade natural plant communities. *(Education – humans; Conserve wildlife – invasives)*

f. Potential Partnerships to Deliver Conservation

Private Landowners

- Protect and enhance habitat through innovative partnerships with private landowners.
    - Implement best management practices that protect and enhance habitat for forest birds, bald eagles, forest passerines and raptors.
    - Develop and implement incentive programs that encourage the management of forest communities.

- Through incentive programs, target private landowners adjacent to public natural lands to manage land for mature forest in order to increase effective size and connectivity of forest patches.
- Encourage farmers to preserve farmland through conservation easements through partnerships with the DEP's Green Acres Program, The Nature Conservancy–NJ Chapter, Natural Lands Trust, and local municipalities for the conservation of forest communities.
- In the context of landowner incentive programs such as LIP and Forestry Stewardship, work with landowners to develop and implement deer management plans that achieve desired deer densities.
- Work with landowners to maintain/enhance existing habitats where special concern fish species occur.

Public

- Expand volunteer Citizen Scientist recruitment and activities.
  - Collaborate with conservation groups (NJ Audubon Society, The Nature Conservancy-NJ Chapter, NJ Conservation Foundation, Natural Lands Trust) and other environmental, member-based organizations to recruit and train Citizen Scientists to locate, survey, and monitor wildlife habitats and populations in a systematic manner to achieve short and long term monitoring goals.
  - Involve Citizen Scientists in management and protection projects, such as protection and posting of bald eagle nesting areas and building osprey nest structures.
  - Recruit North American Butterfly Association volunteers to conduct surveys for lepidoptera species.
- Promote backyard habitat management for migratory raptors and passerines, and for vernal pools where appropriate.
- Collaborate with NJ Audubon Society to educate public on the effects of feral cats on wildlife species of conservation concern.

Wildlife Professionals

- Collaborate with researchers in Delaware, Maryland, Virginia, New York, and Pennsylvania to continue to develop best management practices and conservation plans for bald eagle nesting, foraging and wintering areas.
- Consult with entomologists to design and conduct surveys for listed and rare invertebrates in appropriate habitats, and then develop best management practices and conservation plans.

Conservation Organizations

- Partner with Citizens United to Protect the Maurice River and its Tributaries and other conservation organizations such as NJ Audubon Society (NJAS), The Nature Conservancy-NJ Chapter (TNC) and NJ Conservation Foundation (NJCF) to protect and enhance habitats for rare species.
  - Work with TNC, NJAS, and NJCF to protect and enhance large tracts of contiguous forest, especially those adjacent to state lands.
  - Work with TNC and Citizens United to manage and protect bald eagle, osprey and raptor nesting and wintering areas.

    - Protect and enhance sites hosting significant populations of rare Odonates and Lepidopterans on conservation lands.
- Work with Citizens United to Protect the Maurice River and its Tributaries to develop local wildlife festivals and educational programs such as classroom curricula.
- Encourage the use of the Landscape Project's critical habitat mapping to guide land acquisition by conservation organizations through programs such as Green Acres, State Agricultural Development Committee (SADC) Farmland Preservation, and local land trusts.
- Conservation organizations should act as advocates for legislation and regulatory reform that address integrating deer management goals into farmland tax assessment laws, farmland preservation programs, and other farm conservation programs.
- Work with land trusts to develop and implement deer management plans that achieve desired deer densities on preserved lands.
- Partner with The Nature Conservancy–NJ Chapter to protect and enhance critical habitat where listed or special concern fish and wildlife species occur.

Academic Institutions

- Partner with Rutgers and other academic institutions to conduct studies necessary to better understand the impacts of deer on biodiversity, forest health, and ecosystem processes and to develop habitat-specific or landscape-specific deer density targets.

Local Government, Other State and Federal Agencies

- Partner with local, state, and federal government agencies, including municipal and county planning boards, USDA-NRCS, USFWS, National Park Service (NPS), and the DCA, Office of Smart Growth, to protect, enhance, and create habitats, and to protect NJ's native wildlife.
    - NJ Department of Environmental Protection's (DEP) Division of Fish and Wildlife (DFW) to maintain and protect bald eagle, osprey, and interior-forest bird nesting and foraging sites.
    - NJ and USFWS to develop a plan with state and federal wildlife law enforcement agents to protect sensitive endangered/threatened species areas from disturbance.
    - DFW and DEP's Division of Parks and Forestry (DPF) to work with the DEP's Office of Natural Lands Management, Natural Heritage Program (NHP) to develop mapping of significant natural vegetative communities, particularly on public lands and lands that serve as wildlife corridors, to be incorporated as a layer within the Landscape Map. Sensitive information would be a separate layer for use within the NJ Department of Environmental Protection only.
    - DFW and DPF to collaborate on forest management guidelines to achieve forest management goals for listed and rare wildlife, on both public and private lands.
    - DFW to share site information and expertise with state and federal law enforcement to increase surveillance of bald eagle sites.
    - DFW and conservation organizations to work with DEP's Land Use Regulation Program (LURP) to protect vernal pools and appropriately classify wetlands for Pine Barrens treefrog, Cope's gray treefrog, eastern tiger salamander, and rare dragonfly and damselfly populations.
    - Expand efforts to create habitat and implement best management practices for forest passerines and raptors, forest reptiles, and bald eagles on state lands and with natural resource managers, county and municipal utility authorities and planners.

  - Implement best management practices for scrub-shrub wildlife on power lines that cross Wildlife Management Areas and conservation lands, via the state permit process and direct communications with utility companies.
  - DFW to lead in the development of specific conservation plans for special concern reptiles and amphibians on state lands.
  - DFW to work with state and county mosquito commissions to reduce the use of deleterious insecticides and biological controls at known amphibian breeding sites.
  - DFW and DEP's Bureau of Water Monitoring and Standards to work together to recommend classification upgrades in water bodies where listed or special concern species occur.
  - DFW to work with USFWS and other state, federal, and non-governmental partners to implement North American Waterfowl Management Plan as appropriate.
  - DFW to work with USFWS and other state and federal partners to implement the American Woodcock Management Plan, seeking areas where such management complements rare species management.
  - DFW to work with federal and state agencies, including USFWS, USCG, National Oceanic and Atmospheric Administration, NJ Bureau of Emergency Response, and NJ Office of Natural Resources Restoration (NRCS) to plan for and assist with emergency oil spill response.
  - DFW and DPF to work with the USFWS to develop effective plans to eradicate invasive non-indigenous plants on federal and state lands that are threatening critical wildlife habitats.
  - DFW to work with USDA through NRCS and the WHIP program to control purple loosestrife, Japanese sedge and other invasive plants in critical wildlife habitats.
  - DFW to develop guidelines for wildlife buffers with DEP's Division of Watershed Management, Bureau of Water Monitoring and Standards, and others, for important riparian and floodplain areas such as the Maurice River and its tributaries. Partner with them to investigate water quality and reduce threats of contaminants/pollution.
  - Improve habitat protection by partnering with the National Park Service's office for the Wild and Scenic River.
  - DFW to determine groundwater recharge areas for vernal pools with the DEP's Division of Water Quality (DWQ) and the NJ Geological Survey. Expand efforts with DWQ to minimize impacts on water quality and conduct hydrological monitoring in these areas.
  - DFW to work with USDA-NRCS to ensure that deer management goals are integrated into farm conservation plans that include measurable outcomes.
  - DFW to work with land management agencies at the state, local, and federal levels to implement deer management plans and harvest quotas that achieve desired deer densities to maintain ecological integrity of natural communities.
  - DFW will work with DEP's Bureau of Water Monitoring and Standards to recommend appropriate stream classifications.
- DFW to lead in the development of educational materials for public and private landowners about forest-dependent wildlife and nesting and wintering bald eagles and their habitats.
- DFW, conservation organizations, and park commissions to expand public outreach through on-site programs, wildlife festivals, and wildlife viewing opportunities.

- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide habitat protection and land acquisition by federal, state, and local governments through programs such as DEP's Green Acres Program, State Agricultural Development Committee Farmland Preservation, local land trusts, and through mitigation.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide land use planning and zoning decisions by planning agencies at the federal, state, and local level.

g. Monitoring Success

- Conduct habitat assessment and monitor habitat changes over time; monitor efficacy of habitat management and restoration efforts.
- Annually monitor abundance, productivity, distribution, and trends of bald eagle, osprey (biannually), forest passerine and raptor populations, listed and special concern amphibian and reptile populations. Compare vegetation parameters and populations between managed/protected sites and non-managed sites to provide feedback into management strategies.
- Monitor contaminant levels that might impact bald eagle and osprey populations.
- Monitor species abundance of migratory raptors at key locations to determine migration count trends.
- Monitor populations of breeding, migratory and wintering waterfowl of conservation concern.
- Continue the long-term monitoring of reptile and amphibian populations through the Herp Atlas Project, the Calling Amphibian Monitoring Program, and the vernal pool project.
- Develop indicator metrics for monitoring forest health and implement at the scale necessary to monitor effectiveness of deer management strategies.
- Employ/implement adaptive management techniques for the goals and conservation actions established for species of greatest conservation need. Review effectiveness of research and management, and improve techniques as necessary.