Mesic hardwood forest in Melvin Hazen Park with evidence of excessive deerbrowse and invasive English ivy

Chapter 4
Threats to SGCN and Critical Habitats

4.1 Overview: What will impact wildlife and habitats?

The District was established as the capital of the United States in 1792. It initially encompassed 100 square miles of Virginia and Maryland. At the time of its designation there was little development in the area, apart from large landholdings and the colonial towns of Georgetown and Alexandria. Since then, much of the land that was originally forested has been altered by development, construction, soil disruption, and fragmentation. Aquatic and riparian habitats have been impacted by land reclamation, stormwater runoff, and pollutants. Wildlife have lost habitat to development, and much of the remaining habitat is being further impacted by additional threats. This chapter details the problems and threats to the District's species of greatest conservation need and their critical habitats. These threats can be anything that adversely affects species and habitats, as well as management deficiencies which may contribute to deficiencies in data or resources needed to address particular needs. Threats may impact wildlife and habitats directly or indirectly through a combination of stressors or intermediary processes.

A variety of stable habitats are vital for the long term welfare of wildlife and the recovery of species that experienced population declines or have been extirpated from an area or region. Some species utilize the same habitat year round, while others may breed in one and migrate through others. Summer and winter habitats may be as different as pine barrens and tropical rainforest. Some species can travel thousands of miles during a migration cycle, while others may occupy a single vernal pool. Human activities and habitat degradation can and do occur in all locations and all times of the year. Healthy, stable habitats can be used a proxy for predicting robust wildlife populations. The ultimate goal of this plan is to target habitat-based threats with actions that will recover and restore degraded critical habitats, coupled with protecting habitats that are in good condition from new threats and degradation. Non habitat-based threats to individual species, such as diseases, depredation, and overfishing are

also critical threats that require local and regional action to reverse declines in several SGCN populations.

4.2 Regional Threats

There is no comprehensive assessment of threats across the northeast region. However, numerous threats to fish, wildlife, and their habitats have been identified by the northeastern states as part of their individual SWAPs. After the completion of these 2005 SWAPs, a survey was conducted to identify common threats listed by states (AFWA 2011). The 13 Northeast states and the District of Columbia identified 37 common, recurring threats to SGCN or their habitats (AFWA 2011). The most frequently mentioned threats included invasive species (mentioned by 100% of Northeast states) and industrial effluents; commercial and industrial areas; housing and urban development; and agricultural and forestry effluents (all of which were mentioned by at least 83% of Northeast states). Other important challenges mentioned by 50% or more of the Northeast states included: dams and water management; habitat shifting and alteration; recreational activities; roads and railroads; storms and flooding; temperature extremes; logging and wood harvesting; problematic native species; harvest or collection of animals; lack of information or data gaps; and droughts. In addition to the specific threats mentioned in the 2005 Wildlife Action Plans, recent work by the Northeast states has emphasized the importance of additional, emerging threats such as climate change, exurban developments, new invasive species, and diseases.

4.3 Threat Selection and Prioritization

Key threats in the Northeast Region were identified through Regional Conservation Needs (RCN) collaborative efforts and projects and summarized in the Northeast Regional Synthesis for State Wildlife Action Plans (Terwilliger and NEFWDTC 2013). Threats to both habitats and species were based on the Northeast Lexicon (Crisfield and NEFWDTC 2013), which uses the International Union for Conservation of Nature (IUCN) Threat Categorization Scheme (Version 3.2) (Salafsky et al 2008, IUCN 2015) and is linked to threats in the USFWS Tracking and Reporting Actions for the Conservation of Species (TRACS) system (USFWS 2015) (see Table 16). The IUCN Threat Categorization Scheme was not developed to address completely urban areas. Some of the IUCN nomenclature identifies Level 2 threats that may not directly correlate to urban areas, such as agricultural and forestry effluents; however, the Level 3 threats in that category (nutrification, soil erosion, and sedimentation) are directly related.

Table 16 IUCN Hierarchy of Conservation Threats and TRACS Action Drivers in the District

IUCN Level 1	IUCN Level 2	IUCN Level 3	TRACS Level 1	TRACS Level 2
Residential and Commercial Development	Housing and Urban Areas	List the type of development	Resource Threats	Fish and wildlife habitat loss or degradation
	Commercial and Industrial Areas			
	Tourism and Recreational Areas			
Transportation and Service Corridors	Roads and Railroads	List the specific type of road	Not in TRACS	*(Assume fish and wildlife habitat loss or degradation)*
	Utility and Service Lines	List the specific type of utility line		
	Flight Paths	List the specific type of flight path		
Biological Resource Use	Hunting and Collecting Terrestrial Animals	Intentional Use	Resource Threats	Overharvesting of biological resources
		Unintentional effects		
		Persecution/Control		
	Fishing and Harvesting of Aquatic Resources	Intentional Use (subsistence/small scale)		
		Intentional Use (large scale)		

IUCN Level 1	IUCN Level 2	IUCN Level 3	TRACS Level 1	TRACS Level 2
Human Intrusions and Disturbance	Recreational Activities	List the specific activity	Not in TRACS	*(Assume fish and wildlife habitat loss or degradation)*
	Work and Other Activities			
Natural Systems Modifications	Dams and Water Management/Use	Abstraction of Surface Water (domestic use)		
		Small Dams		
	Other Ecosystem Modifications	List the specific source of alteration		
Invasive and Other Problematic Species, Genes and Diseases	Invasive Non-native/Alien Species/Diseases	Named or Unspecified Species	Resource Threats	Invasive and other problematic species and genes
	Problematic Native Species/Diseases			
	Problematic Species/Diseases of Unknown Origin			
	Viral/Prion-induced Diseases	Named or Unspecified Species (Disease)		
	Diseases of Unknown Cause			
Pollution	Domestic and Urban Waste Water	Sewage	Not in TRACS	*(Assume fish and wildlife habitat loss or degradation)*
		Runoff		
		Type Unknown		
	Industrial and Military Effluents	Oil Spills		
		Type Unknown		
	Agricultural and Forestry Effluents	Nutrient Loads		
		Soil Erosion and Sedimentation		
		Herbicides and Pesticides		
	Garbage and Solid Waste	Type, source, specific pollutants of concern		
	Excess Energy	Light Pollution		
		Thermal Pollution		
		Noise Pollution		
Climate Change and Severe Weather	Habitat Shifting or Alteration	List the specific problem	Resource Threats	Climate change and severe weather
	Droughts			
	Temperature Extremes			
	Storms and Flooding			
	Sea Level Rise			

4.4 Resource Deficiencies and Programmatic Threats

There can be many administrative and management challenges to implementing the conservation actions included in this SWAP. These challenges can be viewed as threats to SGCN and habitats just as development and resource extraction are threats to wildlife. This section presents some of the obstacles that must be overcome before the District will be able to effectively implement its conservation actions.

There is a significant lack of initial baseline knowledge or inventory for a number of taxa. Bees, beetles, mussels, snails, crayfish, copepods and other invertebrates have not been sufficiently studied in the District. Lack of knowledge of these taxa resulted in low certainty of listing some species as SGCN and caused DOEE to rely on expert knowledge and regional data.

There is an overall lack of aquatic resources and wildlife education facilities in the district and limited avenues for large-scale outreach and education of adults and children. Outreach and education about SGCN and wildlife habitats can foster an appreciation for wildlife and for the critical places that wildlife use.

Limited resources in the form of funding and grants will impair the ability to properly execute some aspects of the SWAP. Additionally, resources will be targeted towards Tier I species for fiscal efficiency. This may lead to negative population trends in Tier II species that do no benefit from District wide conservation actions, and non-detection of Tier III species.

Although DOEE is responsible for the development of the SWAP for the entire District, implementation must fall to many partner and stakeholder organizations. Additionally, much of the District's wildlife habitats are on federal land. Conservation actions must be coordinated with federal land managers. Determining the role of each and serving everyone's interest presents challenges to a coordinated conservation effort. The District also shares habitat with the surrounding states and region. It is home to several stopover points for migratory species that transverse the region. Since species and their habitats are not limited by administrative boundaries, the District must coordinate with federal entities, states, and land managers of the region and attempt to address cross-border issues.

4.5 Habitat-Based Threats

Threats to habitats can be shown to impact a wide number of wildlife species. For instance, construction of commercial development on a formerly forested parcel results in the total loss of habitat for all of the wildlife that used that parcel. Stormwater runoff in streams can erode stream banks, wash out fish and invertebrates, and allow pollutants to leach into the groundwater. The same assessment of species and their habitats in this plan that informed the SGCN and critical habitats lists also included a habitat-based threat selection, ranking, and prioritization process. It is necessary to rank and prioritize habitat-based threats so that those species and habitats in most dire need can be targeted for conservation actions.

Prioritization of Threats by Habitat


Invasive periwinkle groundcover in Bald Eagle Hill Park

Threats to habitats were scored and ranked using the threat characteristics listed in Chapter 3 of the Northeast Lexicon. These include severity, reversibility, immediacy, spatial extent, certainty, and likelihood. These characteristics are described in Table 17. Each habitat was ranked for each of these threat characteristics. Low impact characteristics were scored with a 1, moderate impact characteristics were scored with 2, and high impact characteristics were score with a 3. Scores were averaged for each Habitat System, and then re-averaged for each habitat Macrogroup. Since the District is so small, threats to similar systems within each Macrogroup can be treated as a threat to the entire Macrogroup, and conservation actions can be applied in Conservation Opportunity Areas or in other locations that are targeted for the recovery of one or more specific species.

The top threats to vegetative habitats at the Macrogroup level are invasive species, problematic native species, recreational activities, and development of recreational

areas. The top threats for aquatic habitats are urban wastewater, invasive species, nutrification/ sedimentation, and ecosystem modifications. Table 18 shows these habitat-based threats for aquatic and terrestrial habitats. The overall table of habitat-based threats at the Habitat System level can be found in Appendix F. Threats to Developed habitats were not ranked, since they are inherently significantly altered habitats, and can frequently represent threats to wildlife (see section 4.6.3 and 4.7). The overarching habitat-based threats are discussed in the remainder of Section 4.5.

Table 17 Threat Characteristics and Categorical Ratings

Threat Characteristic	Low Impact	Moderate Impact	High Impact
Severity	Slight Severity: Degree of ecological change is minor	Moderate Severity: Degree of ecological change is substantial	Severe: Degree of ecological change is major
Reversibility	Reversible: Effects of the threat can be reversed by proven actions	Reversible with difficulty: Effects of the threat may be reversed but costs or logistics make action impractical	Irreversible: Effects of the threat are irreversible
Immediacy	Long-term: Effects of the threat are expected in 10–100 years given known ecosystem interactions or compounding threats	Near-term: Effects of the threat are expected within the next 1–10 years	Immediate: Effects of the threat are immediately observable (current or existing)
Spatial Extent	Localized: (<10%) A small portion of the habitat or population is negatively impacted by the threat.	Dispersed or Patchy: (10%–50%)	Pervasive: (>50%) A large portion of the habitat or population is negatively impacted by the threat.
Certainty	Low Certainty: threat is poorly understood, data are insufficient, or the response to threat is poorly understood	Moderate Certainty: some information describing the threat and ecological responses to it is available, but many questions remain	High Certainty: Sufficient information about the threat and ecological responses to it is available
Likelihood	Unlikely: Effects of the threat are unlikely to occur (<30% chance)	Likely: Effects of threat are likely to occur (30%–99% chance)	Occurring: Effects of the threat are already observable

Table 18 Threat Priority Ranking of Vegetative and Aquatic Macrogroup Habitats

IUCN 1	IUCN 2	Vegetative Macrogroups							Aquatic Habitats									Overall Average Score
		Central Oak-Pine	Northern Hardwood & Conifer	Eraly Successional	Coastal Plain Swamp	Northeastern Floodplain Forest	Emergent & Mofified Managed Marsh	Average Score, Vegetative Macrogroups	Great River & Embayed Areas	Smal River	Creek/ Stream	Pnds (Freshwater & Riverine)	Intertidal Shore (Mudflats & Rocky Shoals)	Reservoir	Vernal Pool	Springs & Seeps	Average Score Aquatic Habitats	
Invasive & Other Problematic Species, Genes and Diseases	Invasive Non-native/Alien Species/Diseases	16	16	17	16	16.7	16	16.6	14	14	14	14	0	14	14	14	11.2	13.2
	Problematic Native Species/Diseases	12.7	17	0	6	11.3	17	5.8	0	0	0	14	0	14	14	0	8.4	7.4
Residential & Commercial Development	Housing & Urban Areas	6.3	9	0	0	0	0	0.0	0	0	17	0	0	0	17	7	4.8	3.0
	Commercial & Industrial Areas	7	9	0	0	0	0	0.0	17	0	0	0	0	7	13	7	5.4	3.4
	Tourism & Recreational Areas	12	16	10	4	10.3	6	8.1	7	0	0	7	4.5	7	10	11	7.9	8.0
Human Intrusions & Disturbance	Recreational Activities	14	16	10	4	10.3	6	8.1	0	0	0	6	4.5	6	10	10	7.3	7.6
Pollution	Domestic & Urban Waste Water	0	0	0	13.5	13.5	14	9.0	16	13.5	15	14	12	10	15	15	13.2	11.6
	Agricultural & Forestry Effluents; Erosion/ Nutrification	0	0	0	8	16	15	8.0	0	15.5	15	15	11	10	15	15	13.2	11.3
	Industrial & Military Effluents	0	0	0	0	0	0	0.0	0			0	10.5	10	0	0	4.1	2.6
	Garbage & Solid Waste	0	0	11	0	0	13	3.7	16	16	16	0	7	0	0	0	1.4	2.3
Natural Systems Modifications	Ecosystem Modifications	0	0	10	0	10	10	6.7	0		10	10	0	10	15	15	10.0	8.8
	Dams & Water Management/Use	0	0	0	0	0	0	0.0	16	16	16	0	0	0	0	0	0.0	0.0
Biological Resource Use	Fishing & Harvesting of Aquatic Resources	0	0	0	0	0	0	0.0	12	0	13	0	0	0	0	0	0.0	0.0
Resource Management Needs	Resources Information Collection Needs	10	10	10	10	10	10	10.0	10	10	10	10	10	10	10	10	10.0	10.0
Education/Outreach Needs	Education Needs	7	7	7	7	7	7	7.0	7	7	7	7	7	7	7	7	7.0	7.0

4.5.1 Invasive Species

A non-native invasive species is an organism that is non-native to the ecosystem under consideration and whose introduction causes, or is likely to cause, economic or environmental harm, or harm to human health (Invasive Species Advisory Committee 2006). Invasive species have been introduced to habitats either intentionally or unintentionally. Habitats may be susceptible to invasive species if they are already stressed by fragmentations, nutrification, hydrological changes, or soil compaction. Invasive species become overabundant in habitats because they lack the natural control mechanisms of predation and diseases that limited their populations in their native environments (National Invasive Species Council 2008). The reintroduction of well-established invasive species (such as red-eared sliders *Trachemys scripta elegans*) and new introductions of potentially invasive species (such as leatherleaf mahonia *Mahonia bealei*) is ongoing nationally and internationally through the pet trade and horticultural industry.


DOEE fisheries biologist Eric Thadey with a northern snakehead

Invasive plant and animal species are the greatest threat to both terrestrial and aquatic habitat types within the District. Invasive species can include non-native plants, animals, fungi and pathogens. An example of an invasive plant species is lesser celandine (*Ficaria verna)*. Lesser celandine is an ephemeral spring plant that begins growing in mid-winter. It occupies moist floodplain soils where it can grow thick monoculture mats which limit the growth of native spring ephemeral wildflowers such as spring beauty (*Claytonia virginiana*) and Virginia bluebells (*Mertensia virginica*). Lesser celandine is ubiquitous in Northeastern Floodplain Forest habitats in the District.

Invasive animal species can also impact habitats. The emerald ash borer (*Agrilus planipennis*) is an Asian beetle that damages and kills ash trees. In many areas this insect has killed nearly all the white ash (*Fraxinus americana*) and green ash (*Fraxinus pennsylvanica*) trees, which can severely alter forested riparian and upland habitat. Emerald ash borer is found in critical habitats along the Potomac and Anacostia Rivers.

4.5.2 Urban Wastewater

Urban wastewater includes stormwater runoff and sewage. Increases in stormwater runoff occur concurrently with high levels of impervious surfaces and changes in land

use during development. Because much of the District was developed prior to modern stormwater regulations, runoff is directed into streams and artificial gullies where it produces significant erosion, even in naturally vegetated areas. Untreated stormwater leads to erosion, the transport of pollutants, and dramatic changes in water temperature in the District's creeks, streams and rivers.

Other pollutants can enter habitats through stormwater runoff. The District, as an urban center, is especially vulnerable to both point and non-point source water pollution. Point source pollution includes municipal wastewater and stormwater discharges. For example, millions of gallons of raw sewage may be released from combined sewer outfalls into the Anacostia and Potomac Rivers, even after relatively minor storm events. Stormwater pollution results from vast urban development, roads, construction, impervious surfaces, and new development, both in the District and upstream, bringing pollutants into the Potomac, Anacostia, and Rock Creek watersheds.

Like many older U.S. cities, the District has an original combined sewer system (CSS) that carries stormwater runoff and sewage in the same pipes, and a newer municipal separate storm sewer system (MS4) that carries them in separate pipes. One third of the District is still served by the CSS. During normal weather conditions, the CSS sends stormwater and sewage to the District of Columbia Water and Sewer Authority (DC Water) facilities for treatment. The MS4 sends sewage to DC Water for treatment, and discharges stormwater directly into local waterbodies.

DC Water's Blue Plains facility is the largest advanced wastewater treatment facility in the world, with a treatment capacity of 370 million gallons per day and a peak capacity of more than 1 billion gallons per day (DC Water 2015). However, during periods of significant rainfall, CSS pipes that exceed their capacity are designed to discharge overflow directly into local waterways, through what is called a combined sewer overflow (CSO) outfall. There are currently 53 CSO outfalls in the District, with approximately 3.2 billion gallons of sewage and stormwater overflows annually.

Untreated sewage and stormwater runoff cause environmental degradation to District waterbodies by reducing dissolved oxygen, spreading diseases, creating algae blooms, introducing organic chemicals (such as motor oil, gasoline, and polynuclear aromatic hydrocarbons), introducing metals (such as mercury, zinc and copper), changing water temperatures, and increasing acidity.

4.5.3 Nutrification/Sedimentation

Sedimentation in the District is mainly a function of activities occurring in jurisdictions outside of the District but within the Potomac, Anacostia and Rock Creek watersheds. Due to land disturbance caused by housing and road construction, changes in the hydrologic regime, and the concurrent increase in impervious surfaces, stormwater runoff during rain events moves large quantities of soil from land surfaces into the waterways. Once the rivers begin to widen and slow in the District, the sediment which had been transported downstream with the swift upstream currents begins to precipitate. Additionally, headwater creeks and streams in the District receive

stormwater and carry nutrients and sediments from land in the District. Sedimentation is also caused by stormwater eroding soil in disturbed sites in the District.

Nutrification results from excess phosphorous and nitrogen in aquatic habitats. These nutrients can come from combined sewer outfalls, nonpoint sources and stormwater runoff. This can lead to hypoxic conditions in the water column and fish kills. Nutrification can also create conditions which further favor invasive plant species over native plants in both aquatic and wetland systems.

4.5.4 Problematic Native Species


Whitetail deer

Problematic native species include native animals that have become overabundant due to introduction, habitat changes, and a lack of natural control mechanisms. Whitetail deer (*Odocoileus virginianus*) are a native species that has become overabundant in the forests of Rock Creek Park and surrounding medium-density residential areas. The National Park Service estimated the density of deer in Rock Creek Park to be 70–80 deer per square mile (NPS 2014b). Fifteen deer per square mile is maximum density that allows for forest regeneration in most eastern forests (Marquis, Ernst, and Stout 1992).

Canada geese (*Branta canadensis)* are another problematic native species. Migratory Canada geese are native to the District and are a common and abundant winter resident. More than 5,000 wintering geese were counted by DOEE in 2015. These migratory geese are the eastern subspecies, *Branta canadensis* subspecies *canadensis*, which return to northern Canada to nest. A different subspecies, *Branta canadensis* subspecies *maxima*, was introduced to the area in the 1930s and 40s. This introduced population became non-migratory, creating a resident population of approximately 550 Canada geese along the Anacostia River. The non-migratory geese overbrowse and decimate the vegetation in the freshwater tidal wetlands along the Anacostia River (NPS 2014c).

4.5.5 Other Top Habitat-Based Threats

Development of recreational infrastructure and ongoing recreational activities in wildlife habitats are the other top threats to terrestrial vegetative habitats systems. These threats are combined for discussion and application of conservation actions due to their similarity. Ecosystem modifications are a top threat to aquatic systems.

Recreational Activities and Infrastructure

Recreation-based threats include both pressures from recreational- and tourism-based infrastructure, and pressures from recreational activities and tourism. Recreational infrastructure includes existing bicycle and hiking trails, athletic fields, docks and access ramps, construction of new recreational infrastructure, new mowing regimes, and creation of unofficial trails (social trails). Recreational infrastructure continues to be developed in the District. Existing and new infrastructure contributes to fragmentation of habitats and increased recreation activities. For example, the Anacostia Riverwalk trail was recently extended from Kenilworth Park to the District border, resulting in the loss of Coastal Plain Swamp and Northeastern Floodplain Forest habitats. Trail systems through wildlife habitat can alter bird species composition, increase nest depredation and brood parasitism, and limit ranges for specialist species (Miller 1998).

In addition to formal infrastructure, unofficial trails are beaten into the forest by accumulated foot and bicycle traffic. There is an extensive and growing network of unofficial trails in Rock Creek Park, C&O Canal Park, and other locations in many forest habitats in the District. There are more than 44.2 miles of official trails in Rock Creek Park and many miles of unofficial trails (social trails).

Impacts from recreational use can extend beyond trails. DOEE wildlife biologists frequently encounter off-leash dogs along trails. Many DOEE game cameras (used in winter meso-mammal surveys) record off-leash dogs far from any trails. Off-leash dogs are a threat to ground-dwelling animals, can impact herbaceous plants in forests, disperse invasive plant seeds, harass wildlife, and can damage sensitive vernal pool habitats

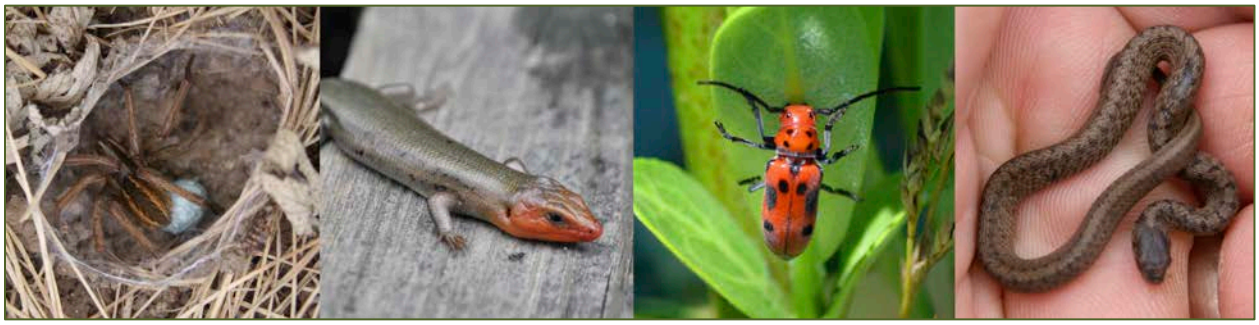
Ecosystem Modifications

Ecosystem modification includes changes to hydrology, vegetation patterns, changes to land forms, cement stream channelization, changes to fire regimes, and other human-driven ecosystem changes. In aquatic systems the modifications that represent the greatest threat to wildlife habitats are dams and other instream obstructions, and stream channelization. Hydrological alterations have affected a number of vegetative systems, particularly the endemic Magnolia Bog, a Northeastern Floodplain Forest, and Coastal Plain Swamp habitats. The Magnolia Bog has become drier with changes to land use near Oxon Run Park, resulting in changes to its vegetative community. Instream obstructions have disconnected many small tributaries from the Anacostia River.

Landform changes can apply to both upland and aquatic habitats. Landfill remediation may affect a significant portion of the meadow habitat in the District. Kenilworth Park sits on former landfill sites and contains several large ruderal meadows. These sites are under study to be capped with additional soil to contain and prevent leaching of any pollutants from the landfill. Capping of these meadows without significant restoration will result in the loss of most of the meadow habitat in the District. Landform modifications that accompany stream restoration can impact instream and riparian habitats by altering stream morphology (introducing step pools and cascades,

reducing sinuosity), altering streambed composition, introducing non-native plants and soils, and opening closed-canopy forests. Any threats to SGCN can be minimized and overall habitat can be improved with detailed planning that keeps wildlife diversity and critical habitat, in addition to water quality, as a goal.

4.6 Species-Based Threats



In addition to threats that directly and indirectly impact the habitats utilized by the wildlife of the District, non-habitat based threats must also be addressed. The improvement in the quality and health of a habitat or ecosystem may not secure the conservation of a declining species, if non-habitat based threats are excluded from the overall strategy to conserve and positively affect SGCN.

4.6.1 Diseases and Pathogens

Wildlife diseases and pathogens have the potential to impact a wide range of species and decimate populations in a short time span. Zoonotic pathogens may become transmissible to humans, can economically impact commercial animals, and infiltrate pet populations. A number of current and emerging diseases are either currently impacting or may impact wildlife in the District in the near future:

Rabies – Rabies is a preventable, fatal disease transmitted from animals to humans, caused by a virus (lyssavirus) that attacks the central nervous system. Symptoms include brain swelling, convulsions, paralysis, and ultimately death. The virus is present in the saliva of infected animals and transmitted primarily through bites. The virus is most often found in raccoons, skunks, foxes, and bats, but can be in unvaccinated dogs and cats. There were 727 reported cases of rabies in the District between 1982 and 2009, with 78% of those cases being infected raccoons (District Department of Health, 2009).

White-nose Syndrome – has killed more than 5.7 million hibernating bats in the Northeast. The disease is named for a white fungus (*Geomyces destructans*) that invades the skins of hibernating bats and is seen around the nose and eyes. Infected bats are aroused from torpor more often than healthy bats, contributing to higher mortality rates. Much about the disease is still unknown and research is ongoing (National Wildlife Health Center 2015).

***Batrachochytrium dendrobatidis* (*Bd*)** – Chytrid is a type of fungus species that lives exclusively in water and moist environments. *Bd* is species of the fungus which is linked to devastating declines in amphibian populations and has caused extinctions and extirpations of a number of species from the wild (Rosenblum et al 2010). Because of the rapid progression of population declines and the speed in which it can spread and exterminate herpetofauna, the threat of *Bd* in the District must be of concern. *Bd* has been found in eastern North America. The pet trade in the region may be a vector for the spread of *Bd* to District habitats.

***Batrachochytrium salamandrivorans* (*Bsal*)** – A chytrid fungus that is specific to salamander species and currently, first documented in European fire salamanders (Yap et al. 2015). Scientists are looking for signs in the United States, as the discovery of the pathogen could lead to devastating declines and extinctions of salamanders. While *Bsal* has not been recognized in the United States, the pet trade inevitably carries the threat of spreading the fungus (Yap et al. 2015).

Avian Influenza (H5N1) – H5N1 is a highly pathogenic influenza virus that occurs mainly in birds, is highly contagious among avian species, and has a high mortality rate in poultry. Fortunately, H5N1 does not infect humans easily and is difficult to spread between people. Because all influenzas have the ability to mutate, public education and monitoring for potential changes may be required.

West-Nile virus (WNV) – WNV is most often spread to people from the bite of an infected mosquito. WNV normally cycles between mosquitoes and birds, but humans may be infected if bitten by a WNV positive mosquito. Corvid populations (jays and crows) were heavily impacted by WNV in the United States, but most are recovering since the highest mortality levels in 2003–2004 (McLean 2006). Public education and monitoring of outdoor workers may be required.

Lyme Disease (*Borrelia burgdorferi*) – Lyme disease is a bacterium transmitted through the bite of infected ticks. Typical symptoms include fever, headache, fatigue, and skin rashes. If untreated, infection can inflame joints, the heart, and the nervous system. In from 2004 to 2013, 84% of Lyme disease cases were reported in the Northeast (Centers for Disease Control and Prevention 2015). Whitetail deer are part of the bacterium's host cycle and may need management to reduce human infections. Small mammals such as white-footed and deer mice (*Peromyscus* spp.) are an important component of the Borrelia life cycle as well.

Avian Vacuolar Myelinopathy (AVM) – AVM is a recently discovered, fatal disease impacting waterbirds and raptors. AVM affects neurological pathways, reducing muscle function, and makes flying and swimming difficult. It has been linked to an epiphytic cyanobacterium (*Aetokthonos hydrillicola*) (Williams et al 2006, Wilde et al 2014). The bacteria are found on hydrilla (*Hydrilla verticillata*), an invasive submerged aquatic plant, which is in the District.

Parvovirus – Various parvoviruses infect wild carnivores and can cause disease. Feline panleukopenia or canine parvovirus are highly contagious and found in domestic animals. Raccoons have been shown to harbor parvoviruses. Wild canids, such as gray fox, red fox, and coyotes may also harbor and be able to transmit parvoviruses.

Canine Distemper – Canine distemper is a highly contagious virus with a high mortality rate. This virus has spread from domestic dogs and can infect and devastate multiple species of wildlife. The disease can spread through populations of raccoon, skunk, fox, and similar animals quickly.

Ranavius – Ranavirus is a DNA based virus responsible for the massive die-off of amphibians and turtles, specifically Eastern box turtles (*Terrapene carolina carolina*). Presence of the virus in wetlands can result in mortality of hundreds to thousands of amphibians within 1–5 days. Because of the seasonality of the ranavirus events, it is suspected to be linked to spring frog and salamander larvae. Symptoms of the virus include lethargy, erratic swimming, swelling in the body, and lesions (National Wildlife Health Center 2013a).

Toxoplasmosis – Toxoplasmosis is caused by the Toxoplasma gondii parasite, which has recently been linked to the mortality of aquatic mammals. These parasites are found globally and distributed into water resources from feline feces. The infection from these parasites can lead to inflammation in the brain and other tissues of the body (Gibson et al 2011).

Snake Fungal Disease – Snake fungal disease is a newer disease emerging in populations of wild snakes. Clinical signs of the fungus include scabs on the scales, nodules, abnormal molting, opaqueness of the eyes, skin ulcers and swelling of the head and face. Population level impacts are not widely known at this point and seemingly hard to monitor given the cryptic nature of snake species (National Wildlife Health Center 2013b).

Chronic Wasting Disease – Chronic wasting disease is a disease of the nervous system that affects deer and elk populations causing brain lesions. Although currently not documented in deer within the District, occurrences have been documented in Maryland and Virginia (National Wildlife Health Center 2013c).

4.6.2 Invasive Animal Species

Invasive animal species not only impact habitats, they are responsible for the direct take of species through depredation and competition for resources. This category includes non-native predators such as cats, fish, crayfish, and birds.

Cats (*Felis catus*) are non-native predators that have been among the most aggressive invasive species globally (Lowe, Browne, and Boudjelas 2000). In the District, they take the form of free-ranging animals that damage bird, mammal, and reptile populations, including declining, rare, and sensitive populations. Free-ranging (outdoor pets, abandoned pets and feral) cat diets have been shown to consist of 69% mammal, 24% bird, and 5% reptiles/amphibians (Woods 2003), and an estimated 1.3–4.0 billion birds

and 6.3–22.3 billion small mammals are lost to cats in the United States annually (Loss, Will, and Marra 2013, North American Bird Conservation Initiative 2014, American Bird Conservancy 2015a). Free-ranging cats pose a direct threat to the health of natural resources, habitat and individual animals. When viewed together, the impacts of free-roaming cats, off-leash dogs, and social trails can be seen as direct human-caused threats to critical natural habitats. Habitats have lower value when these threats are present.

Cat populations or their impacts on local bird, mammal, and herpetofauna have not yet been studied in the District, but free-ranging cats have been frequently documented by DOEE. As a part of ongoing meso-mammal surveys, cats were recorded by game cameras or on track plates 13 times in eight locations in the District from 2009 to 2014 (see Figure 22). DOEE wildlife biologists have observed or photographed free-ranging cats in large patches of forest and meadow habitats in Rock Creek Park, Anacostia Park, Kenilworth Aquatic Gardens, Fort Dupont Park, Poplar Point, Suitland Parkway, National Arboretum, and Pope Branch Park (see Figure 23). Cats have also been observed in smaller habitat patches such as Langdon Park and Hillcrest Park. Cats with notched or docked ears have been observed in these habitats. This indicates cats that have been treated in a Trap-Neuter-Return (TNR) program are found in wildlife habitat. According to the NPS, pets and TNR animals are often illegally abandoned or released on NPS property and into prime wildlife habitats.

Figure 22 A free-roaming cat photographed at night by a game camera placed in Kenilworth Aquatic Gardens in March, 2012.

Figure 23 An ear-tipped cat photographed in the National Arboretum in September 2015.

The northern snakehead (*Channa argus*) was first discovered in the Potomac River watershed in 2002 in Crofton, MD. Since then, it has spread throughout the Chesapeake Bay system. It is a predatory fish that can be found in the Anacostia and Potomac Rivers, in Rock Creek below Pierce Mill Dam, in floodplain ponds, the freshwater ponds at Kenilworth Aquatic Gardens, and in tidal freshwater wetlands. Northern snakehead are voracious eaters, consuming fish, frogs, crustaceans, and in some instances, small birds, mammals, and reptiles. The blue catfish (*Ictalurus furcatus*) is a very large catfish introduced to the region in the 1970's. They grow quickly, and can be as long as five feet and weigh more than 100 pounds. Blue catfish are opportunistic feeders, impacting populations of shad and herring.

European starlings (*Sturnus vulgaris*) and House sparrows (*Passer domesticus*) are aggressive, non-native birds which out-compete native secondary cavity nesters for breeding opportunities and will often kill nesting native species.

4.6.3 Other Threats

Endocrine (Hormone) Disruptors – Field and laboratory studies have shown that exposure to certain endocrine and hormone disruptors have contributed to adverse effects in some wildlife species and populations. Endocrine disruption has the potential to cause reproductive and behavioral changes, impair immune systems, and cause neurological problems and tumors (USFWS 2014). These effects can be subtle changes in physiology or more overt. The extent to which hormone disruptors permeate the environment and cause lasting impacts is unknown.

Noise Pollution – The nearly constant background noise of an urban area, punctuated by sirens, vehicles, planes, and other auditory spikes may be a contributing factor to alterations in wildlife behavior and a decline of certain populations. Hearing loss or the

inability to hear breeding or warning calls over ambient noise may lead to males not being able to find a mate or the detection of a predator too late. Birds have to sing longer and louder to compete in urban areas, expending valuable energy resources, while others have altered pitch and singing times to compete (Mioron et al 2015).


Ovenbird killed by a collision with a glass-clad building

Light Pollution – The use of street lights and other sources of direct and ambient light throughout the District have the potential of being a disturbance for nocturnal and crepuscular wildlife. Bright lights can disorient and become a source of mortality for migratory birds, bats, and some invertebrates.

Collisions with Glass and Buildings – An estimated 300 million to 1 billion birds are killed annually from collisions with glass on buildings and homes (Seewagen and Sheppard 2014, American Bird Conservancy 2015b). The urban character of the District creates a dangerous gambit for migratory and residential species.

4.7 Development and Redevelopment

Developed habitats offer little to no value to most wildlife species. Few native species are adapted to survive in commercial and industrial areas, although some, such as grey squirrel and Virginia opossum make use of human spaces and detritus. Some birds, rabbits, and other species use the residential areas of the District. The threats to natural habitats that are detailed above are fully realized in developed areas. Urban habitat areas are small, fragmented, patchy, disconnected, and mimic the forest edges. Non-native and invasive plants are common in suburban landscaping, and commonly escape and encroach into more natural habitats. Roads and walkways reduce habitat connectivity, are an impediment to dispersal and foraging, and are a source of

polluted stormwater runoff. Redevelopment and increased density in some developed locations may further reduce already low habitat values.

The aging of the street tree and suburban tree canopy may result in the loss of mature tree canopy and reduce the value of these areas. Increasing the use of large, native street trees where practicable instead of small native flowering trees and non-native species such as goldenrain tree (*Koelreuteria paniculata*) or Japanese zelkova (*Zelkova serrata*) could improve the value of urban habitats. The potential for invasiveness of non-native trees and plants is not rigorously reviewed before plants are integrated into the horticultural trade. Natural resource agencies must use extreme caution in supporting the planting of trees that could be invasive.

4.8 Climate Change

Although many threats associated with climate change are on a global, national, or regional scale and outside the scope of being solved through local conservation actions, the species and habitats of the District will be impacted by climate change. See Chapter 5 for an assessment of the predicted condition of habitats, threats to SGCN and habitats, and possible conservation actions relating to climate change.