

5. Central Highlands

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a. Habitats

The Central Highlands is characterized by lower elevation mountain ranges and sculpted valleys with a forest cover of mixed oak-hardwood forest and forested wetlands with patches of rocky outcroppings. This area of the Highlands physiographic province (Figure 32) includes the headwaters of the Musconetcong, South Branch of the Raritan and Lamington rivers and Pohatcong Creek and has fewer wetlands, fens, wet meadows and scrub-shrub wetlands than the Northern Highlands Zone. Vernal pools are prevalent throughout this zone. Forests become more highly fragmented in the Central Highlands although some large tracts still persist and provide habitat for area-sensitive forest species, primarily forest passerines. Agricultural fields are prevalent throughout this zone and provide habitat for grassland birds and other early succession (grassland and scrub-shrub) wildlife. Abandoned iron mines exist throughout the region, and provide critical hibernacula for bats.

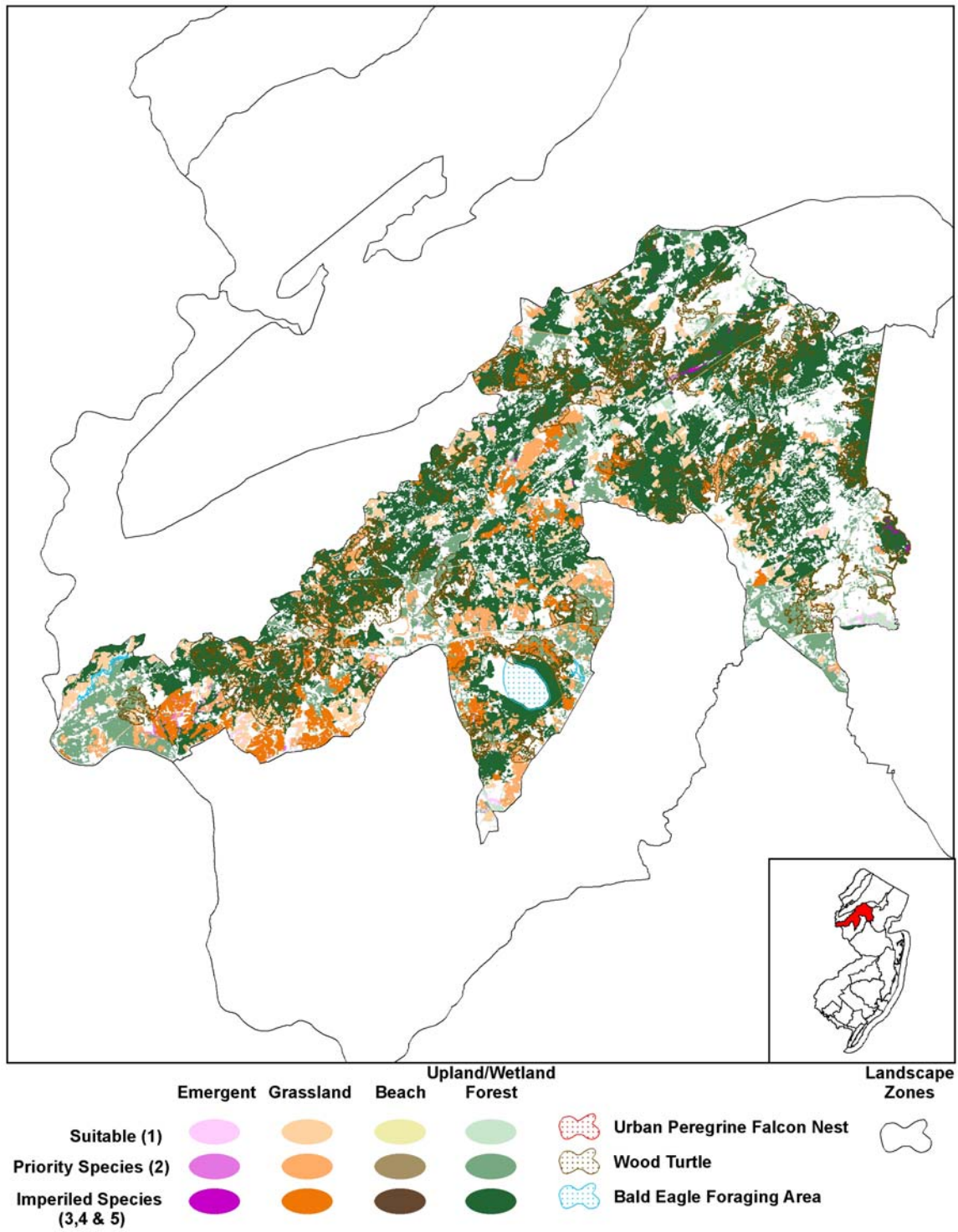
Conservation areas of opportunity in the Central Highlands include Black River WMA, Ken Lockwood Gorge WMA, Clinton WMA, Spruce Run Recreation Area, Round Valley Recreation Area, Voorhees State Park and Hacklebarney State Park, and the extensive holdings of the Hunterdon County Park System.

b. Wildlife of Greatest Conservation Need

The Central Highlands support three federal endangered and threatened, nine state endangered, 11 state threatened, and 70 special concern and regional priority wildlife species, in addition to six game species of regional priority and five nongame fish species currently without state or regional status. The Indiana bat is federal endangered and the bog turtle is federal threatened. State endangered species include the bobcat, American bittern, northern harrier, red-shouldered hawk, upland sandpiper, vesper sparrow and arogos skipper. The state threatened species include the barred owl, bobolink, Cooper's hawk, red-headed woodpecker, wood turtle, grasshopper and savannah sparrows, long-eared owl, and osprey. Special concern wildlife are cavity-nesters, colonial waterbirds, forest passerines, freshwater wetland birds, grassland birds, raptors, scrub-shrub/open field birds, reptiles, and amphibians.

Forest-interior wildlife take refuge in the Central Highland northern hardwood forest, including bobcats, cavity-nesters, forest-dwelling bats, forest passerines, raptors, eastern box turtles, northern copperheads, Fowler's toads, Jefferson salamanders, and marbled salamanders. Due to the proximity of known hibernacula, the forests of this zone likely provide summer foraging and roosting habitat for Indiana bats. Wood turtles are found in forested wetlands. Rocky outcroppings provide habitat for bobcats and northern copperheads. Wetlands in the Central Highlands provide habitat for great blue herons, freshwater wetland birds, bog turtles, spotted turtles, damselflies, and dragonflies. Tables S37 – S43 identify the species of greatest conservation need within this zone.

Figure 32. Critical landscape habitats within the Central Highlands conservation zone, as identified through the Landscape Map (v2).



Wildlife Species and Associated Habitats of the Central Highlands

Table S37. Federal Endangered and Threatened Species*

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Indiana bat		X		X
Reptiles				
Bog turtle		X		
Insects				
American burying beetle♦			X	

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife

♦Only historic records exist. Species believed to be extirpated.

X: Species occurs within the identified habitat.

Table S38. State Endangered Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Bobcat				X
Birds				
American bittern		X		
Bald eagle		X		X
Northern harrier			X	
Red-shouldered hawk				X
Short-eared owl			X	
Upland sandpiper			X	
Vesper sparrow			X	
Mollusks				
Green floater	X**			
Insects				
Arogos skipper			X	

**Riverine habitat, within Landscape Map, these species are identified within the “Emergent Wetlands” layer

X: Species occurs within the identified habitat.

Table S39. State Threatened Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
Barred owl				X
Bobolink			X	
Cooper’s hawk				X
Grasshopper sparrow			X	
Long-eared owl			X	X
Osprey		X		
Red-headed woodpecker				X
Savannah sparrow			X	
Reptiles				
Wood turtle			X	X
Mollusks				
Tidewater mucket	X**			
Yellow lampmussel	X**			

**Riverine habitat, within Landscape Map, these species are identified within the “Emergent Wetlands” layer

X: Species occurs within the identified habitat.

Table S40. Nongame Species of Conservation Concern

Common Name	Water	Wetlands	Grasslands	Forest and Forested Wetlands
Mammals				
Eastern small-footed bat				X**
Eastern red bat				X**
Hoary bat				X**
Silver-haired bat				X**

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Nongame Species of Conservation Concern (continued)

Common Name	Water	Wetlands	Grasslands	Forest and Forested Wetlands
Mammals (continued)				
Long-tailed (Rock) shrew				X
Southern bog lemming				X
Birds				
Acadian flycatcher				X
American golden-plover		X		
American kestrel			X	
Baltimore oriole				X
Black-and-white warbler				X
Black-billed cuckoo				X
Black-throated blue warbler				X
Blue-winged warbler				X
Broad-winged hawk				X
Brown thrasher				X
Cerulean warbler				X
Chimney swift			X	
Cliff swallow			X	
Common barn owl			X	
Common nighthawk				X
Eastern kingbird				X
Eastern meadowlark			X	
Eastern screech-owl				X
Eastern towhee				X
Eastern wood-pewee				X
Field sparrow			X	
Gray catbird				X
Gray-cheeked thrush				X
Great blue heron		X		X
Great crested flycatcher				X
Green heron		X		
Hooded warbler				X
Indigo bunting			X	
Kentucky warbler				X
Least bittern		X		
Louisiana waterthrush				X
Marsh wren		X		
Northern flicker				X
Northern parula				X
Pine warbler				X
Prairie warbler				X
Purple finch				X
Rose-breasted grosbeak				X
Scarlet tanager				X
Sharp-shinned hawk				X
Veery				X
Willow flycatcher				X
Wood thrush				X
Worm-eating warbler				X
Yellow-bellied sapsucker				X
Yellow-throated vireo				X
Yellow-throated warbler				X
Reptiles				
Eastern box turtle		X	X	X
Eastern hognose snake			X	X
Eastern ribbon snake		X	X	
Northern copperhead				X
Spotted turtle		X		
Amphibians				
Carpenter frog		X		
Fowler's toad				X
Jefferson salamander				X
Marbled salamander		X		X
Northern spring salamander		X		X

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Nongame Species of Conservation Concern (continued)

Common Name	Water	Wetlands	Grasslands	Forest and Forested Wetlands
Insects				
Club dragonfly	X			X
Extra-striped snaketail	X			X
New England bluet	X	X		
Pitcher plant borer moth		X		
Schweitzer's buckmoth				X
Fish				
American brook lamprey*	X			
Bridle shiner	X			

*Species is also recognized as target species of ecoregional concern by the Nature Conservancy-NJ Chapter

**Potential presence.

X: Species occurs within the identified habitat.

Table S41. 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		X
Canada goose (Atlantic population)	X	X		
Wood duck	X	X		X
Virginia rail		X		
Fish				
Brook trout*	X			

*Species is an excellent indicator of water quality.

X: Species occurs within the identified habitat.

Table S42. Fish Species

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

Common Name	Water
Fish	
Comely shiner	X
Cutlips minnow	X
Margined madtom	X
Shield darter	X
Slimy sculpin	X

X: Species occurs within the identified habitat.

Table S43. 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		X
Birds				
Ruffed grouse				X
Sora rail		X		
Fish				
Brown trout*	X			
Rainbow trout*	X			

*Species are not native to New Jersey. Established breeding populations exist due to stocking for recreational use.

X: Species occurs within the identified habitat.

c. Threats to the Wildlife and Habitats of the Central Highlands

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 remaining forest and grassland habitat in the Central Highlands is vulnerable to poorly planned development. Considerable habitat loss, fragmentation, and degradation already threaten forest-interior wildlife in the region. Bat hibernacula need to be identified and protected from disturbance. Wildlife in the Central Highlands are also threatened by the bioaccumulation of contaminants, human encroachment, illegal collection, ground and surface water degradation, and disease. 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.
- Identify, protect, maintain, enhance, and restore large contiguous tracts of critical grassland habitat (areas with >75 % herbaceous and <25% woody vegetation) as identified by the Landscape Project for upland sandpipers, vesper, grasshopper and savannah sparrows, bobolinks, special concern grassland birds and wintering raptors.
- Identify, protect, maintain, enhance, and restore large contiguous tracts of critical forest and forested wetland habitat as identified by Landscape Project for the long-term viability of forest-dwelling, area-sensitive and interior-nesting wildlife. These include such species or suites as the bobcat, Indiana and other forest-dwelling bats, barred owl, red-shouldered hawk, interior forest passerines, cavity nesting birds, and the wood turtle. Forest patches within this zone are becoming fragmented and large contiguous parcels are somewhat rare. Protection of remaining large patches is important as well as connecting corridors.
- Identify, protect, maintain, enhance, and restore critical wetland and riparian habitats, and water quality to preserve aquatic ecosystems, as identified by the Landscape Project for freshwater wetland birds, bog turtle, wood turtle, vernal pool breeders, special concern reptiles and amphibians, rare damselflies and dragonflies, and nongame fish. .
- Inventory, determine distribution, and monitor wildlife (including nongame fish species) of greatest conservation need in the Central Highlands.
- Prevent, stabilize, and reverse declines of interior-forest species including passerines and raptors, bobcats, forest-dwelling bats, special concern reptiles and amphibians, grassland and scrub-shrub wildlife populations of birds, rare dragonflies and damselflies, butterfly and moth species of conservation concern, riparian and aquatic species such as rare freshwater mussels, and special concern fish species.
- Preserve the ecological quality and integrity of vernal pool communities.
- Protect and enhance important and unique natural communities.
- Protect and enhance bald eagle nesting, foraging and roosting habitat.
- Assess large-scale habitat change (every five to 10 years).
- Maintain the ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife.
- Identify and protect hibernation sites and associated staging (foraging, breeding) habitat for Indiana bat and other winter resident bat species within New Jersey.

- Protect, enhance, and restore coldwater fish habitat and ecosystems.
- Conserve and enhance native, wild trout populations at optimal levels.
- 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 Skylands Regional Landscape stakeholders during a meeting held on January 10, 2007 (see *Attachment G*). 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	
2°	Refine existing Landscape Project species occurrence areas through research and, where lacking, develop new species occurrence areas as data on species requirements become available. Develop, review, and improve species-habitat associations as new land use/land cover data become available. (<i>Protect habitat – Landscape Project</i>)
2°	Support programs, provide guidance and work with public and private landowners and managers to eliminate or control harmful, invasive, exotic vegetation in areas where it is presenting a threat to species of conservation concern. (<i>Conserve wildlife – invasives</i>)
2°	Identify, prioritize, and reclaim degraded rare species habitats by working with land management agencies to determine the appropriate actions needed to restore habitat values for the documented species. Appropriate actions might include the control of harmful, invasive, vegetation, restoring natural stream flows, re-vegetation with native plants or restoring habitat structure. (<i>Evaluate restoration – invasives</i>)
2°	Use GIS measures, other remote-sensing tools, and surveys to identify important winter foraging sites for short-eared owls and northern harriers. Work with public and private landowners and managers to protect and maintain suitable wintering habitat through incentive programs, best management practices, and acquisition. (<i>Silviculture – land management; Agriculture – land management; Protect habitat – migratory birds</i>)
Protect critical grassland habitats identified in the Landscape Project	
1°	Use GIS measures, other remote sensing tools, and surveys to identify critical core grassland habitats (areas with >75 % herbaceous and <25% woody vegetation), assess their condition for nesting grassland birds, and maintain information. Identify protection (e.g., landowner incentives, farmland preservation, acquisition) and management (timing restrictions for mowing, conversion to warm-season grasses) strategies to maintain and enhance large existing core areas of grassland in perpetuity. Focus on habitat patches that can be managed to enhance the total size of suitable grassland habitat. (<i>Conserve wildlife – rare wildlife; Enhance habitat – private lands; Agriculture – land management Protect habitat – sprawl, Landscape Project, development</i>)

Priority	Conservation Actions (continued)
1°	Consolidate adjacent grassland fields, through the elimination of hedgerows, fences, or tree lines, in areas where open land occupies a considerable amount of the surrounding landscape and grassland management can be identified as a reasonable management alternative. (<i>Agriculture – land management</i>)
1°	Use GIS measures, other remote sensing tools, and surveys to identify critical scrub-shrub habitats, assess their condition for nesting birds (golden-winged warbler and woodcock), and maintain information. Identify protection (e.g., landowner incentives, farmland preservation, acquisition) and management (timing restrictions for management, cooperative agreements with utility companies for maintenance of rights-of-ways) strategies to create interspersed scrub-shrub habitat in a grassland matrix. (<i>Conserve wildlife – rare wildlife; Enhance habitat – private lands; Agriculture – land management Protect habitat – sprawl, Landscape Project, development</i>)
1°	Increase the effective size and connectivity of grasslands 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 grasslands and scrub-shrub habitats and target these areas for acquisition to maintain a system of large, connected tracts of grasslands within and between conservation zones. Where possible, enhance and restore grassland habitat through revegetation and management practices such as prescribed burns and appropriate mowing strategies. Work with the NJ DEP, Green Acres Program and the Dept. of Agriculture to identify parcels for acquisition or purchase of development rights. Target 2,000 hectare (7.7 sq. mi.) regions. (<i>Enhance habitat – private lands; Corridors – sprawl, migratory birds; Protect habitat – Landscape Project</i>)
2°	Work with Bureau of Land Management to identify appropriate sites on public lands to maintain and enhance grasslands. Establish mowing schedules, control exotic, invasive vegetation, and establish stands of native warm season grasses on 30 - 50 acres per year within the Landscape region. (<i>Conserve wildlife – rare wildlife; Protect habitat – Landscape Project, migratory birds</i>)
2°	Develop best management practices to guide public and private land managers in maintaining and enhancing grassland and other early succession habitats (scrublands and shrublands). (<i>Agriculture – land management; Other practices – land management</i>)
Protect critical forest and forested wetland habitats identified in the Landscape Project	
1°	Identify critical core forests and assess their suitability for interior forest wildlife. Incorporate the information into the Landscape Project and Biotics database. (<i>Protect habitat – Landscape Project</i>)

Priority	Conservation Actions (continued)
1°	<p>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 possible, enhance and restore forested habitat through afforestation and revegetation. <i>(Enhance habitat – private lands; Corridors – sprawl, migratory birds; Protect habitat – Landscape Project)</i></p>
1°	<p>Increase the number of forests managed to contain a mix of seral (successional) stages to provide habitat for a wide range of forest-dwelling species (e.g., woodland raptors, cerulean warblers, 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.</p> <ul style="list-style-type: none"> • The primary goal being to maintain or manage for large and contiguous areas of mature and near-mature forests with large trees, $\geq 80\%$ canopy cover, and an uneven-age structure that is suitable for woodland nesting raptors (forest raptors). • Maintain and enhance floodplain and ridge-top forests for forest-interior passerines (managing for mature forests with 65-85% canopy closure and structural diversity). • Selected areas of second-growth forested wetlands of moderate wildlife value should be allowed to mature to create future barred owl and red-shouldered hawk habitat. • Take action to minimize loss of older growth 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. <p><i>(Silviculture – Land management; Protect habitat – Landscape Project, migratory birds, rare wildlife)</i></p>
1°	<p>Develop a GIS model of Indiana bat habitat to incorporate into the Biotics database. Identify appropriate protection strategies to maintain and enhance habitat (landowner incentives for protecting summer habitat, public education regarding importance of bat conservation, development of best management practices). <i>(Protect habitat – Landscape Project; Conserve wildlife – rare wildlife)</i></p>
2°	<p>Use GIS measures, other remote-sensing tools, and surveys to identify critical habitats and assess their condition for bald eagle nesting and wintering populations. Develop specific protection strategies to address the threats (e.g., working with the National Park Service to limit recreational opportunities in areas near eagle nests, closing sections of river shoreline to foot traffic and seasonal trail closures). <i>(Protect habitat – humans, Landscape Project)</i></p>

Priority	Conservation Actions (continued)
2°	Use GIS measures, other remote-sensing tools, and surveys to identify forested stopover areas important for migrant forest raptors, passerines and bats during spring and fall migration. Use appropriate measures (e.g. regulations, land acquisition, incentive programs) to protect habitat and develop conservation forestry plans. <i>(Protect habitat – Landscape Project, migratory birds)</i>
Protect critical wetland and riparian habitats identified in the Landscape Project	
1°	Increase the effective size and connectivity of wetlands and riparian habitat on permanently protected public lands and surrounding private lands through incentive programs and targeted land acquisition through local land use policy and planning. Use GIS measures, other remote sensing tools, and surveys to identify important corridors that connect wetland habitats and target these areas for acquisition or work with public and private landowners to enhance and restore the corridors. <i>(Enhance habitat – private lands; Corridors – sprawl, migratory birds; Protect habitat – Landscape Project)</i>
1°	Maintain optimal biological buffers (beyond regulatory requirements) around wetlands, riparian and floodplain areas and minimizing 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. <i>(Protect habitat – Landscape Project; Enhance habitat –private lands)</i>
1°	Protect water quality and aquatic-dependent species by appropriately designating Category 1 waters. <i>(Protect habitat – rare wildlife, fish, mussels)</i>
2°	Perform QA/QC of the NJDEP - DFW, Bureau of Freshwater Fisheries' FishTrack Database and query the database to determine distributions of fishes identified as special concern by the Delphi process. <i>(Monitor wildlife – fish)</i>
2°	Identify and protect habitat for fish by plotting distributions of special concern fish species, and integrate those data into the Biotics database. <i>(Protect habitat – Landscape Project, fish)</i>
2°	Reduce the impacts of mute swan herbivory to native vegetation in wetlands and managed impoundments. Mute swan populations should be reduced to the population objectives identified for New Jersey in the Atlantic Flyway Mute Swan Management Plan. <i>(Conserve wildlife – invasives)</i>
2°	Prevent runoff and sedimentation by maintaining riparian areas through stream bank restoration efforts. <i>(Conserve Wildlife – contaminants, development; Protect habitat – humans, sprawl, development, mussels, fish; Restore habitat – humans; Enhance habitat – riparian species, Odonata, private lands; Agriculture – land management; Silviculture – land management)</i>
Inventory and monitor endangered, threatened and special concern wildlife and fish	
1°	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.

Priority	Conservation Actions (continued)
1°	Develop research proposal to investigate habitat requirements for woodland raptor populations. <i>(Conserve wildlife – rare wildlife)</i>
1°	Systematically survey the Central Highlands Zone for all endangered and threatened species and selected species of special concern to track population and habitat trend data. <i>(Monitor wildlife – long-term monitoring)</i>
1°	Conduct concentrated field sampling for listed or special concern fish species in areas indicated by Fish Track database queries and incorporate data into the Biotics database. <i>(Protect habitat – fish; Monitor wildlife – fish)</i>
1°	Use GIS measures, other remote-sensing tools, and surveys to determine home range and habitat use for bobcats and wood turtles. Use the new data to refine species occurrence areas and integrate into the Biotics database. <i>(Protect habitat – Landscape Project)</i>
1°	Identify and research water quality parameters for spotted turtles, Fowler’s toads, Jefferson salamanders, marbled salamanders, northern spring salamanders, rare mollusks, and nongame fish. Assess impacts and incorporate into BMPs. <i>(Conserve wildlife – rare wildlife; Protect aquatic wildlife - humans, development)</i>
1°	Research and evaluate effectiveness of water quality management practices on spotted turtles, Fowler’s toads, Jefferson salamanders, marbled salamanders, northern spring salamanders, rare mollusks, and nongame fish, particularly those practices associated with permitting or mitigation actions, and revise management actions where appropriate. <i>(Conserve wildlife – rare wildlife)</i>
1°	Determine population status and monitor trends of species of conservation concern in comparison to land use changes and alteration of habitat through long-term sampling and surveys. <i>(Monitor wildlife – long-term monitoring)</i>
1°	Conduct sampling to determine distribution, range, and habitat use of summer bats. <i>(Protect habitat - Landscape Project; Monitor wildlife – long-term monitoring)</i>
1°	Conduct telemetry studies during spring emergence from hibernacula to determine dispersal distances, roost characteristics, and travel corridors of Indiana bats. <i>(Protect habitat – Landscape Project)</i>
1°	Conduct telemetry studies during summer months to determine roost characteristics and habitat requirements for Indiana bat maternity colonies. <i>(Protect habitat – Landscape Project)</i>
2°	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. <i>(Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife)</i>
2°	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. <i>(Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife)</i>

Priority	Conservation Actions (continued)
2°	Continue to monitor reproductive success of eagles and protect nesting areas from human disturbance.
2°	Conduct the annual Mid-Winter Waterfowl Survey to monitor population trends. <i>(Monitor wildlife – long-term monitoring)</i>
2°	Conduct the Atlantic Flyway Breeding Waterfowl Survey annually to monitor population trends. <i>(Monitor wildlife – long-term monitoring)</i>
2°	Trap Indiana bats during spring emergence from hibernacula and apply colored, plastic bands to aid in recovery efforts during summer concentration surveys. <i>(Monitor wildlife – long-term monitoring)</i>
2°	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. <i>(Monitor wildlife – long-term monitoring)</i>
Prevent, stabilize, and reverse declines of wildlife and rare freshwater fish species	
1°	Work with public and private landowners and managers with significant bog turtle, wood turtle, longtail salamander, cavity-nester, woodland raptor, freshwater wetland birds, grassland and scrub-shrub/open field bird populations, and special concern mollusks to enhance targeted wildlife habitat through the implementation of best management practices and incentive programs. <i>(Protect habitat – rare wildlife; Conserve wildlife – rare wildlife; Agriculture – land management; Silviculture – land management)</i>
1°	Research the intensity and characteristics of threats to wildlife species of conservation concern and their habitats, including the causes and effects of habitat loss, degradation, and alteration, edge, disturbance, predation, disease, food availability, contaminants, water quality, competition by invasive plants and animals, and hybridization. <i>(Protect habitat – sprawl, recreational vehicles, humans; Conserve wildlife – contaminants, invasives, rare wildlife, subsidized predator; Evaluate restoration – roads)</i>
1°	Protect species of greatest conservation need from exotic pathogen introduction or incident through rapid response; DFW to give priority attention to these species in planning or implementing a response. <i>(Conserve wildlife – rare wildlife, invasives)</i>
1°	Research the habitat requirements for species of conservation concern (e.g., forest passerines and woodland raptors, timber rattlesnakes, northern copperheads, bobcats, and Indiana bats, where appropriate) and implement planned silviculture practices to enhance forests for these species and species suites. <i>(Protect habitat – Landscape Project; Silviculture – land management; Conserve wildlife – rare wildlife)</i>

Priority	Conservation Actions (continued)
1°	DEP to work with partners in conservation to establish a policy to control damage to native wildlife populations resulting from feral and free-ranging domestic cats on public lands. <i>(Conserve wildlife – cats, subsidized predators)</i>
1°	Develop and implement management actions to enhance populations of special concern and rare fish. <i>(Protect habitat – fish)</i>
1°	Collaborate with DOTs, NGOs, and volunteers to identify areas with known wildlife mortality issues including road crossings for breeding amphibians and roads with high incidences of road mortality (snakes, turtles, large mammals). <i>(Protect habitat – roads; Corridors - roads)</i>
1°	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, USFWS Special Agents, National Park Service 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 (including bog and wood turtles) and human disturbance (off-road vehicles). <i>(Protect wildlife – humans, recreational vehicles)</i>
1°	Use GIS measures, other remote-sensing tools, and surveys to identify critical wetland habitats and assess their suitability for bog turtles and/or other wetland dependent species. Maintain, enhance, and restore populations through habitat protection, management, and maintaining appropriate water levels and buffers, as appropriate, such as innovative public and private partnerships, incentive programs, and cooperative agreements to protect and manage habitat. Additional actions can include fencing and grazing, maintaining protective buffers, eliminating invasive, non-native vegetation and controlling water levels in impoundments. <i>(Protect habitat – Landscape Project; Conserve Wildlife – rare wildlife; Enhance habitat – private lands)</i>
1°	Develop Indiana bat recovery plan in accordance with federal guidelines and strategies set forth in the USFWS Indiana Bat Recovery Plan (U.S. Fish and Wildlife Service, 1999). <i>(Conserve wildlife – rare wildlife)</i>
2°	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. <i>(Protect habitat – recreational vehicles; Conserve wildlife - recreational vehicles)</i>
2°	Develop research proposal to investigate the impact of land use patterns on woodland raptors and rare reptiles and amphibians. <i>(Protect habitat – sprawl; Corridors - sprawl)</i>

Priority	Conservation Actions (continued)
2°	Prevent declines in wildlife populations by utilizing the Delphi process to determine species that may warrant “special concern status” among taxa that has not undergone Delphi review (e.g., fish, moths). (<i>Monitor wildlife – fish; Conserve wildlife – rare wildlife</i>)
2°	Research effects of parasites and diseases on special concern fish species’ populations. (<i>Monitor wildlife – fish</i>)
2°	Use GIS measures, other remote-sensing tools, and surveys to identify critical habitats and assess their condition for breeding, migratory, and wintering waterfowl populations. Maintain, protect, enhance, and restore these sites, as appropriate, through acquisition, incentive programs, and best management practices. (<i>Protect habitat – sprawl, development, Conserve wildlife – game species</i>)
2°	Evaluate and assess the potential impacts of wind turbines to populations of bats. Carry out post-construction monitoring of both existing and future wind turbines to assess the actual impacts these structures have on bats. (<i>Protect habitat – development; Conserve wildlife – rare wildlife</i>)
Preserve ecological integrity of vernal pool communities	
1°	Locate potential vernal pools through aerial imagery and surveys, conduct species surveys, and integrate certified vernal pools into the DEP regulations database and Landscape Project. (<i>Protect habitat – Landscape Project</i>)
1°	Work with public agencies and private landowners to maintain optimal biological buffers (beyond regulatory requirements) to preserve the integrity of vernal pools and the surrounding upland habitat for vernal pool dependent amphibians. 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. (<i>Protect habitat – sprawl; Enhance habitat –private lands</i>)
Protect and enhance important and unique habitats	
1°	State agencies and local governments will work with the NJ DEP, Natural Heritage Program to cooperatively map significant natural communities within the Black River Wildlife Management Area (WMA). (<i>Protect habitat – Landscape Project</i>)
2°	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) critical migratory stopover habitats such as the Black River WMA and Round Valley Reservoir. (<i>Protect habitat – migratory birds; Corridors – migratory birds</i>)
2°	Work with local governments and NJ DEP’s Natural Heritage Program (NHP) to continue to support the protection of the large wetland complex of the Black River WMA. (<i>Protect habitat – development, private lands</i>)

Priority	Conservation Actions (continued)
2°	Work with local governments and NJ DEP's Natural Heritage Program (NHP) to protect and enhance the high quality floodplain forest natural community and endangered plant communities at the Black River WMA through best management practices and increased law enforcement to minimize disturbance in sensitive areas. <i>(Protect habitat – development, sprawl; Enhance habitat – development, private lands)</i>
Protect and enhance bald eagle habitat	
2°	Actively protect, monitor, and manage bald eagle nests and foraging areas, including posting signs in waterways to prevent disturbance by recreational activity and cooperation with private landowners. <i>(Conserve wildlife – rare wildlife; Protect habitat – recreational vehicles, humans)</i>
2°	Use GIS measures, other remote-sensing tools, and surveys to identify critical habitats and assess their condition for bald eagle nesting and wintering populations. Develop specific protection strategies to address the threats (e.g., working with the National Park Service to limit recreational opportunities in areas near eagle nests, closing sections of river shoreline to foot traffic and seasonal trail closures). <i>(Protect habitat – humans, Landscape Project)</i>
Assess large-scale habitat change every five years	
1°	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.
Maintain the ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife	
1°	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. <i>(Evaluate restoration – deer; Conserve wildlife - deer)</i>

Priority	Conservation Actions (continued)
1°	Develop area-specific deer density or percent-reduction targets to reduce herd size to a sustainable level where regeneration of native vegetative communities is possible. <i>(Evaluate restoration – deer; Conserve wildlife - deer, rare wildlife)</i>
1°	Identify areas where invasive, non-indigenous plants and animals are either already established or are becoming established through GIS, surveys, public participation, and through the creation of a system for reporting and qualifying new locations of invasive species. Prioritize areas for control measures according to the potential level of impact on the ecosystem and species of conservation concern and the likelihood of success. <i>(Conserve wildlife – invasives)</i>
1°	Work with public and private landowners and managers to employ appropriate physical, chemical, or biological control measures, or a combination of these, to reduce invasive non-indigenous plants and animals in areas that are identified as providing critical habitat for endangered, threatened, or priority wildlife species and are being threatened by invasive non-indigenous plants. <i>(Conserve wildlife – invasives)</i>
2°	Where appropriate, continue to develop and expand incentives for harvesting antlerless deer (e.g., “earn-a-buck”). <i>(Conserve wildlife - deer)</i>
2°	Work with land management agencies to survey and monitor for the spread of invasive insect species that jeopardize forest health. The species of primary concern include the hemlock woolly adelgid, gypsy moth, Asian long-horned beetle, and emerald ash borer. Research control options for these pests and use appropriate control methods to reduce tree damage and limit the spread of infestations. <i>(Conserve wildlife – invasives)</i>
Identify and protect important hibernacula for wintering bats	
1°	Survey abandoned mines, caves, and railroad tunnels and determine their suitability as winter roost sites; sites where bats are observed will be incorporated into the Biotics database. Recruit private and public land managers to protect active hibernacula from human disturbance. <i>(Monitor wildlife – long-term monitoring; Conserve wildlife - development)</i>
1°	Decrease or eliminate human disturbance and vandalism at hibernacula through increased patrols by the DFW, Bureau of Law Enforcement. <i>(Protect habitat - humans)</i>
2°	Assess the need for stabilization and gating of important bat hibernacula to ensure structural soundness and prevent human disturbance. Install data loggers in important hibernacula to monitor internal conditions and to evaluate the impacts of the gating structures on those conditions. <i>(Protect habitat - humans)</i>
2°	Identify and implement appropriate protection strategies to maintain and enhance Indiana bat and other bat species’ wintering habitat (e.g., working with recreational groups to limit cave and mine access to summer months, landowner incentives for protecting winter habitat). <i>(Protect habitat - humans)</i>

Priority	Conservation Actions (continued)
2°	Install bat-friendly gates on important bat winter roost sites to prevent human disturbance. <i>(Protect habitat - humans)</i>
2°	Identify and protect critical staging habitat surrounding known hibernacula. <i>(Protect habitat – humans, development)</i>
Protect, enhance, and restore coldwater fish habitat and ecosystems	
1°	Use GIS measures, other remote sensing tools, and surveys to identify critical habitats for freshwater nongame fish and native, wild trout and assess their condition for maintaining populations. <i>(Protect habitat – fish)</i>
1°	Develop and implement habitat improvement and restoration programs for coldwater fish species’ habitats and ecosystems. <i>(Protect habitat – fish)</i>
2°	Assess the impacts of changing water quality to native, wild, summer trout populations. <i>(Monitor wildlife– fish)</i>
Conserve and enhance native, wild trout populations at optimal levels	
1°	Systematically monitor native, wild trout populations to revise management strategies when appropriate, aid in the identification of resource problems and issues, and demonstrate agency commitment to the management of aquatic resources. <i>(Monitor wildlife – fish)</i>
1°	Develop population management strategies to assure the protection of NJ’s wild coldwater fisheries. <i>(Protect habitat – humans)</i>
2°	Work with fisheries biologists and managers to evaluate current management practices that may negatively impact native, wild trout populations and revise management practices where appropriate to reverse declines or increase populations. <i>(Protect habitat – humans)</i>
2°	Protect native, wild trout populations by increasing the enforcement of established fishing regulations. <i>(Protect aquatic wildlife – humans)</i>
Promote public education and awareness and wildlife conservation	
1°	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. <i>(Education – humans; Conserve wildlife – invasives)</i>
1°	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. <i>(Education – humans)</i>
1°	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. <i>(Education – humans; Conserve wildlife – rare wildlife)</i>

Priority	Conservation Actions (continued)
2°	Develop and maintain educational 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. <i>(Education – humans)</i>
2°	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. <i>(Education – humans; Conserve wildlife – invasives)</i>
2°	Educate homeowners, through newsletters, press releases, brochures, presentations, etc., about habitat requirements of chimney swifts and discourage use of chimney caps where possible (e.g., abandoned and unused chimneys) and prudent (for human and animal safety). <i>(Education – humans)</i>
2°	Develop brochures and posters to educate the public and increase awareness of New Jersey’s indigenous nongame and coldwater fish species. <i>(Education – humans)</i>

f. Potential Partnerships to Deliver Conservation

Private Landowners

- Protect and enhance habitat through innovative partnerships with private landowners.
 - Implement best management practices that protect nesting and foraging sites of cavity-nesters, forest passerines, freshwater wetland birds, grassland birds, raptors, and scrub-shrub/open field birds.
 - Utilize incentive programs that encourage the management of grassland and scrub-shrub communities and the conservation of bog turtles, and to protect water quality and riparian habitat in areas where rare mussels occur.
 - Encourage farmers to preserve farmland through conservation easements through partnerships with Green Acres, the Nature Conservancy, Land Trust, and local municipalities for the conservation of grassland and scrub-shrub communities and bog turtles.
 - Develop and implement landowner incentives for providing, maintaining, and protecting summer and winter bat habitat.
 - Develop/maintain cooperative relationships with private landowners with bog turtles on their land.
 - Work with landowners to inventory their properties for the presence and severity of invasive non-indigenous plant invasions. Work with them to develop effective control or eradication measures to protect critical wildlife habitats.
 - 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.

Public

- Expand volunteer Citizen Scientist recruitment and activities.
 - Collaborate with conservation groups such as NJ Audubon Society, D&R Greenway, local land trusts, The Nature Conservancy – NJ Chapter (TNC), NJ Conservation Foundation, 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.
 - Collaborate with NJ Audubon Society, NJ Conservation Foundation, and other environmental, member-based organizations to recruit and train Citizen Scientists to monitor vegetative plots (exclosures) on state lands for evaluation of vegetative structure in response to deer densities.
 - Recruit North American Butterfly Association volunteers to conduct surveys for butterfly and moth species
 - Involve Citizen Scientists in conservation projects, such as stream bank restoration.
 - Continue volunteer-based summer bat concentration surveys.

Wildlife Professionals

- Collaborate with researchers in New York, Pennsylvania, and West Virginia to develop best management practices and conservation plans for scrub-shrub/open field birds.
- Consult with animal control officers and extermination companies to implement proper removal of bats from houses and educate them on the importance of providing alternative roosting structures.

Conservation Organizations

- Partner with NJ Audubon Society, The Nature Conservancy – NJ Chapter, NJ Conservation Foundation, and conservation organizations to maintain and enhance habitats.
 - Protect cavity-nester and woodland raptor nesting and foraging sites.
 - Protect and enhance riparian habitats.
 - Initiate and support eradication efforts for invasive plant species.
- Consult with conservation organizations to develop educational programs.
- Encourage the use of 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.
- Continue participation in regional and national bat conservation efforts such as the Northeast Bat Working Group and the North American Bat Conservation Partnership.
- Conduct habitat surveys to determine geographic distribution and severity of invasions of invasive non-indigenous plants.

Local Government, Other State and Federal Agencies

- Partner with local, state, and federal government agencies including municipal and county planning boards, NRCS, USFWS - NJ Field Office, and USDA, 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 protect cavity-nester and raptor nesting and foraging sites.
 - DFW to monitor bat hibernacula for disturbance during critical times.

- DFW to develop a plan to protect sensitive bog turtle, timber rattlesnake, and wood turtle sites from disturbance.
- DFW to share site information and expertise with state and federal law enforcement to increase surveillance of bog turtle and wood turtle sites.
- DFW and conservation organizations to work with the DEP's Land Use Regulation Program to protect and appropriately classify wetlands for special concern reptile and amphibian populations.
- Expand efforts to create habitat and implement best management practices that protect nesting and foraging sites of cavity-nesters, forest passerines, raptors, and other forest-dwelling species, and freshwater wetland birds on state lands and with natural resource managers, county and municipal utility authorities and planners; and where grassland/ scrub-shrub habitats already exist, enhance and maintain habitats for grassland and scrub-shrub/open field birds.
- DFW to encourage greater buffers for important riparian and floodplain areas for forest passerines, reptiles, amphibians, freshwater mussels, and invertebrates with DEP's Division of Watershed Management and Land Use Regulation Program. Partner with them to investigate water quality and threats of contaminants/pollution and to make recommendations on stream encroachment permit issues for areas with listed mussels and rare fish species.
- DFW to develop specific conservation plans for special concern reptiles and amphibians on state lands.
- DFW to work with state and county mosquito commissions to prevent the use of insecticides and biological controls at known amphibian breeding sites.
- DFW will integrate results of vegetative structure in response to deer densities into deer management strategies within deer management zones.
- 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 to work with the USFWS, Department of Defense, and National Park Service to develop effective plans to eradicate invasive non-indigenous plants on federal and state lands and in aquatic systems that are threatening critical wildlife habitats.
- DFW to work with USDA through NRCS and the WHIP program to control purple loosestrife and other invasive plants in critical wildlife habitats.
- DFW to work with the DEP's Office of Natural Lands Management, Natural Heritage Program to develop mapping of significant vegetative communities 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 to determine groundwater recharge areas for bog turtle habitats and 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 neighboring state fish and wildlife agencies to radio-track dispersing Indiana bats across state boundaries.
- DFW to work with USFWS and other state and federal partners to implement North American Waterfowl Management Plan as appropriate.

- DFW to work with USFWS and other state and federal partners to implement American Woodcock Management Plan as appropriate.
- DFW and DEP's Water Monitoring and Standards to work together to recommend classification upgrades in water bodies where listed or special concern species occur.
- DFW to partner with local, county, and state authorities to establish best management practices in areas where listed or special concern fish, freshwater mussels, and wildlife species occur.
- DFW to work with the LURP to make recommendations on stream encroachment permit issues for areas where listed or special concern species occur.
- DFW to lead in the development of educational materials for the public and private landowners about wildlife of greatest conservation need and associated habitats.
- DFW, conservation organizations, and park commissions to expand public outreach through 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 (SADC), Farmland Preservation, and 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.
- Determine distribution, occurrence, and monitor bobcats.
- Annually monitor abundance, productivity, distribution, and trends of bog turtles, wood turtles, forest-dwelling bats, cavity-nesters, colonial waterbirds, forest passerines (2-4 years), freshwater wetland birds (2-4 years), and grassland bird, raptor, and scrub-shrub/open field bird communities (2-4 years), particularly in areas beyond the reach of the Breeding Bird Survey.
- Sponsor "Hawk Watches" for raptor monitoring during the fall migration.
- 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.
- Work with volunteers, private landowners and conservation groups to monitor the success of eradication/control projects that target invasive non-indigenous plants.
- Continue to monitor deer densities and deer harvest data.
- Monitor populations of breeding, migratory and wintering waterfowl of conservation concern.
- 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.