Description of the Basin

The Delaware Basin is in the southeastern portion of New York State (NYS), bordering New Jersey and Pennsylvania. The basin covers 2,363 square miles primarily across Sullivan, Ulster, and Delaware counties. Small portions of Chenango, Greene, Schoharie, Broome, and Orange counties also fall within the boundary of the Delaware Basin. There are portions of two mountain ranges in the basin. The southern Catskill mountain range cuts through the eastern portion of the basin in Ulster, Sullivan, and Delaware counties. The Shawangunk Mountains skirt the southeastern border of the basin in Orange, Ulster and Sullivan counties.

According to the US Environmental Protection Agency (EPA) multi resolution land classification (MRLC) maps, the basin is 86% covered by forest. Of this forest cover, 45% is deciduous forest, followed closely by mixed deciduous and evergreen forests that cover 36%. Evergreen forest is relatively scarce in this basin, covering 5% of the land area. Residential and commercial development covers just over 1% of the basin's land area. Just over 9% of the basin is covered by agricultural land uses. The complete list of land classifications in the basin is given in Delaware Table 1. This high ratio of forests to human land uses contributes to the overall excellent water quality in the basin. There are 1,900 miles of rivers and streams in the basin and 400 lakes and ponds. The eastern central portion of the basin is within the boundary of the Catskill Park and contains extensive publicly-owned and DEC-administered Forest Preserve Lands. About one-third of the park is within the basin. A summary of DEC-administered lands in the basin is given in Delaware Table 2.

Created in 1904, the entire Catskill Park today includes about 700,000 acres of public and private land within boundaries delineated on maps by a line usually called the blue line. Intermingled with the Catskill Forest Preserve lands in the Catskill Park are towns, villages and hamlets, highways and byways, businesses and residences. About 60 % of the lands in the Catskill Park are privately owned, and home to approximately 50,000 year-round residents.

The Catskill Forest Preserve was created on May 15, 1885 when Governor David B. Hill signed a law requiring that,

> *"The lands of the state, now owned or hereafter acquired, constituting the forest preserve as now fixed by law, shall be forever kept as wild forest lands. They shall not be leased, sold or exchanged, or be taken by any corporation, public or private, nor shall the timber thereon be sold, removed or destroyed."*

The Catskill Forest Preserve comprises approximately 287,000 acres of public land, 117,730 of which fall within the Delaware Basin in New York State's Greene, Sullivan, Delaware and Ulster Counties. The watershed includes approximately 19,760 acres of state forest lands; these include Arctic, Hickok Brook, Plattekill, Relay, and Tommanex State Forests. State wildlife management areas in the watershed approximate 16,610 acres and include Mongaup, Bearspring Mountain, and Wolf Hollow wildlife management areas. State unique areas in the watershed comprise approximately 7,470 acres and includes the Neversink Unique Area. State-held conservation easements in the watershed approximate 4,660 acres and

other DEC-administered lands in the watershed approximate 650 acres. Thousands of acres of forests with meadows, lakes, rivers, springs, waterfalls, and cliffs are home to a wealth of wildlife. There are hundreds of miles of trails, scenic vistas, large tracts of wilderness, and intensively used recreational areas such as campgrounds and the Belleayre Mountain Ski Center.

There are two traditional state parks in the Delaware Basin. The 1,390-acre Lake Superior State Park in the Town of Bethel in Sullivan County is primarily forested, with some wetlands and the open water of Lake Superior. Areas within the park are classified as hay/pasture and row crops by EPA's MRLC maps. Oquaga Creek State Park, on the border of Delaware and Broome counties, is about 1,504 acres of primarily forest with some grassy areas and open water. This park abuts DEC forest lands in the northwestern corner of the basin. There is also a 2-acre John Burroughs Memorial Site in Roxbury, NY.

The entire main stem of the Delaware River, from the estuary in Delaware Bay to the confluence of the east and west branches of the river in Hancock, N.Y., is unrestricted by dams. The Delaware is the only major northeastern US river where this is the case. A segment of the upper Delaware within the basin from Hancock, N.Y. to Cherry Island near Sparrow Bush, N.Y. was designated part of the National Wild and Scenic River System in 1978. In order to qualify for this designation, the river must be "free-flowing, and relatively undeveloped, possess outstanding remarkable scenic, recreational, geological, fish and wildlife, historical, and cultural resources, or other similar values." The history of fly fishing has made some of the stream renowned in the sport for brown and rainbow trout catches. This segment of the upper Delaware River includes riffles and Class I and Class II rapids, pools, and eddies. In addition, there are federal guidelines for development and alteration of the lands and waters within the designated segment.

The lack of dams on the main stem of the Delaware River has allowed continued use of this river system by diadromous fish species. Spawning American shad ascend the river to Hancock and the lower East Branch each spring, and juveniles migrate out in the fall. The spawning run supports a popular recreational fishery. American eels are widely distributed throughout the basin. The immature stages ("yellow eels") spend varying numbers of years in streams and ponds, and eventually metamorphose into pre-spawning adults in the late summer and fall. These "silver eels" leave the river and migrate to the Sargasso Sea to spawn and die. There is a modest and historical weir fishery on the Delaware for silver eels. Other diadromous species that enter the New York portion of the basin are sea lamprey, gizzard shad, and striped bass.

The population of the basin according to the 2000 US Census was 177,811 people, at an average population density of 75 people per square mile. The average population density in the Delaware Basin is 1,000 times less than the average population density in Manhattan. The total population is also nearly 1,000 times less than the total population of the Lower Hudson-Long Island Bays Basin. In spite of the relatively small population in this basin, Orange County's population is currently the fastest growing in the state according to the US Census Bureau.

The basin is home to several surface water supply reservoirs, three of which supply water to New York City. Creation of these reservoirs has been through

dams constructed along Delaware River tributaries. These reservoirs are part of an extensive surface water supply system for millions of New Yorkers and divert about one third of the river's total volume. The reservoirs and their watersheds within the Delaware Basin are managed and protected by the New York City Department of Environmental Protection (NYCDEP). The aquatic resources in these reservoirs have been managed for high quality trout fisheries.

The NYCDEP has owned approximately 26,550 acres of reservoir buffer land for decades; the reservoirs themselves total 11,350 acres. In May of 1997, EPA issued a filtration avoidance determination for New York City's water supply because it met the objective criteria of that agency for protection of drinking water. In January of 1997, the New York City Watershed Memorandum of Agreement (MOA) was signed by New York City, New York State, EPA, the towns, villages, and counties within the reservoir watersheds, and some environmental and public interest groups. This MOA created a framework for multiple institutions to protect the water supply of the city. The management plan created by NYCDEP uses a combination of land acquisition, voluntary measures, infrastructure upgrades, and best management practices to protect and improve the water quality in the reservoirs. NYCDEP has provided millions of dollars of funding for these activities. NYCDEP has acquired fee title to 11,730 acres since signing the MOA. These are scattered throughout the watershed. In addition, NYCDEP has acquired conservation easements on 2,625 acres. The Watershed Agricultural Council has acquired easements on 5,850 acres. Non-profit land trusts hold 815 acres of preserves and 9,360 acres of conservation easements.

In addition to the large NYC water supply dams, there are many smaller impoundments distributed throughout the basin. These change the original stream habitat into lentic habitats with mixed consequences for basin flora and fauna. On the negative scale, the low-head dams may block migration routes, disrupt sediment and nutrient transport, and warm downstream stream segments. Two larger hydroelectric dams (Lake Wallenpaupack in PA and the Mongaup system in New York) have these effects and may also indirectly influence releases from the NYC reservoirs.

Critical Habitats of the Basin and the Species That Use Them

The Delaware Basin is home to 81 of the 537 Species of Greatest Conservation Need (SGCN) or about 15% of the SGCN statewide. Of those, 25 are in decline, 5 are stable, 8 are increasing, and 42 are of unknown status. The complete listing of SGCN presently found in the basin and their status is in Delaware Table 3. There are 13 species thought to be extirpated from the basin shown in Delaware Table 4. Delaware Table 5 shows the relative species diversity in the basin compared to the complete list of SGCN in the state. There are two species of odonate whose only populations in New York are found in the Delaware Basin. These are the green-faced clubtail and Septima's clubtail. Populations of native brook trout in the basin with unique genetic signatures are thought to have evolved in the Delaware Basin over thousands of years (Keller, 1979).

The 1,900 miles of streams and rivers and 400 lakes and ponds in the basin provide extensive aquatic habitat for SGCN. There are 17 species that depend on coldwater streams in the basin as critical habitat. The overall water quality in the basin is excellent but prone to degradation by human development, invasive species, and atmospheric deposition.

DEC staff members who compiled the SGCN information in the CWCS Planning Database were asked to indicate habitats associated with critical life stages and activities for those species. During the analysis for each basin, a listing of species occurring in the basin and the critical habitats associated with their life cycle at the system and subsystem level was extracted from the database. The resulting aquatic and terrestrial habitats are summarized in the tables below. The habitat classifications in the database were adapted from the New York Natural Heritage Program's *Ecological Communities of New York State, Second Edition*. In most cases the habitats were simplified from the many vegetation associations listed in the community classifications. In the case of the lacustrine and riverine systems, the subsystems were modified to reflect the classifications most often used by fisheries managers at DEC, e.g., "cold water–shallow."

Each of these systems and subsystems is further refined into a habitat category in the CWCS Planning Database and can be viewed in the taxa reports in Appendix A. The habitat categories are excluded here for the sake of simplicity but were considered during the basin analysis. A complete listing of habitat types used in the preparation of the CWCS can be found in Appendix B. The system-subsystem classes that are listed as critical to species in the Delaware Watershed are listed in Delaware Table 6. These critical habitats are not a comprehensive listing of all habitat associations found in the basin, but are a subset of the habitats deemed critical to SGCN that occur in the basin.

The basin is dominated by forested habitat yet, surprisingly, terrestrial open habitats are used by 38 SGCN, the most in this basin. Terrestrial open habitats make up less than 10% of the basin landscape. Terrestrial open habitats include areas classified as row crops and pasture land in the MRLC data, which occur at lower elevations in the basin, often in river and stream valleys. Higher elevations are generally forested.

Terrestrial forested habitats are used by 36 SGCN in the basin. Forests in the basin are characterized by northern hardwood species (beech, birch, maple) with some smaller patch communities of hemlock and pine. Deciduous and mixed forest stands are dominant in the basin and provide critical habitat for the cerulean warbler and timber rattlesnake, both northeast species of concern (Therres, 1999).

Overall Trends in the Basin

The Delaware Basin was almost completely deforested during the 19th century. The loss of forests resulted in flash flooding and heavy siltation of the Delaware River and its tributaries. Stream temperatures increased dramatically during the summer from lack of shade and reduced groundwater input to the streams. The once extensive hemlock forests of the Catskills were heavily harvested for their bark. Tannery and acid manufacturing waste contributed to degradation of water quality in the basin. All of these factors coupled with intense angling pressure and introduction of non-indigenous brown and rainbow trout in the 1880s drastically changed the native fish communities in the Delaware and its tributaries.

Siltation continues today, though not of the magnitude that spurred the creation of the Catskill Forest Preserve. Reforestation occurred with conversion of agricultural land to forests but some of these areas are becoming deforested again due to changing land uses resulting in forest fragmentation. Orange County in particular, is becoming developed at a high rate and has the fastest growing population of any county in the state. Balancing human with ecological needs continues to be a challenge.

Some of these effects have been reversed by the creation of Catskill Park and the Forest Preserve. The construction of a reservoir system in the 1950s and 1960s altered flows of major Delaware River tributaries. The need for adequate drinking water supply for the City of New York and essential habitat for fish and aquatic invertebrates led to significant degradation of the basin's stream habitats during the last half of the 20th century. Passage of the New York State Reservoir Release Legislation (NYS Environmental Law Article 15, Title 8) in 1976 provided the basis for more suitable flow regimes below New York City reservoirs. An October 1980 proceeding by NYCDEP against DEC in the County of Albany Supreme Court under Article 78 of the CPLR resulted in a Stipulation of Discontinuance which changed the NYS Reservoir Release Legislation. Negotiations between DEC, NYCDEP, and the other Delaware Basin states continue to seek improved thermal and habitat conditions in approximately 70 miles of tailwater below the three reservoirs.

Threats

Habitat Loss and Degradation

All of the species in the Delaware Basin are vulnerable to the effects of multiple threats. The most common single threat listed for species that occur in the Delaware Basin in the CWCS database is loss of habitat by human development. The complete list of threats to SGCN is found in Delaware Table 7. Development pressure and recent large-scale development proposals for the Catskills are the most proximate habitat loss threats at this time. New development stresses existing natural resources decreasing flood protection and habitat provided by these resources and increasing siltation which affects aquatic habitat. In addition, sprawl-type development occurring in adjacent counties is influencing development patterns within the basin.

Dams used to create reservoirs on the tributaries to the Delaware River interrupt the naturally dynamic flow of these streams and block migration routes of anadromous and resident species. Other barriers to species dispersal and movement include culverts, road crossings, gravel deltas and temperature, turbidity, and chemical gradients. Many stream species and riparian communities are adapted to the flood cycles of free-flowing streams. Flood waters often carry fine sediments necessary for stream odonates and other burrowing aquatic animals. Alteration of the flooding cycles may change the community structure in dammed stream reaches. Dams cause sediments to accumulate in reservoirs, altering streambed composition in lower reaches. Terrestrial barriers to species movement also exist and include roads and fences.

Not only is volume of flow an issue for many aquatic species in tributaries affected by the reservoirs, but the temperature of the water released from reservoirs plays an important role in the health of these animals. Water released from reservoirs is drawn from deeper, colder strata. Thus, the aquatic communities that become established below the dams are primarily composed of obligate coldwater species. Impounded waters in reservoirs become warmer than the free-flowing areas of streams below reservoir dams. Releases over the dam from the warmer surface waters in the reservoir can have negative effects on fish and other aquatic species, and releases of insufficient quantity do not maintain suitably cold temperatures in stream reaches further removed from the dams.

Toxics

Toxic contaminants are the second most commonly cited threat to SGCN in this basin. Four water bodies in this basin appear on DEC Division of Water's Clean Water Act Section 303(d) list of waters with fish consumption advisories due to toxic contaminants in fish. Neversink Reservoir, Pepacton Reservoir, and Cannonsville Reservoir all have elevated levels of mercury due to atmospheric deposition. Upper Trout Creek and its tributaries are contaminated by PCBs in creek sediments that likely leached from improper upland disposal.

Other contaminants of concern in this basin include pharmaceuticals and endocrine disrupting compounds, pesticides and MBTE. Pharmaceticals and endocrine disruptors can be discharged from sewage treatment plants and

through on-site septic systems. Pesticides are carried in storm water and MBTE pollutes groundwater from underground petroleum tank leaks and gasoline spills.

Atmospheric Deposition

Atmospheric deposition has degraded the East Branch of the Neversink River, its tributaries, and Wolf Reservoir. Water quality degradation, including atmospheric deposition, is the third most cited single threat to SGCN in the Delaware Basin. Atmospheric deposition in New York State originates primarily from power plant and other industrial emissions of sulfur dioxide, nitrogen oxide, and ammonia in the Midwest. These emissions are carried in clouds by prevailing winds to the east and deposited as precipitation. This causes calcium leaching from soils affecting regeneration of certain tree species and limits uptake of calcium by arthropods, eventually affecting avian diets. Mercury contamination in birds through atmospheric deposition is a potential effect just beginning to be understood. In addition to direct aquatic effects, atmospheric deposition can kill trees, causing loss of terrestrial habitat and secondary effects on aquatic habitats by destruction of riparian vegetation. Loss of riparian vegetation leads to increased temperatures, runoff, and siltation.

Another atmospheric threat to the Delaware Basin is carbon dioxide and other greenhouse gases. There are various projections of how much global warming will occur by what date, but most scientists believe that the earth's temperature will rise significantly in a matter of decades. If this process is manifest in the Delaware basin, any number of temperature-intolerant species may be negatively affected. Projected indirect consequences of global warming, such as floods, droughts and high winds, may further disrupt species and processes that have evolved in the basin over millennia.

Invasive Species

Introduction of non-native species has been and will continue to be a threat to this basin, but both native and non-native species are able to take advantage of ecological imbalances. Forest pests and pathogens include chestnut blight (historic), beech bark disease and wooly adelgid (current) and sudden oak death (potential). Tree diseases have a cascading affect through food webs, habitats, and ecosystems. Other potential biological threats include chronic wasting disease, largemouth bass virus, and swim bladder nematodes. Native species such as tent caterpillars and deer have exploited imbalances in the system with deer browsing leading to the decline of understory vegetation and the animals that depend upon the habitat it provides. Gypsy moth larvae feed voraciously on the leaves of almost any tree, often completely defoliating them in areas of severe infestation. Without leaves, the trees are unable to produce food, weaken, and then die. Some natural controls for gypsy moth, including the *Entomophaga maimaiga* fungus, have been effective in dramatically reducing their populations in the Delaware Basin. There are some native gypsy moth predators in New York including the white footed mouse.

Several species of invasive plants are also found in the basin. Tree of heaven, Oriental bittersweet, autumn olive, common reed, purple loosestrife, and Japanese knotweed are a few of the invaders of note. These plants often out-compete native plants and provide poor habitat and food for wildlife. Oriental

bittersweet can overgrow and choke out trees; purple loosestrife can completely dominate emergent marshes once it becomes established.

Priority Issues in Basin

The major natural resource issue in this basin is conservation and management of resources. The Delaware Basin is home to large stands of high-quality forest habitat and some of the cleanest water in the state. There is an opportunity to use this basin as a baseline for SGCN populations that occur in other areas of the state as well. Since the reforestation of the Catskills and the rest of the Delaware Basin, habitat fragmentation has been limited compared to other parts of the state. There is an opportunity to balance new development with the needs of forest dependant species. Not only should the needs of wildlife shape future development in the basin, but the protection of the New York City reservoir system will have a profound influence as well. Resolution of these competing needs will have to undertaken with care in the coming decades.

In the areas of the Catskill Forest Preserve, there is little to no opportunity for active forest management for tree health or wildlife enhancement. The policy in the forest preserve is to extinguish all wildfires as soon as they are detected. Build up of fuel and other symptoms of forest aging must be carefully monitored. Areas of forest habitat outside the preserve should be managed in context with the adjoining wild areas to maximize the habitat value of managed vs. unmanaged habitats in relation to each other, avoiding abrupt changes in cover type or creation of isolated habitat "islands." State Forest lands not in the preserve and private lands can be managed with prescribed burning and other acceptable silvicultural techniques.

Maintenance of adequate water volume and appropriate temperatures in Delaware Basin streams is essential to maintaining the Delaware River and its tributaries as outstanding fish and wildlife habitat. Protection of the quality of the water in these streams is an increasing concern in areas of the basin experiencing explosive growth.

Vision, Goals and Objectives for the Basin

Vision

The Delaware Basin will have healthy and sustainable populations of all SGCN that presently occur here. Opportunities for reintroduction of extirpated species will be acted upon by all conservation partners in the basin.

Existing conservation partnerships among federal, state, and local government partners, tribal nations, not-for-profit organizations, and other citizens groups will be strengthened. New and innovative partnerships will be formed.

Conservation partners in the basin will work together to collect, share, and analyze information on SGCN and their habitats in the basin. Information will be used to constructively manage species and habitats for the greatest benefit to biodiversity preservation while balancing human needs for use of the resources.

Members of the public will understand the value of healthy habitats and the species that they support. Both consumptive and non-consumptive recreational users of resources in the basin will support scientifically sound management of wildlife and habitats of the basin.

Goals and Objectives

- Ensure that no at-risk species become extirpated from the basin by better understanding the current distribution and abundance of SGCN in the basin. Share this information with local governments and other partners in a way that helps inform land use decision making.

- Develop a stepped down watershed strategy for this basin that expands on the recommendations made here. Key products should include a research agenda that supports management and policy for the basin.

- All of the members of the Delaware River Basin Commission will continue to improve flow management in the Delaware River to enhance natural resource values of the river while protecting drinking water supplies.

- Improve the water quality in the few degraded waters in the basin to achieve a goal of no impaired waters on the Clean Water Act §303(d) list for New York. This should include pursuit of atmospheric deposition abatement in other states.

Priority Strategies/Actions for Basin-wide Implementation

The following recommendations do not appear in any priority order. All of these recommendations are intended to be of high priority to implement in this basin in the coming 5 to 10 years for the benefit of the most critical SGCN in the state. See the discussion of "*Development of Conservation Recommendations for Species of Greatest Conservation Need and their Habitats*" and their prioritization in the Introduction. All of the recommendations for SGCN found in this basin can be viewed in Appendix A.

Data Collection Recommendations for Critical Habitats

- Research upland forested habitat use by vernal pool dwelling animals in this basin, especially blue-spotted salamander, Jefferson salamander.

- Expand mapping and inventory of natural communities in the Basin, especially those on publicly held lands.

- Survey stream habitats for :
  - freshwater bivalves, especially brook floater and Eastern pondmussel
  - lake and river reptiles, especially Eastern ribbonsnake and wood turtle
  - Freshwater and anadromous fish; especially comely shiner, swallowtail shiner, ironcolor shiner, American eel, and American shad

  Determine present distribution and abundance of these species. Water quality and habitat characteristics should be correlated with the faunal distribution data to determine optimal habitat characteristics for all these species.

- Map and sample vernal pools in the basin for use by vernal pool salamanders, especially blue-spotted and Jefferson salamanders.

- Evaluate forest stands in the Delaware Basin for use by tree bats.

- Compare forest habitat use by SGCN in Catskill Forest Preserve areas and forests in active management to determine desirability and efficacy of forestry management actions on forest-dependant SGCN in this basin, especially forest breeding raptors and woodland and grassland snakes.

- Continue to survey and document timber rattlesnake dens in the basin. Incorporate the den location data into the Natural Heritage Program element occurrence database to ensure effective regulatory protection of these animals.

- Identify lakes, ponds and streams in the basin suffering from acidic conditions and examine their suitability for reclamation by liming.

- Continue to map and monitor upland and riparian forest health in the basin.

Data Collection Recommendations for SGCN

- Determine preferred stream habitats and occurrence location for green-faced clubtail and Septima's clubtail in the basin. The Delaware Basin is the only known area in New York where these two odonate species occur.

- Investigate dispersal and migration of SGCN and use this information in land use management decisions.

- In freshwater marshbird populations, especially pied-billed grebe, least bittern, American bittern, and king rail, periodically monitor levels of contaminants in birds and eggs to assess trends and determine effects on eggshell thinning, behavioral modification, chick development, nesting success, and juvenile survival. Identify population dynamics and factors influencing success in these species.

- Identify barriers to movement of SGCN (i.e. culverts, roads, dams).

- Research/understand effects of climate change and atmospheric deposition on SGCN.

- Expand habitat and population monitoring for golden-winged warblers in the Delaware Basin to build on hybridization research in Sterling Forest.

- Research forest canopy manipulations as a management tool for interior songbirds requiring early successional forest in the Delaware Basin. Creation of openings and ground growth and thickets should be explored.

- Determine population status of priority herpetofauna species in the basin, especially:
  - All species of lake and river reptiles found in the basin
  - Eastern hognose snake
  - timber rattlesnake

- Monitor the population of ironcolor shiner in the Basher Kill, the largest and single remaining known location of this species in New York.

- Monitor populations of American eel and American shad.

- Understand the relationship of atmospheric deposition and global climate change to priority species.

- Determine the genetic status of the Heritage Strain Brook Trout in the Catskills. Genetic analysis, using modern methodology, needs to be completed not only for fish found in waters that have previously been described as having heritage strain fish but also for other waters that have wild brook trout without a clear history of non-heritage hatchery blood lines.

Planning Recommendations

- Update water quality, land management and restoration plans for the basin, including NYC reservoir management plans, Delaware River Basin Plan, etc., to include SGCN needs.
- Update forest management plans to address needs of SGCN in the basin, especially early successional forest/shrubland birds.
- Complete comprehensive conservation plans for priority areas and SGCN species and habitats. Ensure plans include measurable objectives and a framework for assessing progress towards goals.
- Transfer SGCN-related data to municipal planning situations.
- Evaluate the importance of remaining Delaware Basin hay and pasture lands to grassland species relative to other portions of the state.
- Incorporate heritage strain brook trout issues into existing management plans including the Neversink River Unique Area Management Plan.
- Investigate the feasibility of improvements of stream bottom in areas of the basin where odonates of rivers/streams are historically known to breed. Softening of some stream reaches will likely benefit freshwater bivalves, too.
- Create and/or provide funding to localities incorporating SGCN concerns into land use plans.
- Fund localities working towards decreasing acid deposition and/or greenhouse gas reduction.
- Develop a management plan for the Delaware Basin population of American eel. This plan should be a part of and support an overall management plan for inland populations of American eel.

Land Protection Recommendations

- Protect expanding bald eagle nesting areas in the upper Delaware River by pursuing conservation easements on suitable nesting sites.

- Protect vernal pool salamanders by pursuing conservation easements or acquisition of wooded uplands surrounding breeding sites.

- Secure dens and other critical habitats for woodland/grassland snakes, especially timber rattlesnake and eastern hognose snake through easement or other acquisition techniques.

- Protect freshwater bivalve species by acquiring easements along stream reaches that support those species, especially Eastern pondmussel and brook floater. Other priority areas should include sections of the Neversink River that support high mussel diversity.

- Support acquisition of the Neversink Highlands parcels recommended in the 2002 NY State Open Space Plan. These parcels will benefit several SGCN and help preserve biodiversity in the area.

- Support acquisition of Shawangunk Mountain parcels within the Delaware Basin that are recommended in the 2002 NY State Open Space Plan. These parcels will benefit several SGCN and help preserve biodiversity in the area.

- Preserve/protect, and acquire wherever possible, unfragmented forest areas in the basin.

- Encourage use of SGCN information into land acquisitions.

- Support acquisition of land consistent with the NYC Watershed MOU and NYS Open Space Plan. Consider acquiring lands with emergent marsh habitat and potential wetland restoration sites adjacent to state-owned land.

Management and Restoration Recommendations

- Investigate population enhancement of timber rattlesnakes in the basin through captive breeding and release into suitable habitats, and relocation of adults.
- Introduce captive-bred freshwater bivalves into stream reaches where populations are isolated by dams, or streambed restoration has occurred.
- Maintain heritage strain brook trout in headwater lakes and ponds in the watershed. Update the heritage brook trout management plan by Keller (1979).
- Maintain existing water and vegetation conditions in the Basher Kill Wetlands owned by DEC to support ironcolor shiner populations at current levels.
- Restore emergent marsh where possible.
- Encourage forest understory regeneration in the forested habitats of the basin. This action will benefit early successional forest/shrubland birds and deciduous/mixed forest breeding birds. A particular technique to explore is the use of exclusion fencing in areas of deer overbrowse.
- Increase hunting participation in the basin to reduce deer herds to levels that allow forest understory regeneration.
- Work with the Delaware River Basin Commission and NYCDEP to improve thermal conditions downstream of reservoir dams in the basin to benefit aquatic biodiversity.
- Define and map nesting, roosting, and perching habitat for forest breeding raptors in the basin, especially long-eared owl. Manage these forest stands in a manner protective of the nesting habitat.
- Map and manage riparian forest and grasslands adjacent to lakes and rivers to secure nesting sites and dispersal routes for lake/river reptiles.
- Update lake and pond fish stocking policies to protect extant populations of vernal pool salamanders.
- Create a habitat incentive program to encourage private land owners to make land use decisions which protect and preserve SGCN habitat.
- In areas where water levels are managed, manage water levels to preserve and protect SGCN.

Information Dissemination Recommendations

- Provide guidance to local governments and state agencies and authorities regarding SGCN prone to road collisions and sensitive to habitat fragmentation in the basin.

- Work with private forest owners in the basin to provide guidance on habitat needs of deciduous and mixed forest dependent SGCN in the basin.

- Work with utilities to effectively manage the utility rights-of-way for early successional forest/shrubland birds, and other shrub community dependant SGCN.

- Educate resource users about prevention of introduction of invasive species into the basin.

Regulatory and Legislative Recommendations

- Support regulatory proposals related to prevention of habitat loss that enhance protection of critical stream segments that provide habitat for SGCN.

- Support regulatory proposals related to protection of water quality in critical stream segments that provide habitat for SGCN with additional remedies and enforcement to abate NPS pollutants, erosion, sedimentation, and hydrological alterations.

- Pursue expanded protection for wetlands that are smaller than 12.4 acres and that are important to SGCN in the basin through the "unique local importance" provisions of Article 24 of the Environmental Conservation Law.

- Explore effective regulatory and legislative remedies to prevent the introduction and spread of invasive species.

- Support legislative and regulatory remedies to decrease acid deposition and greenhouse gas emissions in the Basin.

Incentives

- Pursue incentives and potential funding mechanisms for Delaware Basin localities working toward reduced acid deposition and greenhouse gas emissions.

- Explore creation of tax and other incentives for incorporation of riparian setbacks in land use plans at the local level. The setbacks should be based on the needs of SGCN like lake and river reptiles and others.

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Tables and Figures

Tables

Figures