

7. Southern Highlands

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a. Habitats

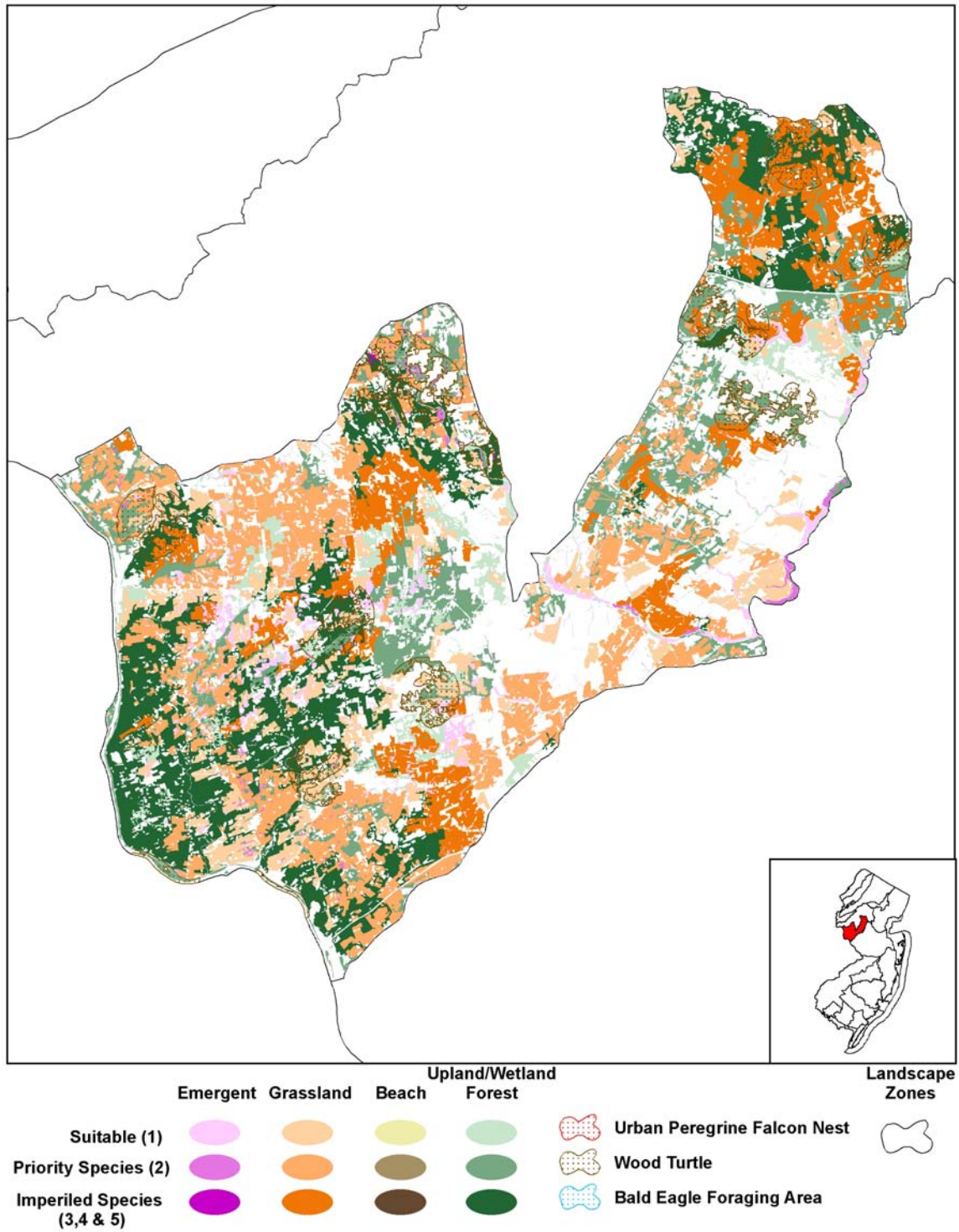
The Southern Highlands Zone is located primarily in southern Hunterdon and extreme eastern Somerset counties (Figure 34). Agricultural fields of cropland and pastures dominate the area. The remaining forest habitat is highly fragmented and exists primarily as small patches interspersed by development and agriculture. Forested ravines exist in the western portion of the zone where small tributary streams flow into the Delaware River. Floodplain forests exist along the Delaware River and provide important habitat to migrating birds. Scattered emergent wetlands occur throughout the zone but many have been impacted by human activity and development.

Very little publicly owned land exists in this zone. Conservation areas of opportunity include the D& R Canal, Bull's Island State Park and the extensive holdings of the Hunterdon County Park System.

b. Wildlife of Greatest Conservation Need

The Southern Highlands supports two federal endangered and threatened, six state endangered, 11 state threatened, and 57 special concern and regional priority wildlife species, in addition to six game species of regional priority and six nongame fish species currently without state or regional status. The Bog turtle is the federally threatened species. The red-shouldered hawk, northern harrier, short-eared owl, upland sandpiper, vesper sparrow, green floater and Appalachian grizzled skipper are state endangered species. State threatened wildlife include the barred owl, Cooper's hawk, long-eared owl, osprey, bobolink, grasshopper sparrow, savannah sparrow, wood turtle, long-tailed salamander, tidewater mucket, and yellow lampmussel. Special concern wildlife are cavity-nesters, colonial waterbirds, forest passerines, freshwater wetland birds, grassland birds, raptors, and scrub-shrub birds. Tables S51 – S57 identify the species of greatest conservation need within this zone.

Figure 34. Critical landscape habitats within the Southern Highlands conservation zone, as identified through the Landscape Map (v2).



Wildlife Species and Associated Habitats of the Southern Highlands

Table S51. 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

**Potential presence.

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

X: Species occurs within the identified habitat.

Table S52. State Endangered Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
Northern harrier		X	X	
Short-eared owl			X	
Upland sandpiper			X	
Vesper sparrow			X	
Mollusks				
Green floater	X**			
Insects				
Appalachian grizzled skipper			X	

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

X: Species occurs within the identified habitat.

Table S53. State Threatened Species

Common Name	Water	Emergent 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		
Savannah sparrow			X	
Reptiles				
Wood turtle				X
Amphibians				
Long-tailed salamander				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 S54. Nongame Species of Conservation Concern

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Eastern small-footed bat				X**
Eastern red bat				X**
Hoary bat				X**
Silver-haired bat				X**
Long-tailed (Rock) shrew				X
Southern bog lemming				X

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Nongame Species of Conservation Concern (continued)

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
Acadian flycatcher				X
American golden-plover		X		
American kestrel			X	
Baltimore oriole				X
Black-and-white warbler				X
Blue-winged warbler				X
Brown thrasher				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
Louisiana waterthrush				X
Northern flicker				X
Northern parula				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
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
Insects				
Club dragonfly	X			X
Extra-striped snaketail	X			X
New England bluet	X	X		
Pitcher plant borer moth		X		
Schweitzer's buckmoth				X

Nongame Species of Conservation Concern (continued)

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
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 S55. 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		
Virginia rail		X		
Wood duck	X	X		X
Fish				
Brook trout*	X			

*Species is an excellent indicator of water quality.

X: Species occurs within the identified habitat.

Table S56. 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
Hickory shad	X
Margined madtom	X
Shield darter	X
Slimy sculpin	X

X: Species occurs within the identified habitat.

Table S57. 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 Southern 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

Encroaching development, disturbance, habitat loss, fragmentation, and degradation threaten the wildlife of the Southern Highlands Zone. Invasive plants alter wet meadows that are bog turtle habitat. The use of pesticides, mowing, and other agricultural practices endanger grassland birds and their habitats. Illegal collection and road mortality impact bog turtles and wood turtles. 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 (areas with >75 % herbaceous and <25% woody vegetation) habitat as identified by the Landscape Project for upland sandpipers, northern harriers, vesper, grasshopper and savannah sparrows, bobolinks, special concern grassland birds, wintering raptors, and special concern butterflies and moths.
- Identify, protect, enhance, and restore important riverine and riparian habitats and water quality to preserve aquatic ecosystems for green floaters and other rare mollusks, wood turtles, special concern reptiles and amphibians, nongame fishes, and rare damselflies and dragonflies.
- Identify, protect, maintain, enhance, and restore the remaining large contiguous tracts of forest and forested wetland habitat as identified by the Landscape Project for the long-term viability of forest-dwelling, area-sensitive and interior-nesting wildlife. These include such species or suites as the Cooper's hawk, red-headed woodpecker, and forest-interior species such as interior forest passerines, cavity nesting birds, and forest-dwelling bats.
- Identify, protect, maintain, enhance, and restore critical wetland habitats as identified by the Landscape Project for bog turtles, wood turtles and long-tailed salamanders, vernal pool breeders, special concern reptiles and amphibians, and rare damselflies and dragonflies.
- Inventory and monitor all endangered, threatened and special concern wildlife (including nongame fish species) in the zone.
- Prevent, stabilize, and reverse declines of grassland and scrub-shrub species (primarily) including grassland passerines and raptors, special concern dragonflies, damselflies, butterflies and moths, rare and special concern reptiles and amphibians, and wetland/riverine species including, rare mussels, special concern fish species, and forest-interior species such as interior forest passerines, cavity nesting birds, and forest-dwelling bats.
- Assess large-scale habitat change (every five to 10 years).
- Protect and enhance important and unique natural communities.
- Maintain the ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife.
- Protect, enhance, and restore coldwater fish habitat and ecosystems.

- Conserve and enhance native, wild trout populations at optimal levels.
- Promote public education and awareness and wildlife conservation.

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>)
2°	Enhance targeted habitats for cavity-nesters, forest passerines, freshwater wetland birds, grassland birds, scrub-shrub birds, and woodland raptors through the use of best management practices. (<i>Agriculture – land management; Silviculture – land management; Enhance habitat – private lands; Protect habitat – rare wildlife; Other practices – land management</i>)

Priority	Conservation Actions (continued)
Protect critical grassland and scrub-shrub 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>)
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>)
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>)

Priority	Conservation Actions (continued)
2°	Research different management techniques to understand the appropriateness of prescribed burning, mowing, brush-hogging, and other methods for maintaining suitable habitat for northeastern grassland birds and grassland dependent invertebrates. <i>(Conserve wildlife – rare wildlife)</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>
2°	Develop, implement and evaluate best management practices (BMPs), through wildlife and habitat surveys, for utility rights-of-way (ROWs) to reduce impacts of vegetation management practices on wildlife and enhance scrub-shrub habitat. <i>(Protect habitat – humans; Conserve wildlife – rare wildlife)</i>
Protect critical riverine and riparian habitats	
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°	Identify and implement actions to protect, maintain and/or restore riverine habitat (e.g., landowner incentives, acquisition, livestock fencing and no-mow riparian buffers) critical riverine habitat as appropriate. <i>(Agriculture – land management; Silviculture – land management; Corridors – migratory birds)</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>

Priority	Conservation Actions (continued)
Protect critical forest and forested wetland habitats identified in the Landscape Project	
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 areas and contiguous 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>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.</p> <p><i>(Enhance habitat – private lands; Corridors – sprawl, migratory birds; Protect habitat – Landscape Project)</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 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></p>

Priority	Conservation Actions (continued)
Protect critical wetland habitats identified in the Landscape Project	
1°	Increase the effective size and connectivity of wetlands 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, sprawl; Enhance habitat –private lands</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>)
Inventory and monitor endangered, threatened and special concern wildlife and fish	
1°	Use the Biotics database and Landscape Project to identify where species data and monitoring gaps exist. Design and implement coordinated surveys to acquire data in those areas.
1°	Systematically survey the Southern 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°	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°	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>)

Priority	Conservation Actions (continued)
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>
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°	Develop and implement habitat conservation goals that will meet the recovery needs of endangered and threatened wildlife populations that depend on grassland and scrub-shrub habitats. This includes guidelines for mowing on public and private lands to enhance breeding success for grassland species. <i>(Conserve wildlife – rare wildlife; Protect habitat – Landscape Project; Enhance habitat – private lands)</i>
1°	Work with private landowners with significant grassland and scrub-shrub/open field bird populations, wood turtle, longtail salamander, cavity-nester, woodland raptor, and freshwater wetland bird populations 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°	Maintain and enhance reptile and amphibian populations, particularly those populations most susceptible to road mortality (known box turtle breeding locations near roads and amphibian breeding migration corridors). <i>(Conserve wildlife – rare wildlife; Protect habitat – roads; Corridors – roads)</i>

Priority	Conservation Actions (continued)
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°	Work with DOTs and other appropriate federal, state, and local agencies to increase the number of sites where road crossing are improved to maintain and avoid disturbance to the natural streambeds and riparian habitat, to permit high volumes of water to flow freely, and to provide adequate travel corridors for terrestrial wildlife, while maintain stream flow for fish passage. Bridges that span rivers and streambeds and include floodplain habitat on either side of the span to provide travel corridors for terrestrial wildlife are preferred over culverts. <i>(Corridors – roads; Protect habitat – roads, fish)</i>
1°	Develop and implement management actions to enhance populations of special concern and rare fish. <i>(Protect habitat – fish)</i>
1°	Maintain and enhance reptile and amphibian populations, particularly those populations most susceptible to road mortality (known box turtle breeding locations near roads and amphibian breeding migration corridors). <i>(Conserve wildlife – rare wildlife; Protect habitat – roads; Corridors – roads)</i>
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°	Use GIS measures, other remote-sensing tools, and surveys to identify, and best management practices to maintain, enhance, and/or protect critical habitats for special concern mollusks, wood turtles, longtail salamanders, special concern reptiles and amphibians, nongame fishes, and special concern damselflies and dragonflies and assess their condition for maintaining populations. Work with the Bureau of Freshwater fisheries to identify critical nongame fish habitat. <i>(Protect habitat – fish; Conserve wildlife – rare wildlife)</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>

Priority	Conservation Actions (continued)
1°	Assess specific threats to nongame fishes, wood turtles, longtail salamanders, and other target species and take the necessary actions to restore, maintain, enhance, and protect habitat, as appropriate. Recommend Category One classification for streams supporting populations. Work with public and private landowners and managers to protect and manage riparian habitat to maintain water quality and reduce siltation. <i>(Conserve wildlife – rare wildlife; Protect habitat – fish, mussels)</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, 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°	Decrease or eliminate human disturbance and vandalism at bat hibernacula through increased patrols by the DFW, Bureau of Law Enforcement. <i>(Protect habitat - humans)</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>(Protect habitat – Landscape Project)</i>
2°	Research effects of parasites and diseases on special concern fish species’ populations. <i>(Monitor wildlife – fish)</i>
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°	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°	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°	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>
Protect and enhance important and unique habitats	
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 Bull’s Island State Park and the Delaware River Floodplain Forests. <i>(Protect habitat – migratory birds; Corridors – migratory birds)</i>
2°	Work with local governments and NJ DEP’s Natural Heritage Program (NHP) to protect and enhance the high quality floodplain forest natural community at the Bull’s Island State Park and the Delaware River Floodplain Forests. <i>(Protect habitat – development, sprawl; Enhance habitat – development, sprawl)</i>
Maintain natural biodiversity, community integrity and structure and ecosystem function	
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>
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)
2°	Work with land management agencies to survey and monitor 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>
2°	Work with the Bureau of Wildlife Management to identify areas (primarily refuge areas where hunting is prohibited) where deer densities exist at unhealthy levels and develop a strategy to reduce deer numbers and maintain them at acceptable levels that encourage natural forest regeneration. <i>(Conserve wildlife - deer)</i>
2°	Where appropriate, continue to develop and expand incentives for harvesting antlerless deer (e.g., “earn-a-buck”). <i>(Conserve wildlife - deer)</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°	Develop brochures and posters about management practices for the public and for private landowners with significant bog turtle, wood turtle, cavity-nester, grassland bird, forest passerine, woodland raptor, scrub-shrub/open field bird populations. <i>(Education – humans)</i>
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 are a major source of non-indigenous species that invade natural plant communities. <i>(Education – humans; Conserve wildlife – invasives)</i>

Priority	Conservation Actions (continued)
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>
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°	Develop a field guide to NJ’s freshwater mussel species to assist in promoting public education and increase awareness of New Jersey’s native freshwater mussel fauna. <i>(Education – humans)</i>
2°	Develop and maintain educational brochures and posters and viewing opportunities 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°	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, ospreys, 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.

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.
- Collaborate with the National Native Mussel Conservation Committee and other experts to develop best management practices for areas with listed and special concern species.
- Work with American Museum of Natural History to maintain existing NY/NJ freshwater mussel web site.
- 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 non-indigenous plant invasions.

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 osprey, cavity-nester, and woodland raptor nesting and foraging sites.
 - DFW to develop a plan to protect sensitive bog turtle 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 and raptors, and other forest-dwelling species 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 work with land managers to maintain grassland bird habitats by impeding succession with controlled burns and scheduled mowing.
 - 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 work with the State Planning Commission, the Office of Smart Growth and local governments to protect critical wildlife habitat and unique communities through the designation of Special Resource Areas within the State Development and Redevelopment Plan.
- DFW to work with the newly created Highlands Council to implement the Landscape Project within the Highlands Region. Work with the Council to designate "no build zones" in the preservation area that are identified as critical habitat on the Landscape maps. Help to identify conservation areas in the surrounding planning area based on Landscape maps.
- 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, 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 osprey (biannually), 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.