

#### **4. Delaware and Musconetcong River Valleys**

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##### **a. Habitats**

The Delaware and Musconetcong River Valleys Zone lies in southern Warren, extreme northern Hunterdon and a very small portion of western Morris counties (Figure 31). Broad river valleys with very fertile soils characterize this zone. Agriculture is the zone's dominant land use. The grassland habitat in these valleys includes natural grasslands, croplands, pastures, old farm fields, utility rights-of-ways, hedgerows, and scrub-shrub dominated areas. Old farm ponds, wet meadows, and swamps infrequently dot the landscape. Scattered, highly fragmented forest parcels remain interspersed throughout. The upland forest and forested wetland habitat includes stands of deciduous hardwood forest, conifer plantations, scrub-shrub uplands and wetlands, vernal pools, and red maple and hardwood swamps. Scattered riparian forests provide important habitat for resident and migratory species.

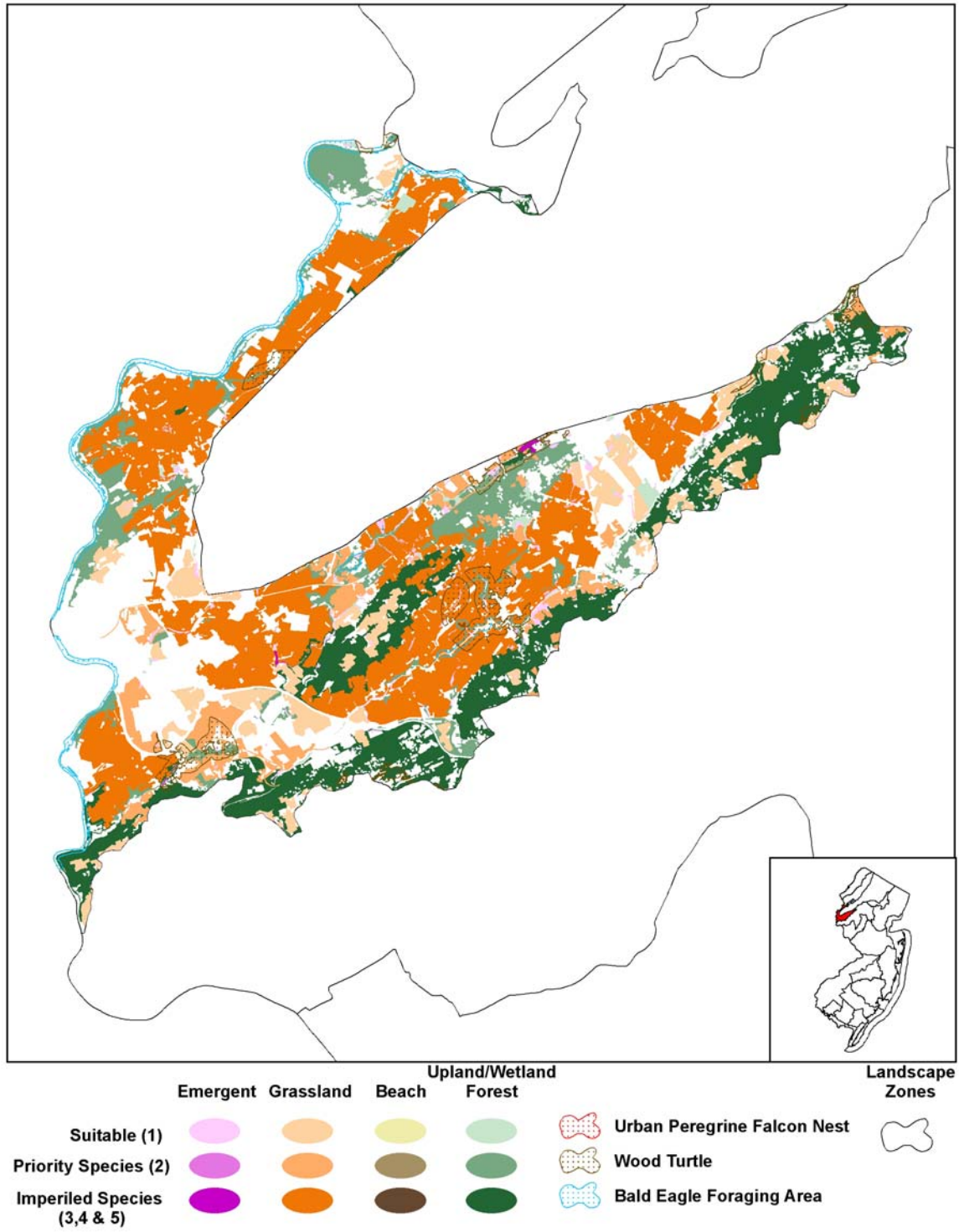
Publicly and privately owned conservation areas of opportunity in the Delaware and Musconetcong River Valleys Zone are scarce. However, important areas of opportunity include Musconetcong and Pohatcong Creek WMA's and the Alpha Grasslands in Pohatcong Township.

##### **b. Wildlife of Greatest Conservation Need**

The Delaware and Musconetcong River Valley habitats support two federal threatened, five state endangered, 10 state threatened, and 50 special concern and regional priority wildlife species, in addition to seven game species of regional priority and four nongame fish species currently without state or regional status. The federal threatened species include the bog turtle and American burying beetle. The state-endangered species are the northern harrier, upland sandpiper, short-eared owl, vesper sparrow and green floater. State threatened species include the barred owl, bobolink, Cooper's hawk, grasshopper sparrow, red-headed woodpecker, savannah sparrow, wood turtle, long-tailed salamander, eastern lampmussel, and triangle floater. Special concern wildlife in the Delaware and Musconetcong river valleys are colonial waterbirds, forest passerines, freshwater wetland birds, grassland birds, scrub-shrub birds, reptiles, amphibians, and mollusks.

The Delaware River serves as a migration route for colonial waterbirds, songbirds, raptors, freshwater wetland birds, and waterfowl. These species take refuge in the floodplain forests and wetland habitats adjacent to the Delaware River. Forests, forested wetlands, and vernal pools are important habitats for a diversity of reptiles and amphibians, including eastern box turtles, spotted turtles, wood turtles, Fowler's toads, long-tailed salamanders, marbled salamanders, and northern spring salamanders. Bog turtles are found in the wet meadows associated with pastures. The valley's grasslands are important to grassland birds and winter-foraging raptors. Tables S30 – S36 identify the species of greatest conservation need within this zone.

**Figure 31.** Critical landscape habitats within the Delaware and Musconetcong River Valleys conservation zone, as identified through the Landscape Map (v2).



Wildlife Species and Associated Habitats of the Delaware and Musconetcong River Valleys

Table S30. Federal Endangered and Threatened Species\*

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
<b>Mammals</b>				
Indiana Bat		X		X**
<b>Reptiles</b>				
Bog turtle		X		
<b>Insects</b>				
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 S31. State Endangered Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
<b>Birds</b>				
Northern harrier		X	X	
Short-eared owl			X	
Upland sandpiper			X	
Vesper sparrow			X	
<b>Mollusks</b>				
Green floater	X**			

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

X: Species occurs within the identified habitat.

Table S32. State Threatened Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
<b>Birds</b>				
Bobolink			X	
Cooper’s hawk				X
Grasshopper sparrow			X	
Osprey		X		
Red-headed woodpecker				X
Savannah sparrow			X	
<b>Reptiles</b>				
Wood turtle			X	X
<b>Amphibians</b>				
Long-tailed salamander		X		
Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
<b>Mollusks</b>				
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 S33. Nongame Species of Conservation Concern

Common Name	Water	Wetlands	Grasslands	Forest and Forested Wetlands
<b>Mammals</b>				
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	X
<b>Birds</b>				
Acadian flycatcher				X

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Nongame Species of Conservation Concern (continued)

Common Name	Water	Wetlands	Grasslands	Forest and Forested Wetlands
<b>Birds (continued)</b>				
American golden-plover		X		
American kestrel			X	
Baltimore oriole				X
Black-and-white warbler				X
Blue-winged warbler				X
Brown thrasher				X
Cerulean warbler				X
Chimney swift			X	
Cliff swallow		X	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		
Indigo bunting			X	
Kentucky warbler				X
Least flycatcher				X
Northern flicker				X
Prairie warbler				X
Purple finch				X
Rose-breasted grosbeak				X
Scarlet tanager				X
Sharp-shinned hawk				X
Spotted Sandpiper		X		
Veery				X
Willow flycatcher				X
Wood thrush				X
Worm-eating warbler				X
Yellow-bellied sapsucker				X
Yellow-billed cuckoo				X
Yellow-throated vireo				X
Yellow-throated warbler				X
<b>Reptiles</b>				
Eastern box turtle		X	X	X
<b>Amphibians</b>				
Carpenter frog		X		
Fowler's toad				X
Northern spring salamander		X		
<b>Insects</b>				
Clubtail dragonfly	X			X
<b>Fish</b>				
American brook lamprey*	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 S34. 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
<b>Birds</b>				
American black duck	X	X		
American woodcock		X		X
Canada goose (Atlantic population)	X	X		
Virginia rail		X		
Northern bobwhite quail			X	X
Wood duck	X	X		X
<b>Fish</b>				
Brook trout*	X			

\*Species is an excellent indicator of water quality.

X: Species occurs within the identified habitat.

Table S35. Fish Species

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

Common Name	Water
<b>Fish</b>	
Cutlips minnow	X
Margined madtom	X
Shield darter	X
Slimy sculpin	X

X: Species occurs within the identified habitat.

Table S36. 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
<b>Mammals</b>				
River otter	X	X		X
<b>Birds</b>				
Ruffed grouse				X
Sora rail		X		
<b>Fish</b>				
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 Delaware and Musconetcong River Valleys**

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](http://www.njfishandwildlife.com/ensp/landscape/lp_report.pdf)

The extensive grassland habitats of the Delaware and Musconetcong River Valleys are vulnerable to losses, as agricultural lands are highly valued by developers. Considerable habitat loss, fragmentation, and degradation have already impacted grassland wildlife in the region. Riparian habitats are in need of protection throughout the zone. Water quality degradation, human encroachment, illegal collection, disease and harmful invasive exotic plants also threaten wildlife. Over-browsing by deer in areas closed to hunting is negatively impacting habitat for

many species. In addition, these areas become more susceptible to invasion by non-indigenous plants. 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, wintering raptors, and special concern dragonflies. Grasslands are a major feature of this zone.
- Identify, protect, enhance, and restore important riverine habitats and water quality to preserve aquatic ecosystems for special concern mollusks, wood turtles, special concern reptiles and amphibians, nongame fishes, native, wild trout populations, and rare damselflies and dragonflies.
- Identify, protect, maintain, enhance, and restore the remaining large contiguous tracts of forest and forested wetlands 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, interior forest passerines and cavity nesting birds, and forest-dwelling bats. Large forest tracts are relatively scarce in this zone and efforts to maintain remaining large tracts is important.
- Identify, protect, maintain, enhance, and restore critical wetland habitats as identified by the Landscape Project for bog turtles, wood turtles, long-tailed salamanders, vernal pool breeders, special concern reptiles and amphibians, and rare damselflies and dragonflies.
- Inventory, determine distribution, and monitor wildlife (including nongame fish species) of greatest conservation need.
- Prevent, stabilize, and reverse declines of primarily grassland and scrub-shrub species including grassland passerines and raptors, special concern dragonflies, damselflies, butterflies and moths, rare and special concern reptiles and amphibians, wetland/ riverine species including colonial waterbirds, special concern fish species, and forest-interior species such as interior forest passerines, woodland raptors, forest-dwelling bats, and red-headed woodpeckers.
- Protect and enhance important and unique natural communities.
- 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 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
<b>Protect wildlife habitat through implementation of Landscape Project mapping</b>	
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°	Enhance targeted habitats for cavity-nesters, forest passerines, freshwater wetland birds, grassland birds, scrub-shrub birds and woodland raptors, bog and wood turtles, and special concern mollusks. ( <i>Agriculture – land management; Silviculture – land management; Enhance habitat – private lands; Protect habitat – rare wildlife; Other practices – land management</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> )
<b>Protect critical grassland and scrub-shrub habitats identified in the Landscape Project</b>	
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 grassland and scrub shrub habitats 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. ( <i>Enhance habitat – private lands; Corridors – sprawl, migratory birds; Protect habitat – Landscape Project</i> )
1°	Identify and enhance grassland habitat for source populations of grassland birds and American kestrels. ( <i>Protect habitat – Landscape Project; Enhance habitat – private lands</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> )
<b>Protect critical riverine and riparian habitats</b>	
1°	Protect water quality and aquatic-dependent species by appropriately designating Category 1 waters. ( <i>Protect habitat – rare wildlife, fish, mussels</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)
2°	Identify and implement actions to protect, maintain, and/ or restore, riverine habitat, as appropriate, for target species. Actions can include acquisition, landowner incentives for protection and management, livestock fencing, no-mow riparian buffers, planting native vegetation in riparian zones to shade streams and control water temperatures. <i>(Agriculture – land management; Silviculture – land management; Corridors – migratory birds)</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>
<b>Protect critical forest and forested wetland habitats identified in the Landscape Project</b>	
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"> <li>• The primary goal being to maintain or manage for large and contiguous areas of mature and near-mature forests with large trees, ≥80% canopy cover, and an uneven-age structure that is suitable for woodland nesting raptors (forest raptors).</li> <li>• Maintain and enhance floodplain and ridge-top forests for forest-interior passerines (managing for mature forests with 65-85% canopy closure and structural diversity).</li> <li>• 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.</li> <li>• 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.</li> </ul> <p><i>(Silviculture – Land management; Protect habitat – Landscape Project, migratory birds, rare wildlife)</i></p>

Priority	Conservation Actions (continued)
1°	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>
1°	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>
<b>Protect critical wetland habitats identified in the Landscape Project</b>	
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>
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>
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>
<b>Inventory and monitor endangered, threatened and special concern wildlife and fish</b>	
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 this zone for all endangered and threatened species and selected species of special concern to track population and habitat trends. Incorporate species occurrence data into the Biotics database. <i>(Monitor wildlife – long-term monitoring; Protect habitat – Landscape Project)</i>

Priority	Conservation Actions (continued)
1°	Conduct concentrated field sampling for listed or special concern species at areas indicated by Fish Track Database queries and incorporate data into Biotics database. <i>(Protect habitat – fish; Monitor wildlife – fish)</i>
1°	Identify and research water quality parameters for spotted turtles, Fowler’s toads, Jefferson salamanders, marbled salamanders, northern spring salamanders and rare mollusks. 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, and rare mollusks, particularly those practices associated with permitting and 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°	Determine distribution of triangle floaters and other rare mollusks in the Musconetcong River and associated waterways through continued surveys and the use of GIS and other remote sensing tools. <i>(Monitor wildlife – long-term monitoring)</i>
1°	Use GIS, other remote sensing tools, and surveys to identify critical habitats for special concern mollusks, wood turtles, long-tail 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 and native, wild trout habitat. Use the new data to refine species occurrence areas and integrate into the Biotics database. <i>(Protect habitat – mussels, Landscape Project, fish; Conserve wildlife – rare wildlife)</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>

Priority	Conservation Actions (continued)
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°	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>
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>
<b>Prevent, stabilize, and reverse declines of wildlife and rare freshwater fish species</b>	
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°	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°	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>

Priority	Conservation Actions (continued)
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, sprawl; Protect habitat – roads, 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°	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°	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°	Investigate causes of decline and landscape-scale habitat requirements of American kestrels and barn owls; identify the most effective methods to restore and enhance habitat and provide nest cavities (standing dead biomass and nest boxes). <i>(Enhance habitat – private lands; Conserve wildlife – rare wildlife)</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>

Priority	Conservation Actions (continued)
2°	Research effects of parasites and diseases on special concern fish species' populations. ( <i>Monitor wildlife – fish</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 – humans; Conserve wildlife – rare wildlife</i> )
<b>Protect and enhance important and unique habitats</b>	
1°	Work with private landowners adjacent to Alpha grasslands and the Garrison Road Priority Site to manage surrounding habitat for grassland species effectively increasing the size of suitable habitat through incentive programs and best management practices. ( <i>Protect habitat – development, sprawl</i> )
<b>Assess large-scale habitat change every five years</b>	
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.
<b>Maintain the ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife</b>	
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)
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>
2°	Work with land management agencies to survey for 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°	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 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>
<b>Identify and protect important hibernacula for wintering bats</b>	
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>
<b>Protect, enhance, and restore coldwater fish habitat and ecosystems</b>	
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>

Priority	Conservation Actions (continued)
<b>Conserve and enhance native, wild trout populations at optimal levels</b>	
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> )
<b>Promote public education and awareness and wildlife conservation</b>	
1°	Develop education materials describing management practices for public land managers and private landowners with significant bog turtle, wood turtle, cavity-nester, grassland bird, forest passerine, woodland raptor, and 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 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> )
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 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, local, and non-governmental organization partners. ( <i>Education – humans</i> )



Priority	Conservation Actions (continued)
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°	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 for the long-term protection of rare mollusks.
  - Work with landowners to inventory their properties for the presence and severity of 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 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 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 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 develop a plan to protect sensitive bog turtle and wood turtle sites from disturbance.
  - DFW 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.
- DFW to work with the DEP's Division of Watershed Management to upgrade stream classifications in areas with rare mussels.
- 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, breeding sites for special concern amphibians, and vernal pools with the Division of Water Quality and the NJ Geological Survey. ENSP to 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, 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.
- Periodically 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.
- 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.
- Monitor extant sites with rare mollusks.
- 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.