Restored tidal wetlands along the Anacostia River

Chapter 3
Habitats

3.1 District of Columbia's Diverse Habitats

The District is a fully developed urban city that also contains significant wildlife habitat in its parks and other natural areas. There are dense commercial areas, moderately dense suburban areas, and two large rivers, all located directly adjacent to permanently protected natural areas. The dichotomy between developed areas and undeveloped habitats, coupled with the small total area of the District, creates a unique dynamic between wildlife and habitat conservation and human use of local natural areas. It also presents opportunities to view and study the urban and suburban parts of the District as integral components of the habitats that SGCN require. District includes more than 900 acres of city parks and more than 6,700 acres of national parkland (District of Columbia Office of Planning 2006). While it can be difficult for humans and wildlife to coexist within the borders of one city, the early protection of large areas of the city (Rock Creek Park in 1890 and Fort Circle Parks in 1925) and the location of the city at the geographic fall line has led to an unexpectedly wide diversity of wildlife and habitats. This combination of developed and natural areas leads to interesting dynamics in terms of the interface between humans and wildlife.

The District's varied land uses, protected areas, soils, geography, topography, and hydrology support a variety of plant communities that provide habitat for animal wildlife. This chapter identifies these habitats, provides an assessment of their condition, and details the selection of key habitat areas (Conservation Opportunity Areas) that will be the targets of direct conservation actions. In the context of this plan habitat is defined as the place where an animal normally lives or spends time while it is present in the District. This includes broad categories such as river or forest, specific natural and semi-natural vegetative communities, and developed areas that may support some wildlife.

3.1.1 Local Context

Habitat type is ultimately driven by abiotic factors such as soil and climate. This section provides brief descriptions of abiotic factors that underlay the vegetative habitats of the District.

The District is bisected by two physiographic regions, which define and influence the local habitat context. The geologic fall line separates the Appalachian Piedmont region and the Mid-Atlantic coastal plain. This fall line marks a transitional zone where the sedimentary rock, softer soils, and sloping hills of the coast intersect with more resilient, steeper, metamorphic rocks of the piedmont. This split provides an increased variety of habitats and the animal species associated with those habitats. The physiographic regions are further classified into smaller ecoregions based on both abiotic and biotic factors. An ecoregion is defined by the World Wildlife Fund as a large area of land or water that contains a geographically distinct assemblage of natural communities that share a large majority of species and ecological dynamics, share similar environmental conditions, and interact ecologically in ways that are critical for longtime persistence. They can also be described as a composition of biotic and abiotic phenomena, including geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology, that affect or reflect differences in ecosystem quality and integrity (Wiken 1986; Omernik 1987, 1995).


Potomac Gorge floodplain

The Environmental Protection Agency (EPA) created a hierarchical categorization of ecoregions with four levels of detail. The level III and IV ecoregions for the Mid-Atlantic states are shown in Figure 1. Above the fall line, the western part of the District is in the EPA level III Ecoregion 64: Northern Piedmont. The Northern Piedmont includes the foothills of the Appalachian Mountains in the Mid-Atlantic region. It extends from Virginia to northern New Jersey and covers approximately 66,491 square kilometers in total. The region is bordered by Mid-Atlantic coastal plain to the east and the Appalachian Mountains to the west. From the geographic fall line at approximately 60 meters elevation, the Piedmont extends west to the Blue Ridge and the Ridge and Valley regions of the Appalachian Mountains, reaching elevations of 300–600 meters. The topography of the Piedmont is descending rolling hills and the soils and underlying bedrock are composed of erosion-resistant igneous and metamorphic rock (Kearney 2003). Below the fall line the eastern part of the District is in the EPA level III Ecoregion 65; Southeastern Plains. This section of the Mid-Atlantic coastal plain extends into Virginia, Maryland, Delaware, Pennsylvania and New Jersey and it covers approximately 56,220 square kilometers. The region is bordered by the Atlantic Ocean

to the east and the Piedmont to the west. The region exists as a result of alluvial deposition of eroded rock and clay from the Piedmont and Appalachian mountains. Steep, high energy rivers that arise in the Appalachian Mountains slow down below the fall line and release sediment onto the Coastal Plain. The low-lying plain begins at an elevation of less than 80 meters and extends down to sea level. The lowest elevations are characterized by bays and tidal rivers, such as the Chesapeake Bay and Potomac River. The soils are primarily derived from the slow-draining clay sediments deposited from the mountains, leading to the development of many types of expansive wetlands (Watts 1999).

In 1995, Bailey provided descriptions of the ecoregions of the U.S. Forest Service classification system (McNab and Avers1994, Bailey1995). The Nature Conservancy (TNC) adapted Bailey's system (1995) to classify ecoregions for its regional planning effort (Groves 2002). The District falls within TNC's Chesapeake Bay Lowlands and the Lower New England Northern Piedmont Ecoregion. In 1998, the North American Bird Conservation Initiative, in conjunction with Partners in Flight, developed its Bird Conservation Regions (BCR) based on TNC's Ecoregions. The District falls within two Bird Conservation Regions: the Piedmont (BCR #29) and the England/Mid-Atlantic Coast (BCR #30) (Kearney 2003, Watts 1999).

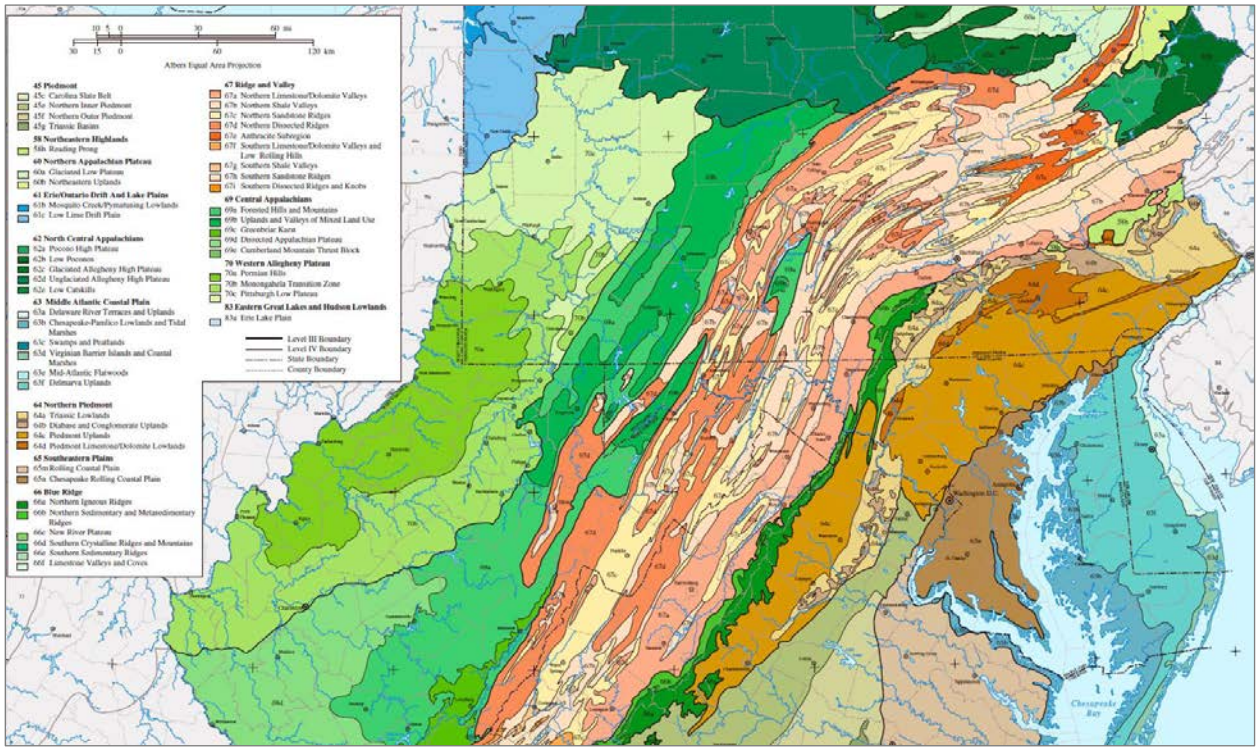


Figure 1 Level III and IV Ecoregions from the Environmental Protection Agency's hierarchical classification system. (EPA Western Ecology Division, 2015).

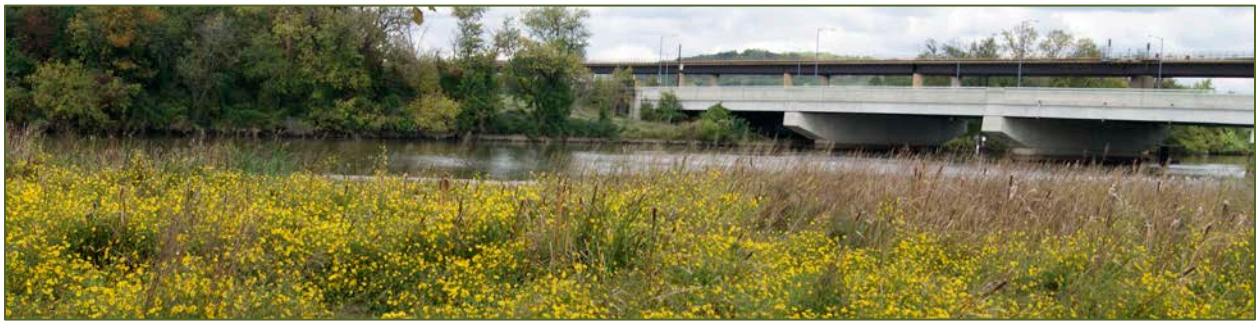
The District shares these ecoregions with the surrounding states of the Mid-Atlantic region, including Maryland, Virginia, Pennsylvania, and New Jersey, making the District geographically similar to those states. This has many important implications for conservation planning. Issues important to habitats within the District are also important to the surrounding states. Therefore, coordination with those states should be a central component to developing conservation strategies.

3.1.2 Northeast Regional Context

The District is part of the northeastern U.S. region that extends from Maine to Virginia. From the NE Regional Synthesis: The Northeast is over 60% forested, with an average forest age of 60 years, and contains more than 200,000 miles of rivers and streams, 34,000 water bodies, and more than 6 million acres of wetlands. Eleven globally unique habitats, from sandy barrens to limestone glade, support 2,700 restricted rare species. Habitat fragmentation is one of the greatest challenges to regional biodiversity, as the region is crisscrossed by over 732,000 miles of roads. The region also has the highest density of dams and other obstacles to fish passage in the country with an average of seven dams and 106 road-stream crossings per 100 miles of river (Martin and Apse 2011). Conversion to human use has also impacted much of the Northeast landscape, with one-third of forested land and one-quarter of wetlands already converted to other uses through human activity. Total wetland area has expanded slightly in the Northeast over the past twenty years, although 67% of wetlands are close to roads and thus have likely experienced some form of disruption, alteration, or species loss.

Many of the threats described above are directly applicable at the finest scale to wildlife habitat in the District. Habitat conditions in the District can serve a proxy for future conditions across the northeast region as human-dominated land uses continue to encroach upon undeveloped wildlife habitat.

3.2 Process for Defining and Describing Habitats



Vegetative habitats were classified using the Northeast Lexicon and the Northeastern Terrestrial Wildlife Habitat Classification System (Gawler 2008). Aquatic habitats are based loosely on the Northeastern Aquatic Habitat Classification System (Olivero and Anderson 2008).

The Northeast Terrestrial Habitat Classification System (NETHCS) was developed in 2008 to provide a coarse but cohesive system to describe the physical and biological characteristics relevant to wildlife conservation (Gawler 2008). The Habitat System corresponds to the ecological system units developed by NatureServe (Comer et al 2003) which occur in the Northeast, with additional systems for altered habitats and land-use types. The hierarchical system uses the terms Formation, Macrogroup and Habitat System (Table 4) as increasingly fine-grained categories of habitat types. The system includes 7 Formation Classes at the top level, 15 Formations in the second tier, 35 Macrogroups in the third tier, and 143 Habitat Systems (Crisfield and NEFWDTC 2013). In this plan the terrestrial habitat types are classified to the Habitat System level, although some finer-scale plant associations are called out in the descriptions of unique habitats.

The Northeastern Aquatic Habitat Classification System was developed to create a standard classification system that describes freshwater aquatic systems, particularly rivers and streams, across the northeastern United States. "The goal of the classification system is to consistently represent the natural flowing-water aquatic habitat types across this region in a manner deemed appropriate and useful for conservation planning by the participating states. The system is meant to unify state classifications and promote an understanding of aquatic biodiversity patterns across the region" (Olivero and Anderson 2008). The hierarchical system uses Drainage Area, Gradient, Buffering Capacity, and Temperature to classify streams. Drainage Area is a measure of river or stream size, which is a critical factor determining the aquatic animal community. Gradient affects the morphology and substrate of the steam bed, and the velocity of the water. Buffering Capacity is a measurement of the stream's underlying soils and bedrock, which influences the pH of the stream. Acidic water can be detrimental to the health of fish and other organisms (Allan 1995). Aquatic organisms are also limited by stream temperature for successful reproduction and overall survival. Non-vegetated intertidal aquatic habitats are from the NETHCS. Other aquatic habitats include freshwater ponds, reservoirs, riverine ponds, vernal pools, and springs and seeps.

Table 4 Formations and Macrogroups Comprising the Northeast Terrestrial Wildlife Habitat Classification System from *The Northeast Lexicon* (Crisfield and NEFWDTC 2013)

Formation Class	Formation Name	Macrogroup
Forest and Woodland	Southeastern Upland Forest	Longleaf Pine
	Northeastern Upland Forest	Southern Oak-Pine
		Central Oak-Pine
		Northern Hardwood & Conifer
		Plantation and Ruderal Forest
		Exotic Upland Forest
	Northeastern Wetland Forest	Southern Bottomland Forest
		Coastal Plain Swamp
		Central Hardwood Swamp
		Northeastern Floodplain Forest
		Northern Swamp
	Boreal Upland Forest	Boreal Wetland Forest
		Boreal Forested Peatland
Shrubland and Grassland	Grassland and Shrubland	Glade and Savanna
		Outcrop & Summit Scrub
		Lake & River Shore
		Ruderal Shrubland & Grassland
	Coastal Scrub-Herb	Coastal Grassland & Shrubland
	Peatland	Northern Peatland
		Coastal Plain Peatland
		Central Appalachian Peatland
	Freshwater Marsh	Coastal Plain Pond
		Emergent Marsh
		Wet Meadow / Shrub Marsh
		Modified / Managed Marsh
	Salt Marsh	Salt Marsh
Polar and High Montane	Alpine	Alpine
Aquatic (in part)	Intertidal	Intertidal Shore
Sparsely Vegetated Rock	Cliff and Rock	Cliff and Talus
		Flatrock
		Rocky Coast
Agricultural	Agricultural	Agricultural
Developed	*No name provided*	Maintained Grasses and Mixed Cover
		Urban/Suburban Built
		Extractive

3.3 Habitat Descriptions

The District of Columbia is 69 square miles in total area. It is 78% developed land; 10% open water; and 12% undeveloped forest, shrubland, or grassland (Table 5). The District is located at the geographic fall line between the Appalachian piedmont and Atlantic coastal plain. Two tidal rivers, the Anacostia and Potomac, converge in the District. Developed land makes up the largest proportion of the District. This includes industrial and commercial areas, roads and other paved areas, residential areas, and mowed grasslands such as athletic fields and roadside rights-of-way. The forests in the District are in the Northeastern Upland Forest and Northeastern Wetland Forest Formations. Most forested areas are found in National Park land in Rock Creek Park, National Capital Parks-East and Chesapeake and Ohio Canal National Historical Park. Shrublands, emergent wetlands, and meadows are typically found in these parks as well. The natural areas in the District include a broad range of habitat types, including a globally rare plant community (Gravel Terrace Fall-Line Magnolia Bog) and the diverse ice-scour forest communities of the Potomac Gorge ecosystem. The Anacostia and Potomac Rivers make up a large portion of the open water of the District and several medium and small-sized creeks are tributaries of both larger water bodies. Rock Creek is a tributary of the Potomac River, while Oxon Run, Watts Branch, and many other creeks are tributaries of the Anacostia River.

Soils

Most soils have been altered by development or dredge/fill operations, but much of the soils in parks remain undisturbed. Soils types are influenced by the geologic history of the Piedmont and Coastal Plain. Soils of the Piedmont are underlain by bedrock. Erosion and weathering of the bedrock contribute to the soil type. Soils of the Coastal plain are the result of the geologic erosion and weathering of the softer stone of the Appalachian Mountains, and by the most extreme southerly glaciation of past ice ages. Silty loams dominate the piedmont soils, while sandy, gravelly soils dominate the higher elevations of the Coastal Plain. Low elevations of the coastal plain are typically clayey soils. Low elevations of the Potomac Gorge area are dominated by boulder-underlain Fluvaquent soils. Low elevations along the Anacostia River are nearly 100% altered Udorthent soils, dominated by coarse textured soil materials, silt and loam, often severely compacted (Smith 1976). Udorthent soils represent a significant level of land area adjacent to the Anacostia and Potomac Rivers that was created through dredge/fill reclamation operations (see Figure 27 for an example.)

Climate

The District's climate is temperate/sub-tropical, with hot humid summers and cold winters. Average precipitation is 39.7 inches per year, and the mean annual temperature is 58.2 degrees Fahrenheit. The warmest month is July, and the coldest month is January. Average monthly precipitation is 3.2 inches, and the wettest month is May and the driest month is January (NOAA 2014). Severe weather can include hurricanes, winter blizzards and ice storms, riverine flooding, and high wind events.

Table 5 Area and Percent of Developed Land and Habitat Areas in the District Categorized by Formation Class from the Northeast Terrestrial Wildlife Habitat Classification System

Formation Class	Acres	Hectares	Percent
Water	4,573.4	1,850.8	10.4
Developed Land	34,162.0	13,823.3	77.8
Forest and Woodland	4,728.7	1,913.6	10.8
Shrubland and Grassland	440.6	178.3	1.0
Total	**43,904.6**	**17,766.0**	**100.0**

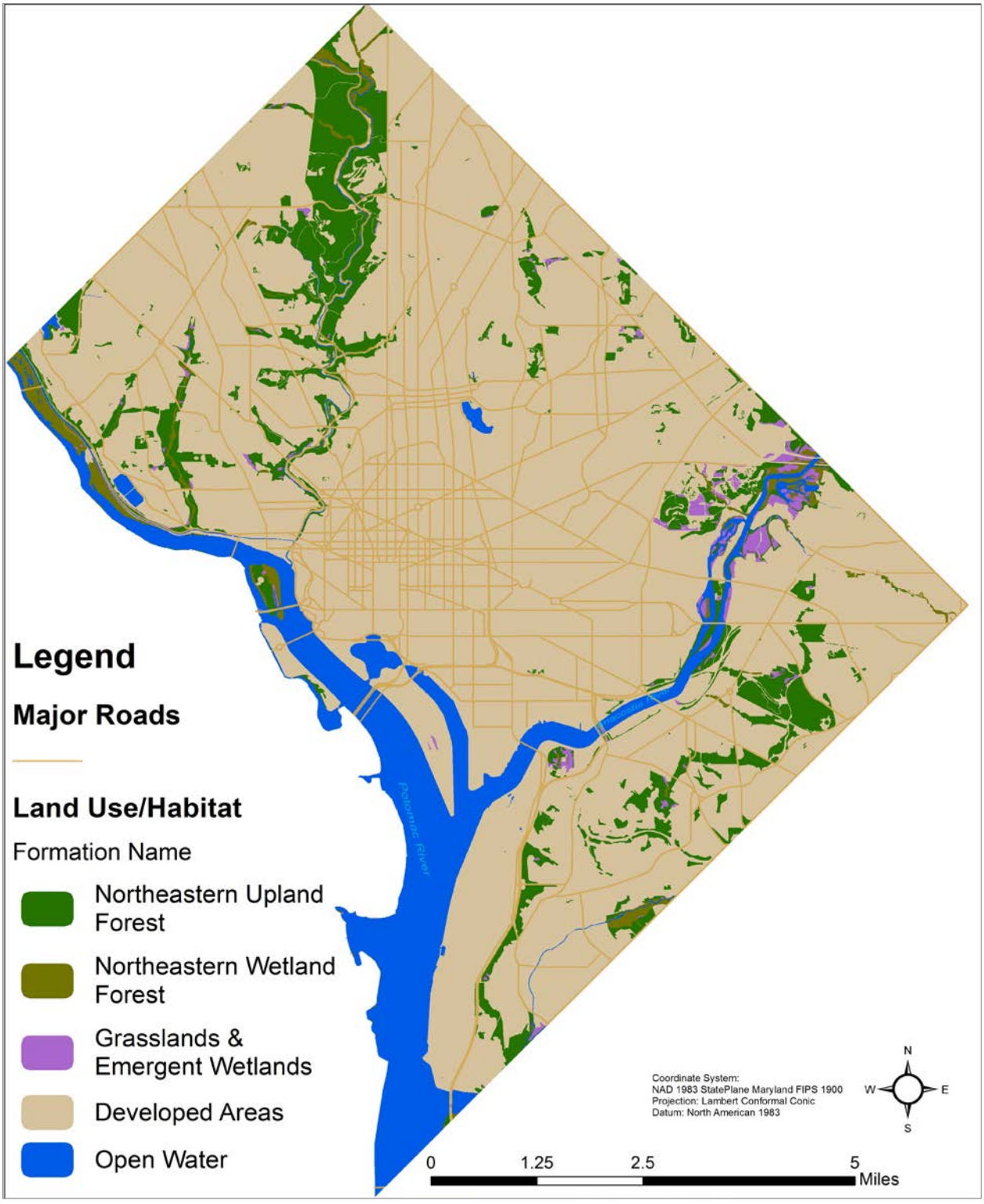


Figure 2 District of Columbia habitat formation map.

3.3.1 Critical Habitat and Vegetation Systems

In the Land Use /Habitat Formation map (see Figure 2), the natural vegetation types are Northeastern Upland Forest, Northeastern Wetland Forest, and Shrubland and Grassland. These areas represent locations where the best wildlife habitats can be found in the District. The variety of vegetation types within these Formations is detailed below. Describing these wildlife habitats in greater detail will help provide an understanding of the complexity of the land in the District, and will create a greater understanding of the threats to wildlife and their habitats and how these areas will change and respond to threats. Nine undeveloped (or natural) and four developed Macrogroups are included, as are seventeen natural and eight developed Habitat Systems. The natural vegetative Habitat Systems will be described in detail. Within the Habitat Systems a few of the rare and endemic vegetative habitats will be described to the plant association level, a higher level of detail. The Habitat System level will allow us to implement conservation actions to various threats to critical habitats. In cases where data is incomplete for population trends for certain taxa, such as reptiles, amphibians and invertebrates, conservation actions at the habitat level may be the best way to ensure conservation of rare species in those habitats.

The classification of the vegetative community types was performed by DOEE using Geographic Information System (GIS) data layers and field surveys of District-owned land. A vegetative community data layer was provided to DOEE by the National Park Service. This dataset contains discrete polygons representing the natural vegetation and other land cover for the National Parks in the National Capital Region. Natural and semi-natural vegetation was classified to the association level of the U.S. National Vegetation Classification (USNVC) or were combined into vegetation complexes. Cultural and developed land cover types were mapped according to the National Land Cover Database 2001. The dataset was developed by photo interpretation of several sets of high-resolution aerial photography with additional ancillary data layers. The dataset was developed as part of the NPS/USGS Vegetation Mapping Program (NPS 2014a).


Soapstone Run

Forested and other habitat areas on non-NPS land (District-owned, federal, institutional, and private lands) were extracted from various data layers from the District of Columbia Geographic Information Service (DCGIS 2015a) and were merged with the NPS vegetation layer described above. Forest vegetative communities were determined using a rapid habitat assessment. Canopy trees and shrubs were identified in several locations in each forested patch. In smaller

patches (<1 acre) the entire patch was assessed. In larger patches the plant community was identified in several areas and extrapolated to the rest of the patch.

The species in these patches were compared to nearby patches from the NPS data layer, and were categorized based on the dominant plant species using the same classification system as the NPS data. The U.S. Department of Agriculture's National Arboretum provided a GIS data layer that included forest and meadow types classified to the association level of the USNVC. For developed areas the DCGIS Land Use/Land Cover data layer was used to extract existing land use delineations the District. The data layer was originally developed to support in the District's 2004 Comprehensive Plan review and is updated annually by DCGIS. Impervious surfaces (roads), commercial areas, industrial areas, institutions, and residential areas were reclassified according to the Northeast Terrestrial Wildlife Habitat Classification System.

3.3.2 Vegetative Systems

Habitat systems are described below. The natural, undeveloped vegetative systems are described first, followed by semi-natural and successional systems, and finally, developed habitats. Habitat System descriptions shown in italics are taken from the Northeast Habitat Guides: A Companion to the Terrestrial and Aquatic Habitat Maps (Anderson et al 2013). Table 6 shows the total area of each Habitat System. Figure 3 shows Habitat Systems for the District as a whole. Figures 4–6 show detailed views of the habitats in the upper Anacostia River area, Rock Creek Park, and the upper Potomac River area.

Table 6 Area of District of Columbia Habitat Systems

Formation Name	Macrogroup	Habitat System	Area	
			Hectares	Acres
Aquatic*		*Aquatic habitats are detailed in a separate table.	1,894.5	4,681.3
Northeastern Upland Forest	Central Oak-Pine	Central Appalachian Dry Oak-Pine Forest	317.0	783.3
		Southern Interior Low Plateau Dry - Mesic Oak Forest	161.5	399.0
		Successional Virginia Pine Forest	4.4	10.9
	Northern Hardwood & Conifer	Southern Atlantic Coastal Plain Mesic Hardwood Forest	681.2	1,683.2
	Plantation & Ruderal Forest	Northern and Central Hardwood and Conifer - Ruderal Forest	507.0	1,252.8
Northeastern Wetland Forest	Coastal Plain Swamp	Northern Atlantic Coastal Plain Tidal Swamp	10.6	26.2
		Successional Woody Wetland	20.0	49.5
	Northeastern Floodplain Forest	Central Appalachian River Floodplain	147.7	364.9
		Central Appalachian Stream and Riparian	78.8	194.7
		Northern Atlantic Coastal Plain Stream and River	27.2	67.3
Shrubland & Grassland	Emergent Marsh	Northern Atlantic Coastal Plain Fresh/Oligohaline Tidal Marsh and Created Marsh	40.0	98.8
	Modified/ Managed Marsh	Introduced Wetland and Riparian Vegetation	0.3	0.7
	Ruderal Shrubland & Grassland	Introduced Shrubland	35.6	88.0
		Ruderal Upland - Old Field	102.9	254.2
Developed	Maintained Grasses & Mixed Cover	Canopy Trees and Recreational Grasses	151.8	375.0
		Urban and Recreational Grasses	1,669.0	4,124.3
	Urban/Suburban Built	Commercial/Industrial	6,250.6	15,445.5
		Residential - High Intensity	1,695.4	4,189.5
		Residential - Medium Intensity	4,044.8	9,995.0
		Total	**17,840.3**	**44,084.3**
		Total Square Miles		**68.9**

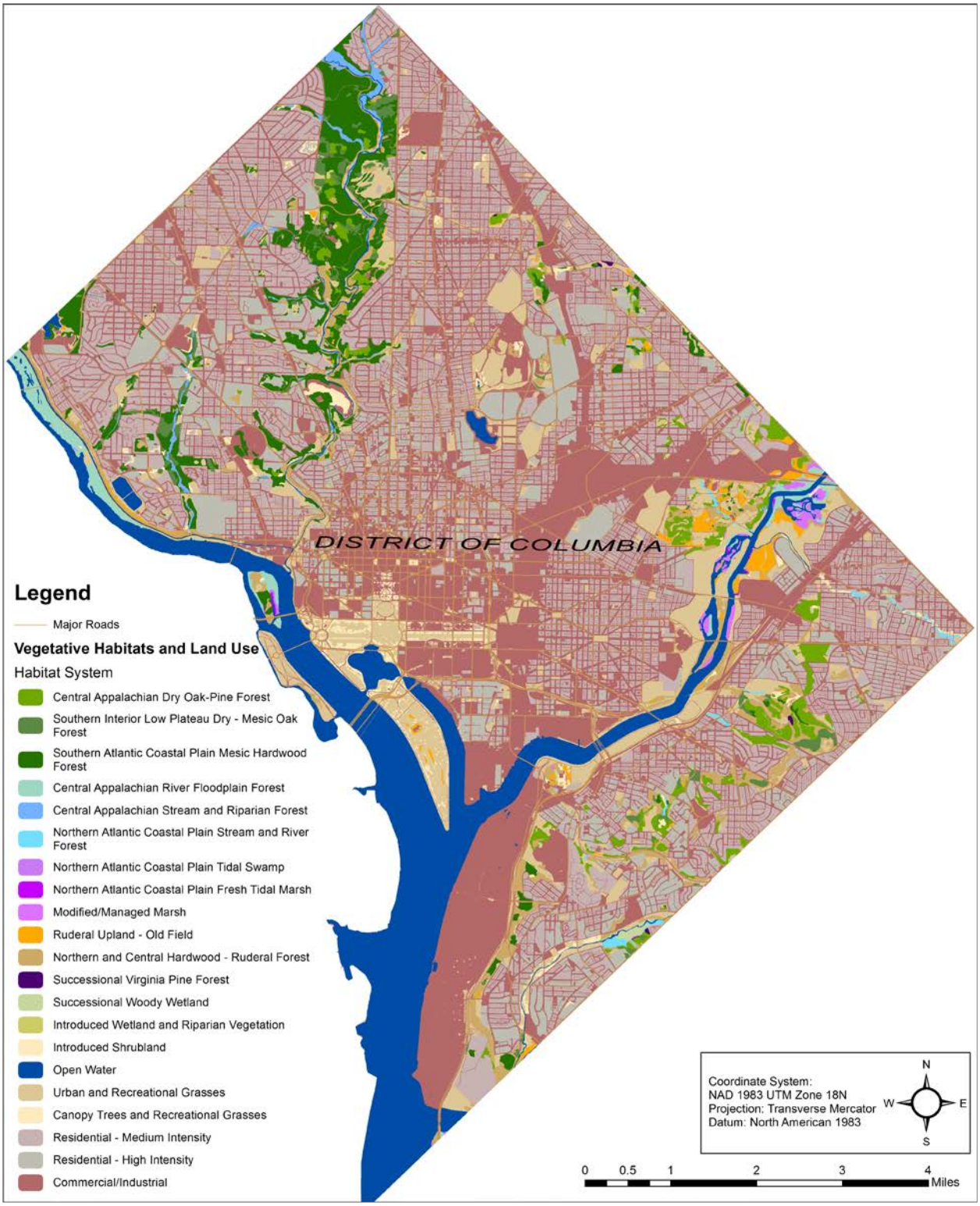


Figure 3 District of Columbia vegetative habitats and land use classified into Habitat System categories.

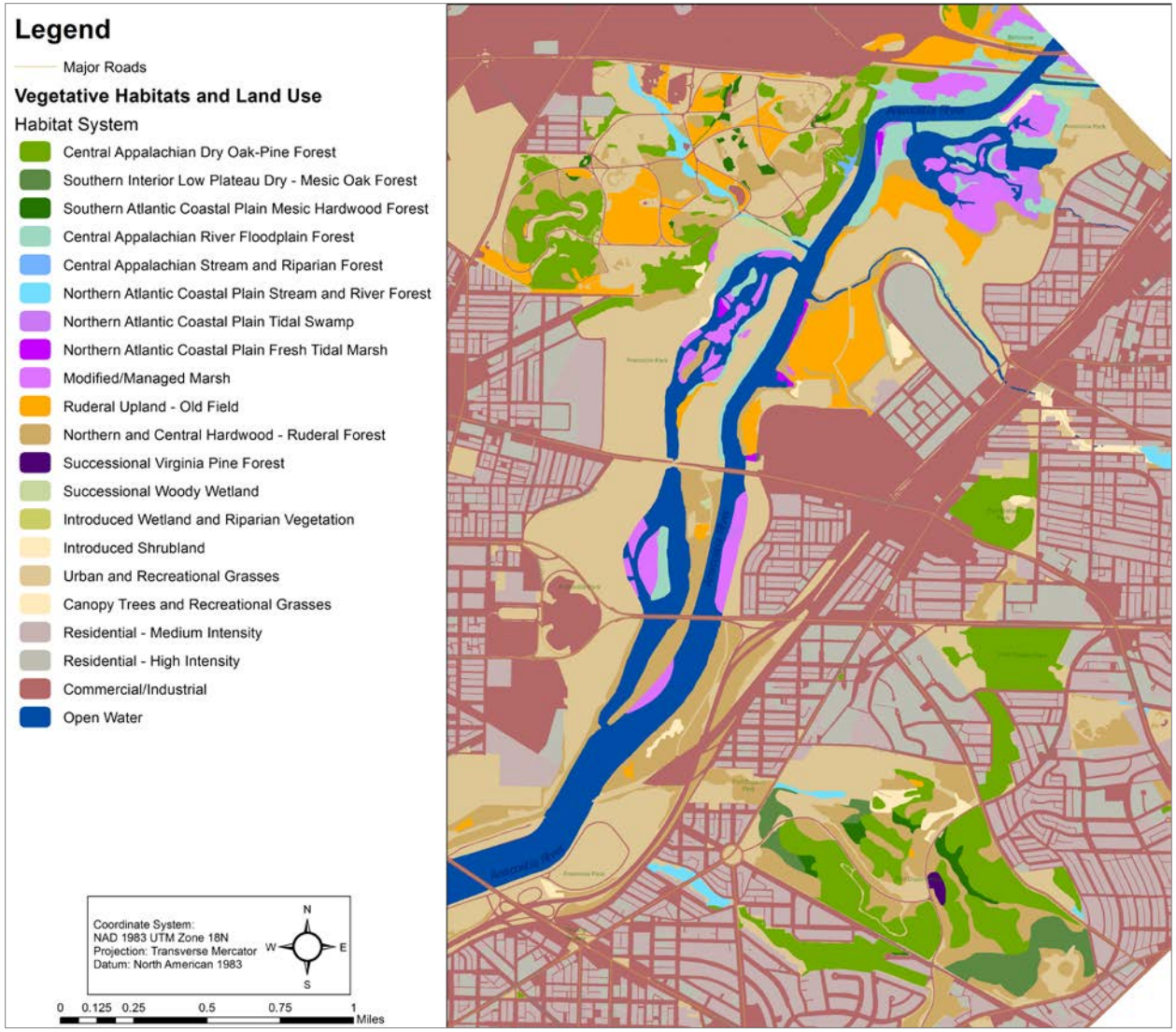


Figure 4 Vegetative habitats and land use in the upper Anacostia River area of the District of Columbia, classified into Habitat System categories.

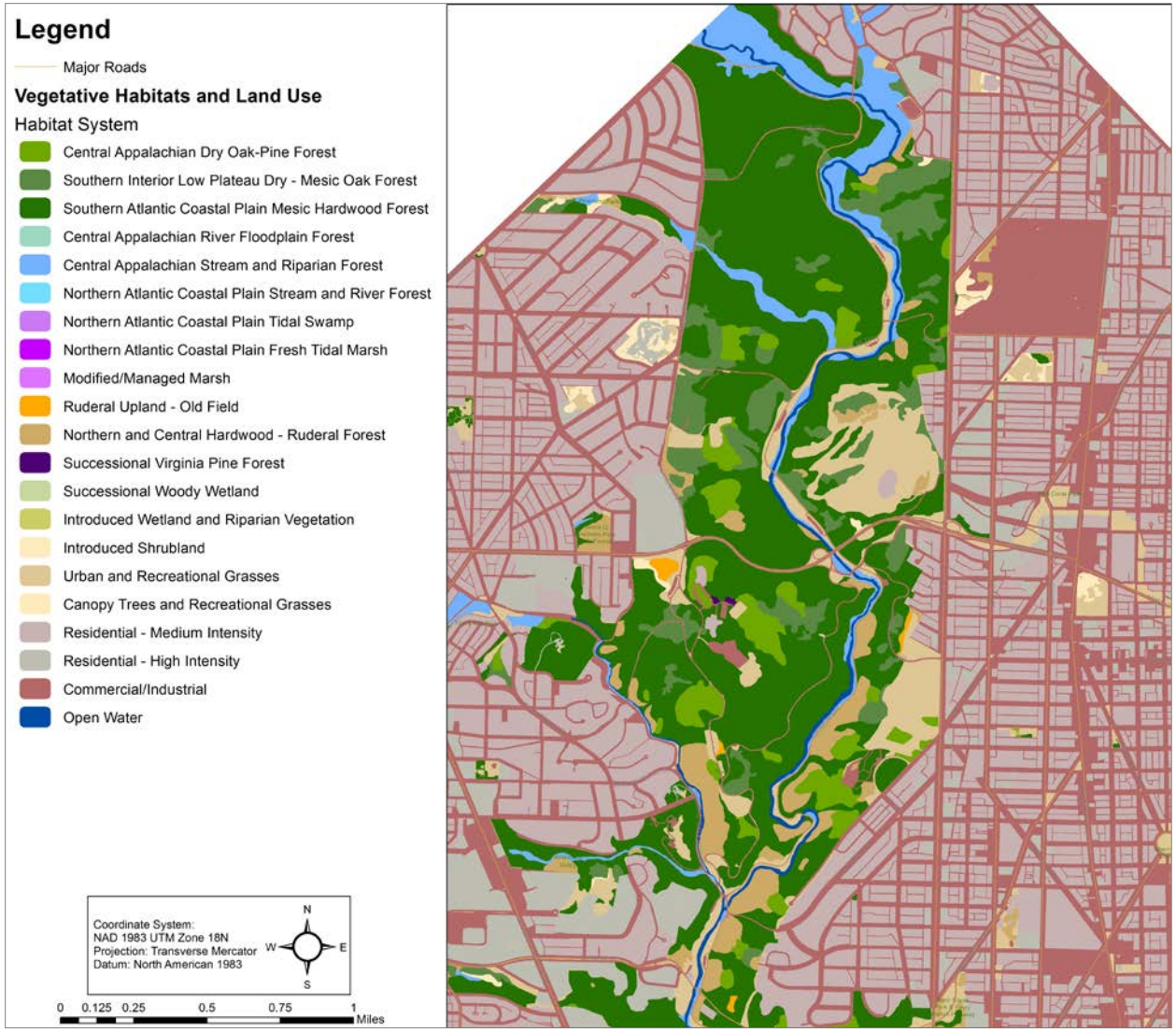


Figure 5 Vegetative habitats and land use near Rock Creek Park in the District of Columbia, classified into Habitat System categories.

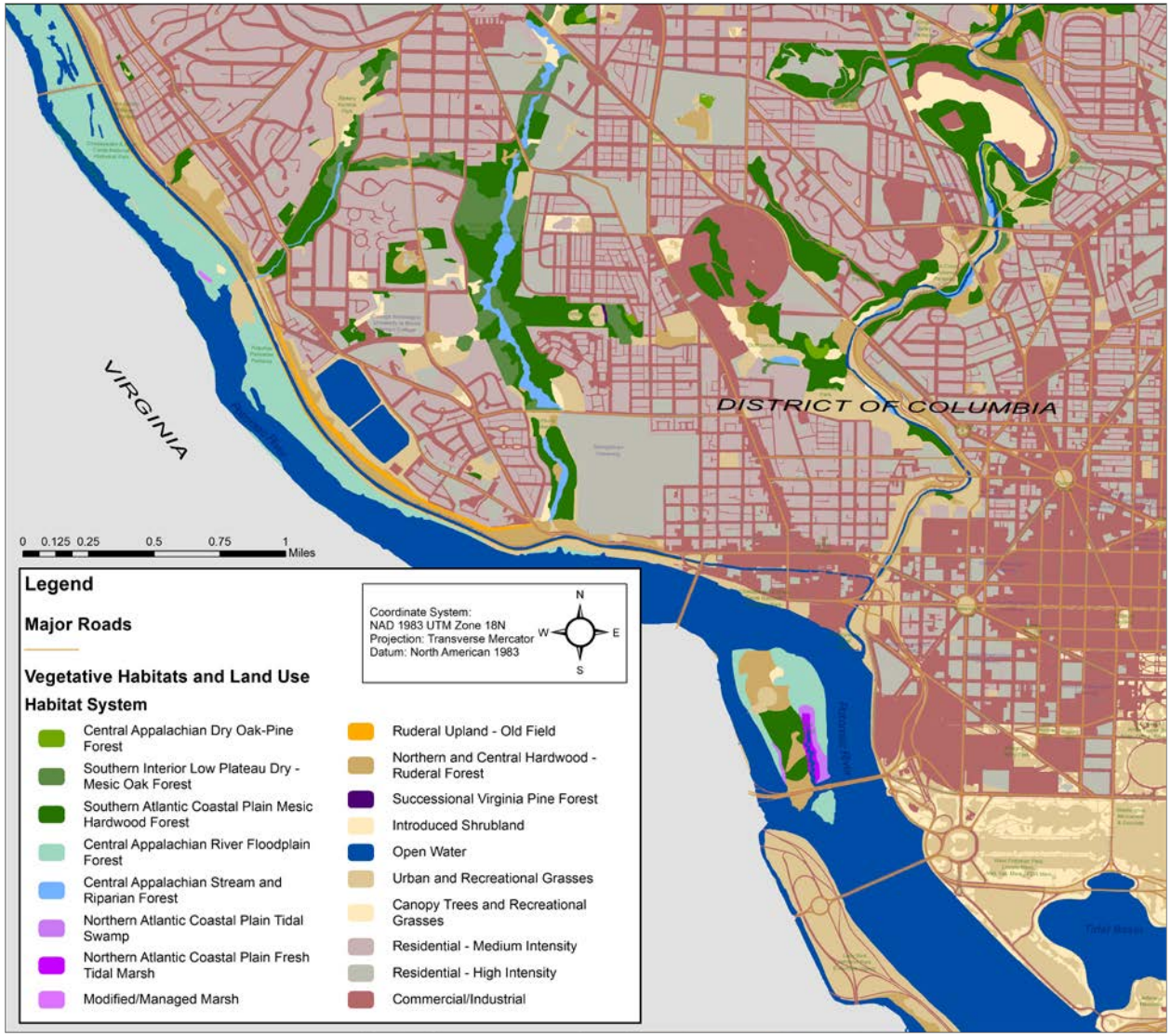


Figure 6 Vegetative habitats and land use near the upper Potomac River and northwest sections of the District of Columbia, classified into Habitat System categories.

Northeastern Upland Forest; Central Oak-Pine; Central Appalachian Dry Oak-Pine Forest

An oak or oak-pine forest of dry sites, characterized by a variable mixture of drought tolerant oaks (chestnut oak, white oak, red oak, black oak, scarlet oak) and pines (pitch, white, Virginia). It occurs broadly in the Central Appalachians and northern Piedmont ecoregions, most commonly as a large (to very large) patch habitat. It has a much more limited range in New England, where hickories may be present. Community structure ranges from open woodlands to closed forest. Heath shrubs are common in the understory; the herb layer is often sparse and lacks diversity. In the absence of fire this system may tend to succeed to hemlock and locally common hardwoods.

In the District this type is found on the gravel-terrace hills of the Coastal Plain. The dominant trees are Chestnut and White Oak, and the dominant understory shrubs are Mountain Laurel and other heath species such as blueberry and azalea. These hilly locations include the Fort Circle Parks (Ft. Chaplin, Ft. Dupont, etc.), and some steep, well-drained slopes in Rock Creek Park. This habitat type is typically the highest quality forest habitat in the District. The parks where this type is found are relatively free of invasive plants, deer browse, and the impacts of human recreation.


Dry oak-pine forest in Fort Dupont Park

Northeastern Upland Forest; Central Oak-Pine; Southern Interior Low Plateau Dry - Mesic Oak Forest

A successional semi-natural forest type of rich mesic soils, characterized by tulip poplar, northern red oak, American beech, maples, spicebush, eastern redbud. It occurs in the central Piedmont region and Coastal Plains, in the interior Low Plateau west of the Appalachian Mountains and at low elevations of the Appalachian Mountains, typically where soils disturbed by agriculture have reforested through natural succession. The shrub and sub-canopy layers are lush, and the herbaceous layer can be dominated by non-native invasive plant species.

In the District this habitat is found in patches throughout the northern part of Rock Creek Park and smaller parks west of Rock Creek. Where this type is adjacent to streets and other urban areas, the forest edges are dominated by invasive vines shrubs and herbaceous plants. The forests have been moderately impacted by deer browse. There are few tree seedlings, and few saplings less than 15 years old. The shrub layer is dominated by deer-resistant species such as spicebush and arrowwood, and there is a sparse herbaceous layer in most places. Human recreation impacts also decrease habitat quality. Formal and informal trails extend through this habitat, which allows invasive plants to penetrate into the forest interior. Formal and informal trails also

fragment interior forest habitat and allow disturbance by humans and pets that otherwise would not occur.

Northeastern Upland Forest; Northern Hardwood & Conifer; Southern Atlantic Coastal Plain Mesic Hardwood Forest

A hardwood forest of the coastal plain with a significant component of mesophytic (moist but non-wetland) species, such as American beech or southern sugar maple. Upland and bottomland oaks at the mid-range of moisture tolerance are usually also present, particularly white oak, but sometimes also southern red oak, cherrybark oak, or Shumard oak. Loblolly pine is sometimes present, but it is unclear if it is a natural component or has entered only as a result of past cutting. Understories are usually well-developed. Shrub and herb layers may be sparse or moderately dense. Ranging south from New Jersey to Georgia, these mostly large patch coastal plain forests occupy a variety of moist sites that are naturally sheltered from frequent fire.


Mesic hardwood forest in Rock Creek Park

This system is extensive in Rock Creek Park and other forested areas in the Piedmont region of the District. Most of the upland forest canopy of Rock Creek Park is this type but the quality is low. The forest edges are dominated by invasive vines shrubs and herbaceous plants. The forests have been extremely impacted by deer browse. There are few tree seedlings, and few saplings less than 15 years old. There is little or no herbaceous layer in most places. Human recreation impacts also decrease habitat quality. Formal and informal trails extend through this habitat, which allows invasive plants to penetrate into the forest interior. Formal and informal trails also fragment interior forest habitat and allow disturbance by humans and pets that otherwise would not occur.

Northeastern Wetland Forest; Northeastern Floodplain Forest; Central Appalachian River Floodplain

A complex of wetland and upland vegetation on floodplains along larger rivers, where temporary to seasonal flooding affects vegetation composition and dynamics. Vegetation includes both non-forested bar and scour communities and a diverse group of more extensive forests. Microtopographic heterogeneity is high, and forests tend to be differentiated by depositional landforms such as levees, sloughs, terraces, and abandoned channels. Better drained soils may support wet site oaks, shagbark hickory, and sweetgum. Wettest swamps are often dominated by green ash and red maple. Bald cypress may occur, but does not dominate. Understories are generally open, with sedges and grasses or moisture-loving forbs in the herb layer.

This system is found in the Potomac River floodplain in the Potomac Gorge, on Theodore Roosevelt Island, and in the upper Anacostia River. This system includes highly biodiverse plant communities that occur in rocky floodplains that are frequently scoured by ice and periodic flooding:

- Riverside Rock Outcrop and Prairie
- Ice-Scour Woodland
- Potomac Gorge Ice-Scour Sycamore Floodplain Forest
- Potomac Gorge Willow Oak Floodplain Forest


Central Appalacian river floodplain in the Potomac Gorge

This system is driven by disturbance, but periodic flooding coupled with human-influenced factors has reduced the quality of this system in the District. Flooding has brought lesser celandine and Japanese stiltgrass from upstream and allowed them to infiltrate the forest interior. These species form monocultures on the forest floor in spring and summer, respectively. The forest edges and interior are dominated by invasive vines whose seeds are transported by flooding. The system has been extremely impacted by deer browse. There are few tree seedlings, and few saplings less than 15 years old. Deer browse and invasive plants have replaced the native herbaceous layer in most places. Human recreation impacts also decrease habitat quality. Formal and informal trails extend through this habitat, which allows invasive plants to penetrate into the forest interior. Where ash trees occur, the Emerald Ash Borer (*Agrilus planipennis*), an invasive beetle, has the potential to severely damage this system. In Kenilworth Aquatic Gardens the beetle has killed most of the ash trees in this system.

Northeastern Wetland Forest; Northeastern Floodplain Forest; Central Appalachian Stream and Riparian


Riparian floodplain forest in Pope Branch Park

A complex of wetland and upland vegetation on floodplains of medium to large rivers in Atlantic drainages. They are typical of larger rivers but they can occur on smaller rivers where the stream gradient is low and a broad floodplain develops. The vegetation complex includes floodplain forests in which silver maple, sycamore, box elder, and cottonwood are characteristic, as well as herbaceous sloughs,

shrub wetlands, ice scours, riverside prairies, and woodlands. Most areas are underwater each spring; microtopography determining how long the various habitats are inundated. Depositional and erosional features may both be present depending on the particular floodplain.

This system is found in the floodplain of Rock Creek Park and other small creeks in the Piedmont region of the District. This system is driven in part by disturbance, but infrequent flooding and human-influenced factors have reduced the quality of this system in the District. Flooding has facilitated the invasion of Lesser Celandine into the forest interior. This species forms monocultures on the forest floor in spring. The system has been somewhat impacted by deer browse. Invasive plants have replaced the native herbaceous layer in most places, although careful management of the lesser celandine has allowed native spring ephemeral wildflowers to thrive in a few locations. Human recreation impacts also decrease habitat quality. Formal and informal trails extend through this habitat, which allows invasive plants to penetrate into the forest interior. Formal and informal trails also fragment interior forest habitat and allow disturbance by humans and pets that otherwise would not occur.

Northeastern Wetland Forest; Northeastern Floodplain Forest; Northern Atlantic Coastal Plain Stream and River Floodplain Forest

This system is found throughout the northern Atlantic Coastal Plain from Virginia to New Jersey along low-gradient small streams and rivers with little to moderate floodplain development. This system is influenced by overbank flooding, groundwater seepage and occasional beaver impoundments. The vegetation is a mosaic of forests, woodlands, shrublands, and herbaceous communities. Canopy composition and cover can vary within examples of this system, but typical tree species may include bottomland oaks, Atlantic white cedar, red maple, green ash, black gum, black birch, sweetgum, and sycamore. Shrubs and herbaceous layers can vary in richness and cover. Some characteristic shrubs include alder, musclewood, and spicebush. Seepage forests dominated by red maple and/or sweet bay can often be found within this system, especially at the headwaters and terraces of streams.

This system includes a globally rare plant community called Fall-line Terrace Gravel Magnolia Bog. Magnolia Bogs of this type are found only in the District and surrounding counties in MD and VA (McAtee 1918, Simmons et al 2008). They form at the base of gravelly hills where acidic water seeps from the hillside onto a clay soil lens. The forested wetlands in Oxon Run Park include a remnant Magnolia Bog plant community and


Northern Atlantic Coastal Plain floodplain forest

swamps dominated by red maple, sweetbay magnolia, and possumhaw. Other locations of this system include successional floodplains of small creeks in the Coastal Plain region. Another system in the Coastal Plain Swamp Macrogroup, the Successional Woody Wetland, is similar to Northern Atlantic Coastal Plain Stream and River Floodplain system. It is a River Birch/Red Maple/Sweetgum Successional Forest with similar tree species, but Spicebush and some non-native invasive plants dominate the understory. This system is also found in Oxon Run Park. In this system the forest edges are dominated by invasive vines, shrubs, and herbaceous plants. In some cases the forests have been moderately impacted by deer browse.

Northeastern Wetland Forest; Coastal Plain Swamp; Northern Atlantic Coastal Plain Tidal Swamp

A tidally flooded hardwood forest and shrubland in lower river floodplains and estuaries of the North Atlantic Coastal Plain. Deciduous hardwood species predominate, especially ash (green or pumpkin), black gum, or water tupelo, along with red maple, American elm, and black willow. Alder and silky dogwood are common shrubs. Lianas and vines are common: poison ivy, greenbrier, and Virginia creeper. Species richness in the herbaceous layer is exceptionally high due to microtopographic features. Regularly flooded hollows primarily support flood-tolerant swamp species such as orange jewelweed, arrow arum, and various smartweeds. Water hemlock and smallspike false nettle are typical of elevated hummocks.

This system is the flooded forest on Theodore Roosevelt Island and parts of the upper Anacostia River. This system is driven in part by disturbance such as infrequent flooding. Fragmentation and human-influenced factors have reduced the quality of this system in the District. Flooding has facilitated the invasion of Lesser Celandine into the forest interior. This species forms monocultures on the forest floor in spring. Where ash trees occur, the Emerald Ash Borer, an invasive beetle, has the potential to severely damage this system. In Kenilworth Aquatic Gardens the beetle has killed most of the ash trees in this system.

Grassland and Shrubland; Ruderal Shrublands and Grassland; Ruderal Upland - Old Field


Managed meadow at the USDA National Arboretum

Herbaceous or herb-shrub vegetation resulting from succession following virtually complete removal of native woody cover of an area, primarily on lands cleared for agriculture or pasture. Soils often show a plow layer, which alters the successional pathway and may increase the likelihood of invasions by exotic species. Lands may have been cleared decades ago or more recently, but have been maintained in a non-forested state (at least until relatively recently) and may

still be annually mowed to control tree incursion. It is generally characterized by unnatural combinations of native and alien species; in the Northeast, they most commonly take the form of fields dominated by pasture grasses plus early successional native or introduced forbs including goldenrods, asters, Queen Anne's lace, black-eyed Susans, hawkweeds, teasel, etc., usually with some shrub component of raspberries, meadowsweet, shrub dogwoods, or viburnums; poison ivy is a common vine. Compared to the pasture/hay system (under the Agricultural formation), this type has more forbs (excluding legumes that may be a pasture component) and more shrubs, and does not produce useable hay.

This system is found in small patches throughout the District, usually adjacent to forest patches or on former landfill sites. This is an uncommon habitat in the District. Most patches have low plant diversity and are dominated by non-native grasses, although native forbs have naturally dispersed into some sites, and have been planted in others. Eastern red cedar, eastern cottonwood, black locust and non-native woody plants dominate the shrubby patches. In addition to its rarity and patchiness, the condition of this habitat is reduced by woody and herbaceous invasive plant species.

Freshwater Marsh; Emergent Marsh; Northern Atlantic Coastal Plain Fresh and Oligohaline Tidal Marsh and Modified/Managed Marsh; Tidal Wetland Restoration and Experimental Areas

A graminoid-dominated wetland of fresh to slightly brackish zones along tidal rivers in very southeast Virginia and the southern shores of the James River. Water salinity varies from nearly fresh (oligohaline) in the drowned creeks and inland estuaries to saltier brackish water near the coast and on or near barrier island inlets. These marshes typically occur as complexes dominated by large graminoids such as salt hay, bulrushes, cattails, and rushes, sometimes with species-rich associations of shorter graminoids, forbs, and floating or submerged aquatics. Brackish marshes tend to be low diversity communities of intertidal flats cut off from direct oceanic influence by protective barrier islands.

In the District this system includes tidal wetlands on Theodore Roosevelt Island and wetland restoration areas. The freshwater tidal marshes on Theodore Roosevelt Island are dominated by narrow-leaf cattail (*Typha angustifolia*) and the Virginia state threatened river bulrush (*Bolboschoenus fluviatilis*). The vegetative diversity in the restored wetlands is high and can be similar to Northern Atlantic Coastal Plain Fresh and

Wild rice in a restored freshwater tidal wetland in Kenilworth Aquatic Gardens and Park

Oligohaline Tidal Marsh after these wetlands have been in place for ten years (Paul, Krafft, and Hammerschlag 2004).

3.3.3 Semi-natural Systems

Plantation and Ruderal Forest; Northern Hardwood and Conifer; Ruderal Forest

Undifferentiated upland forests, typically even-aged, resulting from succession following virtually complete removal of native woody cover of an area, i.e. land clearing for agriculture or (sometimes) forestry. In the case of agriculture, alteration of the soil through plowing or grazing can sometimes lead to low-diversity forests, often with exotic species in the understory, that do not resemble more natural forest systems. The limited structural diversity and low plant diversity apparent in some of these forests can limit insect diversity and other factors important to wildlife. In the case of clearcutting with less soil disturbance, the system may revert to a recognizable "natural" system within a fairly short time. This ruderal system is reserved for combinations of early successional trees that cannot be identified as natural ecological systems even in an incipient state. (If a forest has sufficient cover of indicator trees for a particular "natural" ecological system, even with a prevalence of early successional trees, it is classed as that forest system.) In the Northeast, these forests often contain substantial amounts of red maple, white pine, Virginia pine, red-cedar, tuliptree (south of New York), aspen, and/or white or gray birch, with associates of sassafras, persimmon, black locust, hawthorn, apple, pin cherry, and sometimes walnut. They may contain lesser amounts of more natural matrix forest species such as oaks, northern hardwoods, and hemlocks. Where soil disturbance has not been severe, many sites will follow a trajectory towards one of the later successional and more "natural" forest systems.

In the District this system can vary widely in habitat quality and degree of invasiveness depending on the age of the stand, location, and soil type. Young-age patches on poor soils are dominated by successional tree species such as black locust and eastern cottonwood, with non-native vegetation such as bush honeysuckle and Japanese knotweed in the understory. Older-age stands are dominated by oaks and tulip poplars. The quality of the understory of old-age stands can vary widely as well. Along Canal Road, the Potomac bluff is dominated by oaks, with vine-shrublands in the understory. In the National Arboretum, these Habitat Systems are closed canopy forests and the understory is usually dominated by native vegetation. These patches are adjacent to Central Oak-Pine forests and could readily be classified as such.

Grassland and Scrubland; Ruderal Shrublands and Grassland; Introduced Shrubland

These shrublands are dominated by aggressive exotic species including honeysuckles, multiflora rose, barberry, privet, kudzu, and others. They are primarily upland but can occur in seasonally wet situations, and most typically develop on disturbed former fields where soil structure and/or chemistry have been altered. Return to native species dominance requires intensive and prolonged intervention.

This system is found throughout the District, typically in isolated areas with significant past disturbance, such as historic homesites or former commercial areas, and in areas

where the slender forested parks and parcels are surrounded by urban areas. Habitat condition is very low due to the dominance of invasive plants.

Freshwater Marsh; Modified / Managed Marsh; Introduced Wetland and Riparian Vegetation

Wetlands dominated by introduced species: primarily herbs, but may be a mixture of shrubs and herbs. Species may include purple loosestrife, giant reed, or in aquatic settings exotic milfoils, pondweeds, water chestnut, etc. In the District these are dominated by invasive Phragmites grasses. Few other plants survive.

Due to repeated management of NPS sites by NPS and the Anacostia Watershed Society, few patches of this system remain in the District.

Table 7 Area of District of Columbia Aquatic Habitats

Aquatic Habitat	Hectares	Acres
Great River	1,296.9	3,204.8
Small River - Anacostia	273.4	675.6
Small River - Rock Creek	27.7	68.6
Creek & Headwater Creek	74.9	185.0
Embayed River Area	165.4	408.7
Freshwater Pond	17.0	42.0
Intertidal Mudflat	34.7	85.8
Reservoir	23.7	58.6
Riverine Pond	3.7	9.2
Rocky Shoals	11.2	27.7
Vernal Pool	1.2	2.9
Seeps & Springs	N/A	N/A
Total Acres	**1,929.9**	**4,768.8**
Total Square Miles		**7.5**

3.3.4 Aquatic Habitat Systems

The aquatic habitats of the District are dominated by two tidal, urbanized rivers. The historic extent of the Potomac and Anacostia Rivers, and the tidal emergent wetlands that were associated with them, have been greatly reduced by past land reclamation. Reclamation resulted in the construction of Hains Point, Poplar Point, the RFK Stadium grounds, Kingman Island, and much of Anacostia Park. The Anacostia River is reduced to half of its natural width in many places and both rivers are bounded by a sea wall for much of their length within the District (see Figure 21), Map of historic Anacostia wetlands). Few tidal wetlands remained before the restoration of the Kenilworth wetlands in 1997 (Hammerschlag et al 2004) and the River Fringe/Kingman Island wetlands in 2004 (Hammerschlag et al 2009). There are also many creeks and smaller tributaries. These creeks are impacted by urbanization, including combined sewage

outflow, stormwater flows, fragmentation, and pollution. See Table 7 for estimates of the area of aquatic habitat types in the District. Figure 7 shows Aquatic Habitat Systems for the District as a whole. Figures 8 and 9 show detailed views of the aquatic habitats in the upper Anacostia River area and upper Potomac River area.

Great River: Potomac River

The Potomac River is classified as a Great River (≥9,653 square miles) in the Northeast Aquatic Habitat Classification System (Olivero and Anderson 2008). Its catchment drainage area is 14,670 square miles and extends from West Virginia and Pennsylvania through Maryland and Virginia. It passes from the Appalachian Mountains through the Piedmont and onto the Atlantic Coastal Plain. The Potomac River drains into the Chesapeake Bay, and is the second largest catchment in the Chesapeake Bay watershed. In the District it is a low-gradient (0.02%–0.1%), tidal river. It is a moderately buffered, warm river, but it has a relatively high average pH of 8.1 (DOEE 2014). The Potomac varies in depth from 80 feet at Chain Bridge to less than a foot in some embayed areas. At Chain Bridge the Potomac is a high energy river that flows over solid bedrock as it emerges from the Mather Gorge and the fall line cascades of Little Falls. Farther south, below Georgetown, the river widens and slows. South of the Key Bridge in Georgetown, the riverbanks are bounded by a sea wall or stone rip-rap. There are few natural shorelines. At the southern end of the District the Potomac is 3/4 mile wide and shallow (3–11 feet) except in the navigable channel (26 feet). Below Georgetown much of the riverbed substrate is silt and sand. The Potomac River includes intertidal shore systems such as rocky shoals and intertidal mudflats, as well as beds of submerged aquatic vegetation (SAV). These systems are described below.

Small River: Anacostia River

The Anacostia River is a tributary of the Potomac River and is classified as a Small River (38–200 square miles) in the Northeast Aquatic Habitat Classification. Its catchment drainage area is 176 square miles and extends through Montgomery and Prince George's Counties in Maryland. In the District it is a low-gradient (0.02%–0.1%), tidal river. It is a moderately buffered, warm river with but an average pH of 7.5 (DOEE 2014). The Anacostia varies in depth from 30 feet in the navigation channel to less than a foot in some embayed areas. For its entire length in the District the Anacostia's riverbanks are bounded by a sea wall. There are no natural shorelines, but accretion has created riverine wetlands and mudflats in some areas. Where it enters the District the Anacostia is 150 feet wide, and at its mouth at the Potomac River it is 1,000 feet wide. The Anacostia River includes intertidal shore systems such as intertidal mudflats, as well as beds of SAV.

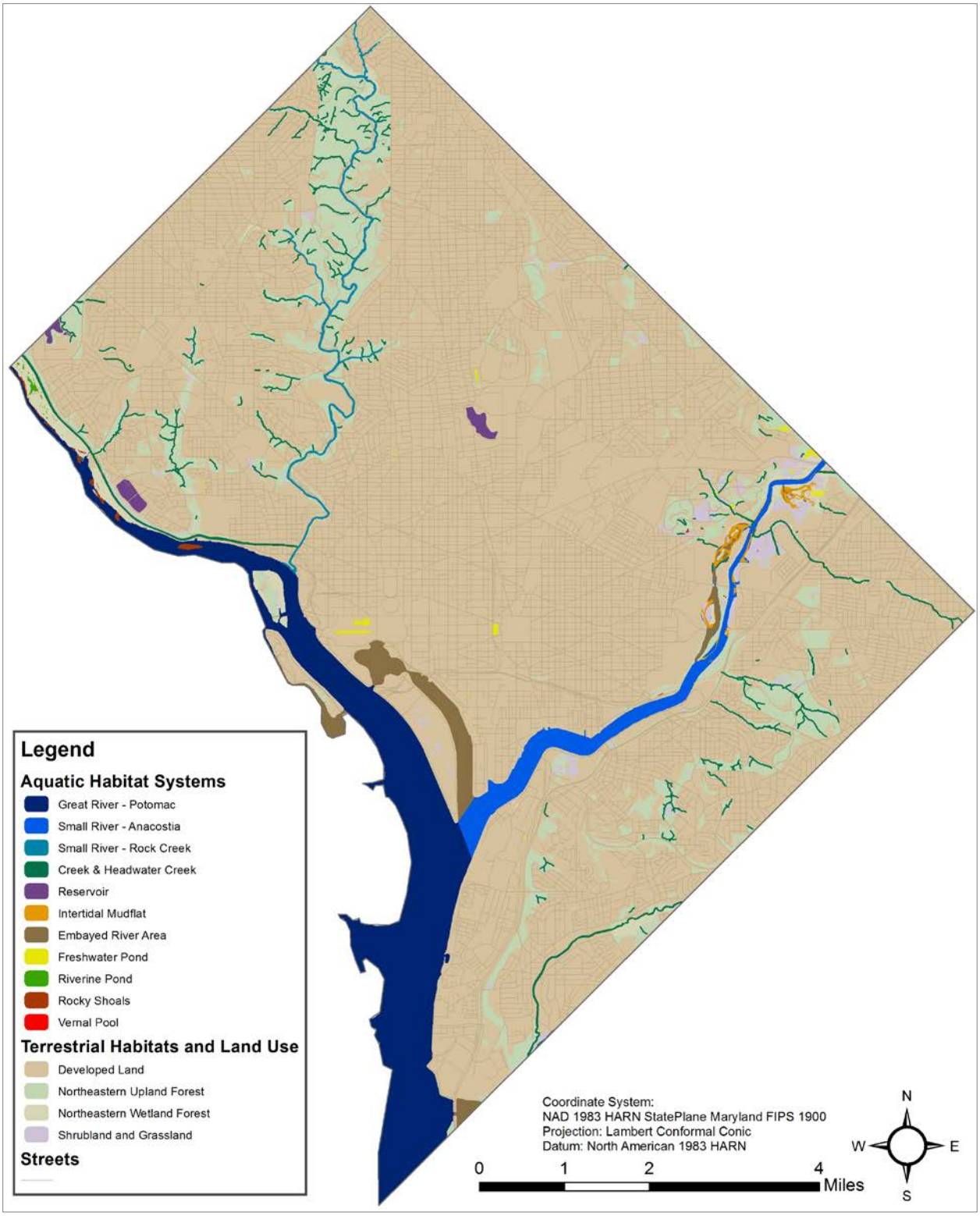


Figure 7 Aquatic Habitat Systems of the District.

Small River: Rock Creek

Rock Creek is a tributary of the Potomac River that is classified as a Small River in the Northeast Aquatic Habitat Classification. Its catchment drainage area is 76 square miles and extends 22 miles into Montgomery County, Maryland. In the District, it is both a low-gradient (0.02%–0.1%) tidal creek and a moderate gradient (0.1%–0.5%) piedmont creek. It is a moderately buffered, neutral, warm river with but an average pH of 7.8 (DOEE 2014). Rock Creek varies in depth from inches to several feet in the downstream tidal areas. There is a mile-long, high energy reach of rocky shoals and cascades where the creek passes the fall line. Rock Creek includes intertidal shore systems such as intertidal sand flats and rocky shoals.

Creek and Headwater Creek; Watts Branch, Broad Branch, Fort Dupont Creek, Foundry Branch, Hickey Run, Klingle Branch, Maddox Branch, Nash Run, Normanstone Creek, Pinehurst Branch, Pope Branch, Soapstone Run, Springhouse Run, Hazen Run, Luzon Branch, Fenwick Branch, Portal Branch


Oxon Run

Creeks and headwater creeks in the District can vary in size and energy level. Creeks on the western slopes of the Rock Creek Valley can be steep, high energy systems that pass over rocky cascades. Some creeks on the Coastal Plain start in the gravel terrace hills and can be moderately-high gradient streams. These streams do not pass over bedrock, but through clay and gravel soils and occasional iron-rich sandstone (bog iron). Other creeks east of the Anacostia River pass between those hills and are low gradient, low energy creeks. All creeks and streams in the District are impacted by high-flow events, driven by the piping of street runoff and other stormwater into the stream valleys.

Intertidal shore; Rocky shoals

Intertidal areas with exposed rocks located along rivers where bedrock is present. The amount of exposed rock varies with tide and river level. These areas can contain herbaceous plants in soils deposited on the rocks. In the District these shallow areas are important for freshwater mussels, and serve as spawning grounds for striped bass and several species of shad. The rocks serve as loafing areas for cormorants and other bird species. SAV may also be present.

North Atlantic Intertidal Mudflats

Intertidal mudflats are usually located in quiet pockets of bays and protected by headlands. Sand-sized particles are mixed with silt and clay. These flats can be highly productive of clams and other invertebrates, and are important habitats for many shorebird species, including the solitary sandpiper, lesser yellowlegs, greater yellowlegs, spotted sandpiper, and least sandpiper. In the summer, green macroalgae, such as sea lettuce and hollow green weed, can cover these mudflats. Other characteristic species include ditch-grass and eelgrass.

Freshwater Pond

Pond habitats in the District consist of artificial small impoundments. They can be groundwater-fed, stream-fed, stormwater-fed, or use municipal water. Many have natural vegetated shorelines, while others have hardened shorelines. These ponds serve as habitat for native and non-native fish, insects and other invertebrates, native and non-native turtles, and as foraging areas for birds. Examples include Beech Pond and Boxwood Pond at the National Arboretum, Constitution Gardens, the lily ponds at Kenilworth Aquatic Gardens the Birdhouse Ponds at the National Zoo, and fishing ponds at the Armed Forces Retirement Home.

Lake/Reservoir

The District has no natural lakes. There are several large reservoirs with unhardened shorelines and beds that store untreated water (Dalecarlia Reservoir and McMillan Reservoir), and one that stores treated water and has hardened bed and shorelines (Georgetown Reservoir). These open water areas serve as loafing and foraging habitat for birds, especially winter-resident ducks. Dalecarlia Reservoir takes water directly from the Potomac River, and may have small fish and other aquatic organisms.

Riverine Pond

Riverine ponds are low areas in the Chain Bridge flats area of the Potomac River floodplain near the western border of the District. These rocky ponds are filled by groundwater seepage and periodic flooding. These ponds host native and non-native fish species (carp and snakehead are common), many species of dragonfly, wading birds and dabbling ducks. One riverine pond is located upstream of Fletchers Cove. It has a slightly higher elevation, and can dry out in summer and act as vernal pool habitat for several amphibian species.

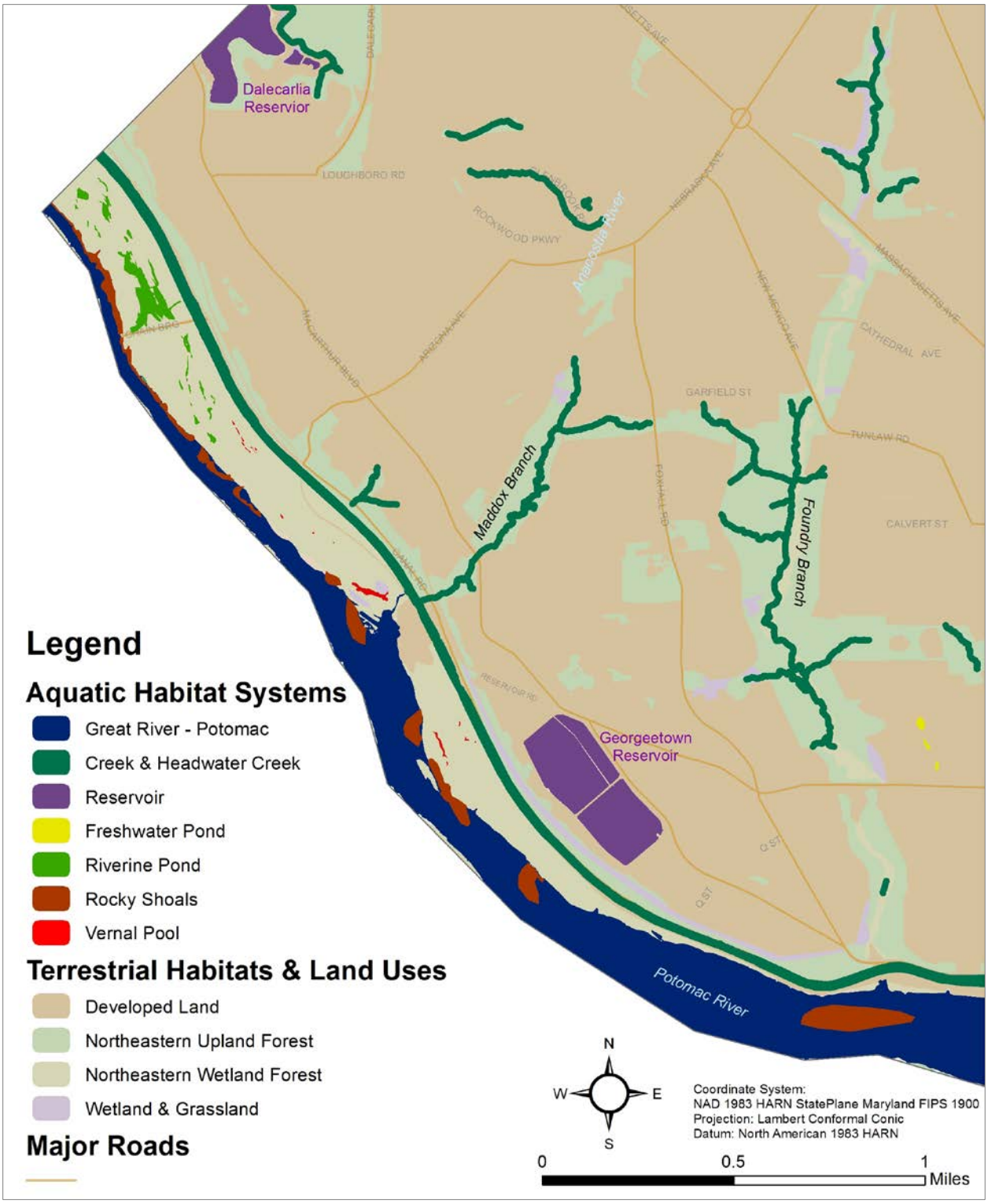


Figure 8 Aquatic Habitat Systems of the upper Potomac River in the District.

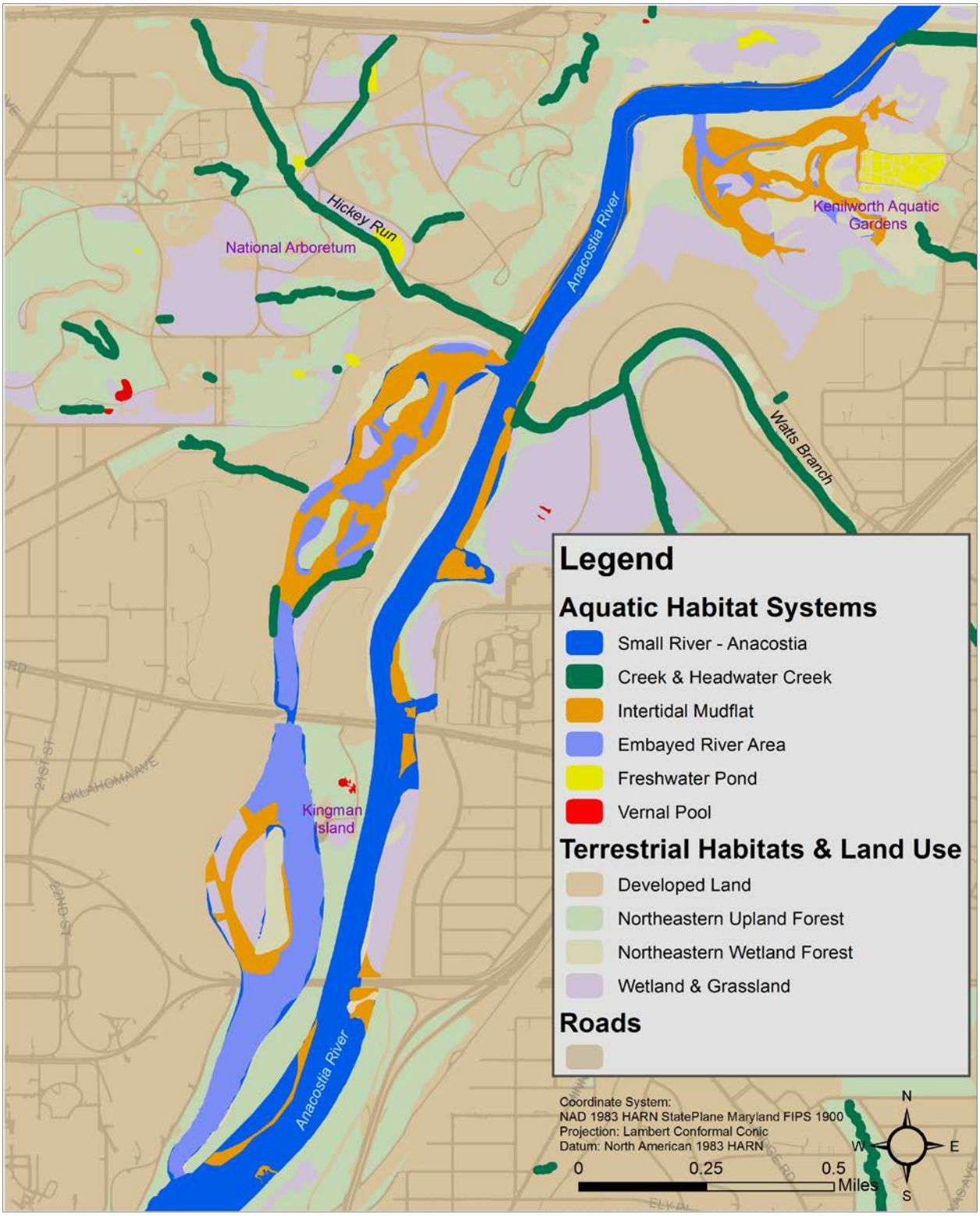


Figure 9 Aquatic Habitat Systems of the upper Anacostia River in the District.

Vernal Pools


A vernal pool with evidence of American beaver activity

Vernal pools are seasonal bodies of water that flood each year for a few months during the spring and dry up by the end of summer. Because they are not permanently flooded, they do not support fish populations. Instead, they provide important breeding habitat for many species of amphibians. Some species, such as the spotted salamander and wood frog, are obligate vernal pool species. The habitat is most often found in woodland areas where the land forms shallow dips and clay soils hold water, but some are also found in the rocky floodplain area of the Potomac River. They are found in Central Oak-Pine and Northeastern Floodplain Forests.

Vernal pools in the District are typically found on federally-protected land. Their condition is variable, and can be dependent upon the condition of the surrounding forest habitat. Some pools have windblown and runoff-borne trash. Several vernal pools and 40 acres of surrounding forest were lost to development in the Ft Lincoln area in 2012. Vernal pools can host ranavirus and other diseases that threaten herpetofauna.

Springs and Seeps

Springs and seeps occur where groundwater flows to the surface. A spring has a concentrated flow, whereas a seep has a diffuse flow (Chicago Region Biodiversity Council 1999). Springs occur when the water table is higher than the ground surface and pressure forces the water out of the land. They serve as a water source for wildlife. The District had many springs that were once a source of drinking water in the 1700s and 1800s, but many springs have disappeared due to the diversion of rainwater, direct piping into the sewers, filling or contamination (Pavek 2002). Seeps are areas where groundwater continuously surfaces and flows as a sheet down a slope. They support habitats made up of tiny mosses, lichens, ferns and flowering plants that cling to peaty soils that develop on the slope. In the District springs and seeps are home to two endemic species and a federally listed endangered species. The Hay's Spring amphipod is both endangered and endemic and Kenk's amphipod is endemic to Rock Creek.

Spring and seeps can be found in a variety of locations in undeveloped habitats. Springs can be found on the western and eastern slopes of the Rock Creek valley. Seeps are common at the base of many gravel terrace hills east of the Anacostia River.

Submerged Aquatic Vegetation

SAV habitats are open water areas where vegetation grows on the river bed. These areas provide important habitat for aquatic animals, sediment stabilization, and improvements in water quality. In 2013 eight species of SAV were found in District waters: *rigid hornwort Ceratophyllum demersum*, *Hydrilla verticillata*, southern waternymph *Najas guadlupensis*, brittle naiad *Najas minor*, grassleaf mudplantain *Heteranthera dubia*, wild celery *Vallisneria americana*, curly-leaf pondweed *Potamogeton crispus*, and sago pondweed *Stuckenia pectinata* Total SAV cover was 204 acres in 2013. See Figure 11 for the mapped extend of SAV in the District in 2012.

SAV is an important component of the District's aquatic ecosystem. SAV beds provide a habitat for both juvenile and adult fish and other aquatic organisms. SAV beds are ecologically important to fish and other aquatic organisms as areas for refuge, feeding, and reproduction (Kraus and Jones 2012).

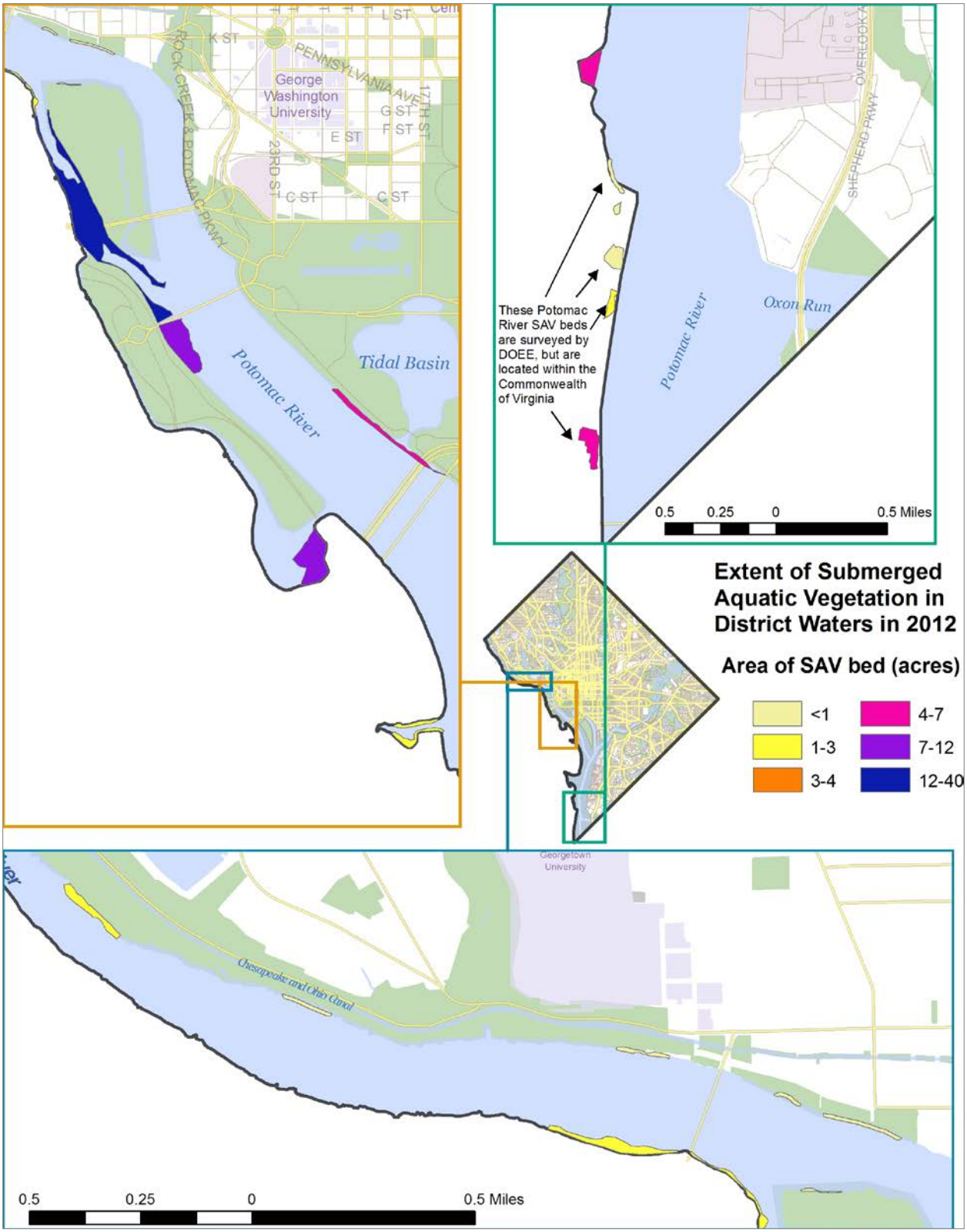


Figure 10 Patches of Submerged Aquatic Vegetation mapped by DOEE in the Potomac River in the District in 2012.

3.3.5 Developed Systems

Developed systems include areas that have been converted or significantly altered for human use. Developed systems include suburban and urban residential housing and yard space, commercial areas, industrial areas, and paved roadways. It can include areas typically considered "green space": mowed grassy areas, athletic fields, picnic areas, water features, roadside rights-of-way, and golf courses. In most cases these areas hold little value for wildlife unless specific effort is made to include and maintain pockets of high quality habitat. Large native trees along streets, backyard wildlife habitat gardens, and clumps of trees or shrubs in yards can all contribute to increased habitat quality in these systems.


Red fox at Hains Point

Maintained Grasses and Mixed Cover; Canopy Trees and Recreational Grasses

Mowed or otherwise managed non-native grasses with sparse canopy trees, usually left standing to provide shade for picnic areas. Canopy-height native trees in recreational areas may provide some habitat value to birds and invertebrates, particularly when adjacent to forest habitat.

Maintained Grasses and Mixed Cover; Urban and Recreational Grasses

Areas of mowed or otherwise managed non-native grasses used for recreation. Athletic fields, golf courses, picnic areas, roadside rights-of-way.

Urban/Suburban Built; Commercial/Industrial

Developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses, commercial/industrial areas, roadways and other impervious surfaces. Impervious surfaces account for more than 80% of the total cover.

These areas have little or no habitat value. Roadways and large buildings represent impediments to dispersal and migration for many animal species. Industrial areas have historically polluted adjacent vegetative and aquatic communities.

Urban/Suburban Built; Residential - High Intensity

Areas with a mixture of constructed materials and vegetation in which impervious surfaces account for 50%–80% of total cover (generally corresponding to lot sizes of <1/4 acre); mostly single-family housing units.

These areas have little or no habitat value, although some high-density residential areas in the District do have large, canopy-height native trees in roadway tree boxes and yards. These trees may provide some habitat value to birds and invertebrates.

Urban/Suburban Built; Residential - Medium Intensity

Areas with a mixture of constructed materials and vegetation in which impervious surfaces account for 25%–50% of total cover (generally corresponding to lot sizes of ¼–½); mostly single-family housing units.


A native plant garden in downtown Washington, DC

These areas have little habitat value to most SGCN, although some may thrive in suburban areas with significant vegetation. The vegetation in some medium density residential areas does simulate forest edge habitat, and can provide habitat for SGCN meso-mammals, small mammals, and birds, although it is unclear whether these habitat patches would represent a sink or a source for any given SGCN metapopulation. These areas also support large canopy trees in fairly large patches (see Figure 10). Large, canopy-height native trees in roadway tree boxes and yards may provide some habitat value to birds and invertebrates.

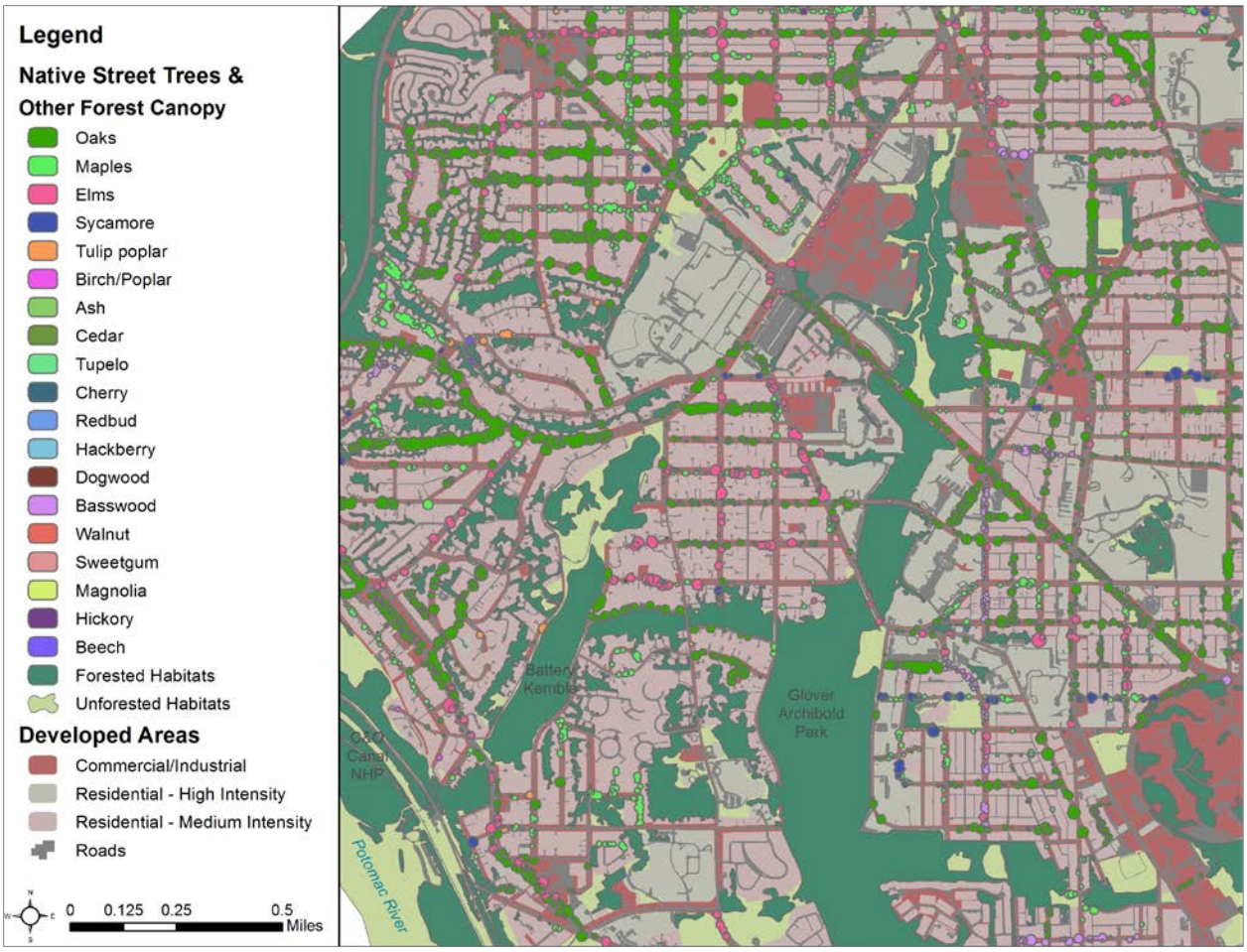
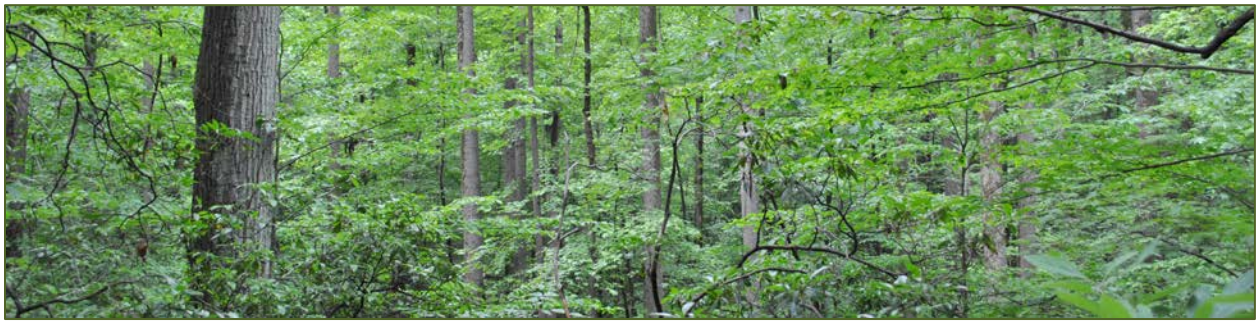


Figure 11 An example of large native street trees, wooded residential areas, and forest canopy in upper northwest Washington, DC.

3.4 Condition of Vegetative Habitats



Guidance from USFWS and AFWA suggests that state agencies should include an assessment of habitat condition or quality and should identify "conservation opportunity areas." Conservation opportunity areas are spatially explicit areas identified in the SWAP that offer the best opportunity and potential for conservation of SGCN. FWD modelled habitat condition using in-house and regional spatial data to create a

ranking score for habitat in the District at a five-meter resolution. The score ranked each five-meter pixel from 0 to100. The assessment included six data layers, though several of those layers were the result of aggregation of other spatial data. The six layers were species richness, species abundance per unit effort, core habitat/degree invaded (invasive plants), soil type/quality, deer browse, and tree canopy. The development of the data layers and the ranking process are described below.

3.4.1 Core Habitats/ Invaded Habitat Data Layer

The vegetative system/developed habitat layer displayed in Figure 3 was used to create a data layer that represents core forest habitat and degree of invasiveness (see Figure 12). Core forest habitats are important to forest interior-dwelling birds, box turtles, worm snakes, and a number of other SGCN. The following process was used to create this data layer:

1. Core forest areas were defined as areas >25 meters from the forest edge.

2. A 25-meter internal buffer was created in these habitat patches, with the core areas categorized as 10.

3. The 25-meter forest edge was categorized as 5 as a proxy for the impacts of invasive plants and other edge effects.

4. Trail areas within core forest habitats were mapped and a 5-meter buffer was calculated. Trail areas within core forests were categorized as 8.

5. Known habitat types that are described as semi-natural or include invasive plants as a part of their description were ranked as 5 or 3, depending on the known degree to which they are invaded by non-native plants.

6. Open water areas (river, pond, etc.), were ranked as 6. No invasive plants are known to affect non-fish species in aquatic habitats.

7. Residential areas were ranked as 2 due to overall low habitat value for SGCN.

8. Commercial/Industrial areas and transportation corridors (roads) were ranked as 1. They have little or no value for wildlife, and impose barriers to wildlife.

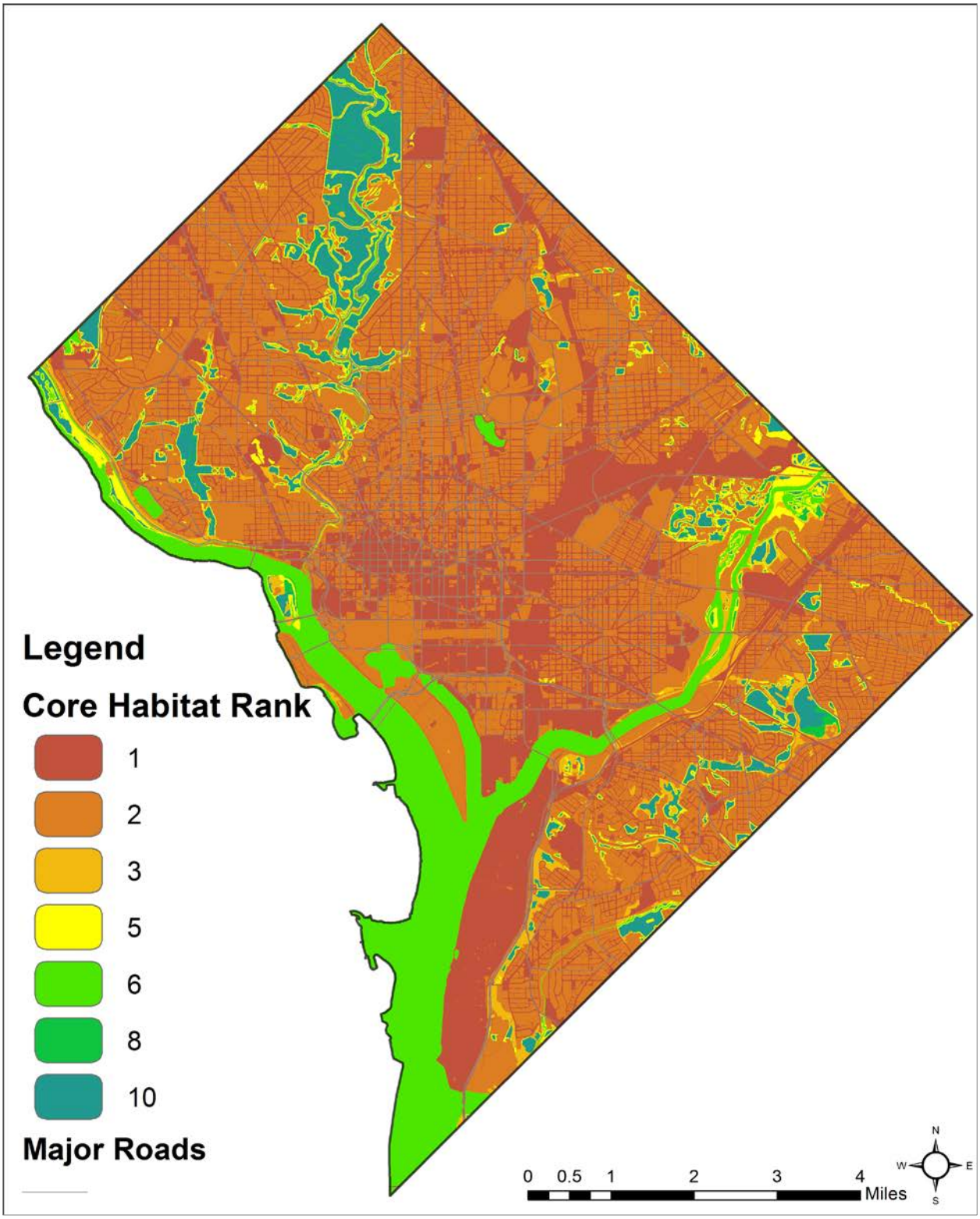


Figure 12 Habitat areas of the District ranked by value.

3.4.2 SGCN Richness and Abundance Data Layers

Point files of SGCN occurrences were provided by DOEE biologists and were aggregated into one file. Data from several surveys were included: breeding bird, migrating bird, winter resident waterbird, small mammal, meso-mammal, bat acoustical monitoring, bats from residences (from District of Columbia Department of Health), vernal pool amphibian egg mass, frog call, herpetofauna coverboards, turtle hoop net, spotted turtle telemetry, dragonfly and damselfly transect, and butterfly transect. Incidental observations were included. Species richness of SGCN was calculated at each point. Survey points within 50 meters of each other in similar habitats were merged into one point. SGCN abundance at each point, normalized by unit effort (as total number of visits to the site for each survey) was also calculated.

Raster files were made from the point files a using a kernel density calculation in Environmental Systems Research Institute (ESRI) ArcGIS. Kernel density calculates the density of features in a radius around those features, and can use a "population" field to weight certain features more heavily than others. The ESRI (2009) Help File describes the kernel density function: "A smooth curved surface is fitted over each point using a defined search radius so that each raster cell's value is highest at the location of the point and diminishes with increasing distance from the point. The density at each output raster cell is calculated by adding the values of all the kernel surfaces where they overlay the raster cell center. The kernel function is based on the quadratic kernel function described in Silverman (1986)." The final SGCN richness layer is shown in Figure 13. The final SGCN abundance layer is shown in Figure 14. The underlying basemap is from DCGIS (2015b).

3.4.3 Soil Data Layer

This data layer is based on a digital soil survey map prepared by DCGIS, which is the most detailed level of soil geographic data developed by the National Cooperative Soil Survey for the District. Soil types were ranked from 2 to 9 for their degree of disturbance, association with urban areas, and degree to which they are the result of dredge/fill operations. Rivers and other open water excluded to minimize their influence on terrestrial habitats. The soil layer is shown in Figure 15.

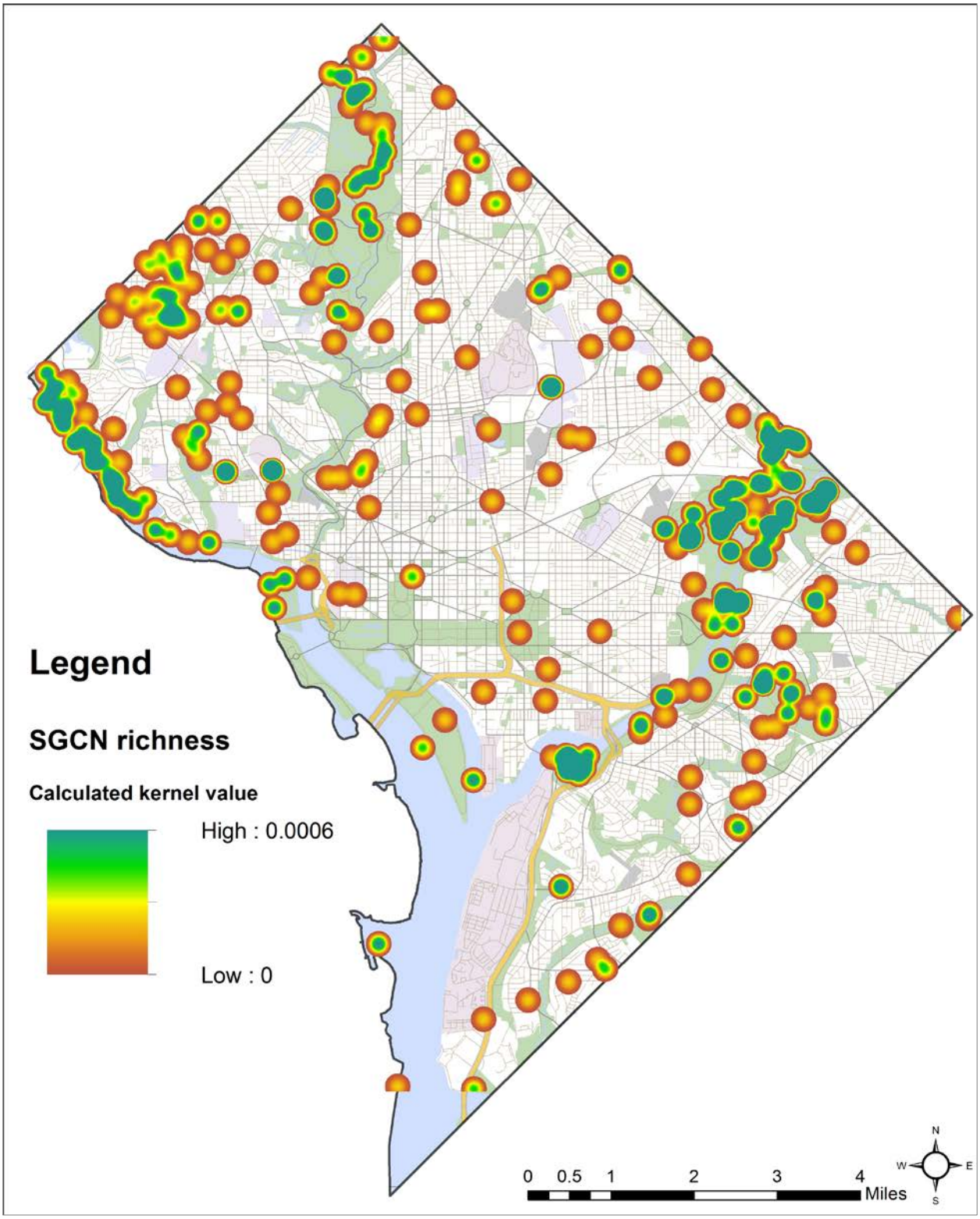


Figure 13 Species richness in the District by SGCN. Number of species per point converted to a surface using a quadratic kernel function. The underlying basemap is from DCGIS (2015b).

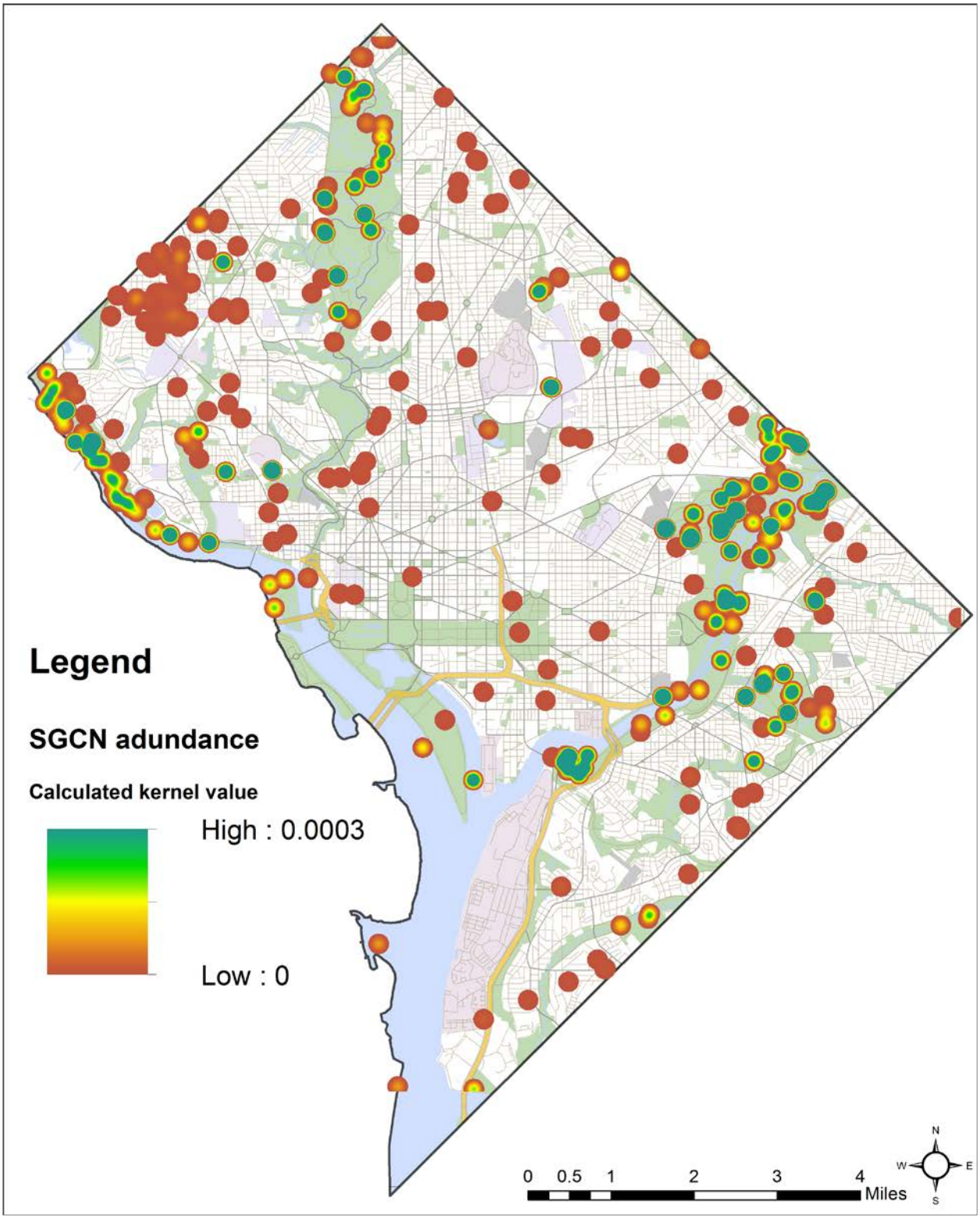


Figure 14 Species abundance in the District by SGCN. Number of SGCN observations per point, normalized by unit of effort and extrapolated to a surface using a quadratic kernel function. The underlying basemap is from DCGIS (2015b).

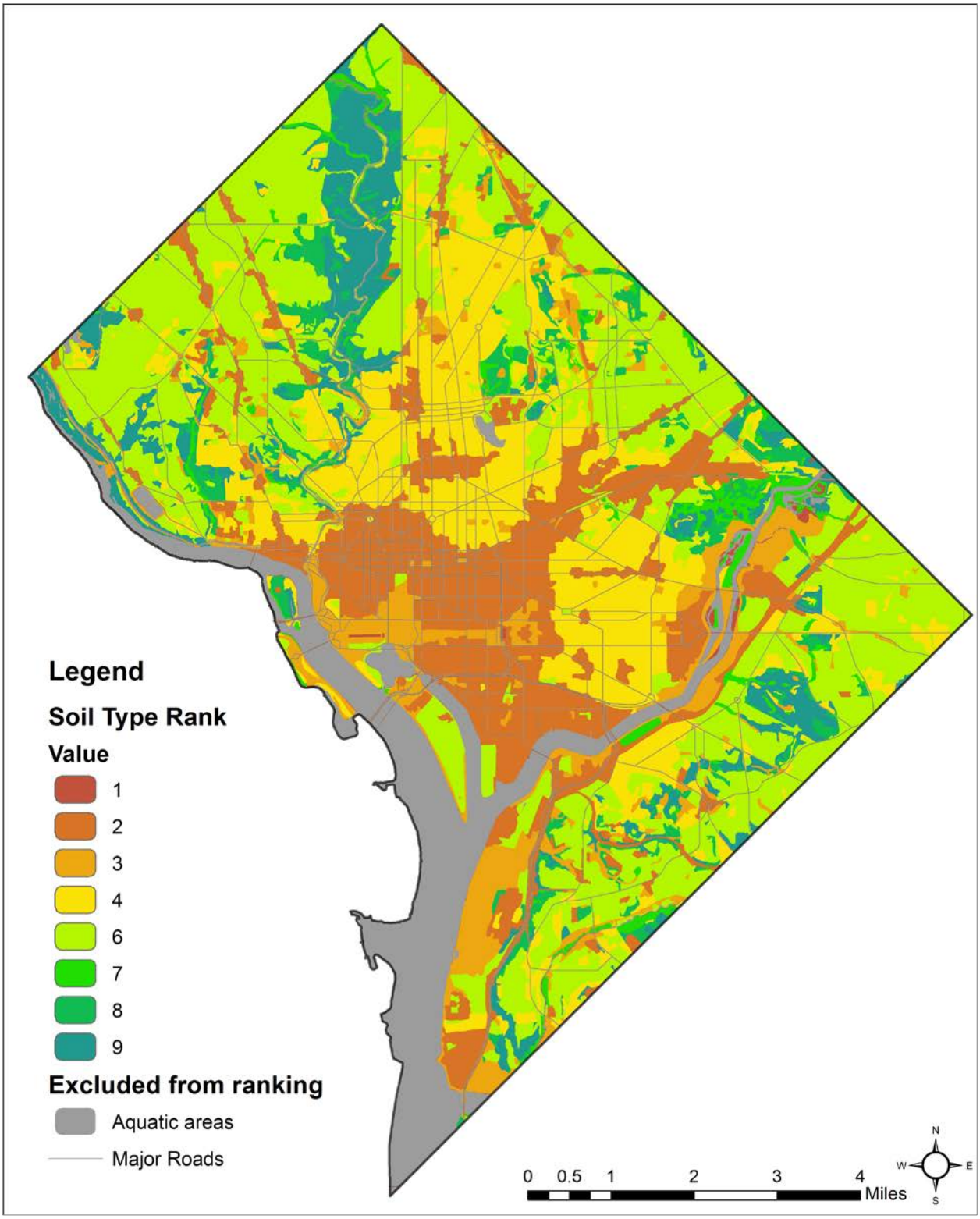


Figure 15 Soil types in the District ranked by type and disturbance. Disturbed soils (such as those in dredge and fill areas) and urban complex soils were ranked lowest. Undisturbed soils were ranked higher.

3.4.4 Tree Canopy Data Layer

Tree canopy can be used by wildlife even in residential and urban areas. This layer combines wooded areas classified by DCGIS and large native street trees. The DCGIS Wooded Areas (DCGIS 2015a) layer contains data for patches of forest or tree canopy in parks and in residential areas. This can include tree canopy that exists over short buildings in residential areas. The DDOT Urban Forestry Administration provided a data layer of trees in street rights-of-way. The dataset contains locations and attributes of Trees, created as part of the District of Columbia, Department of Transportation (DDOT) Street Spatial Database (DCGIS 2015a). Native tree species that are greater than 15 inches DBH (diameter at breast height—tree diameter measured 4.5 feet from the ground) and in excellent, good, or fair condition were extracted to a point file. The canopy cover of each tree was then estimated as ½ DBH (in inches) converted to meters. For example a 24-inch tree has an estimated tree canopy of a 12 meter diameter circle. This canopy was created using a buffer command in ArcGIS. The street tree and wooded data layers were merged and converted to a raster where canopy = 10 (present) and non-canopy = 1 (not present). The tree canopy layer is shown in Figure 16.

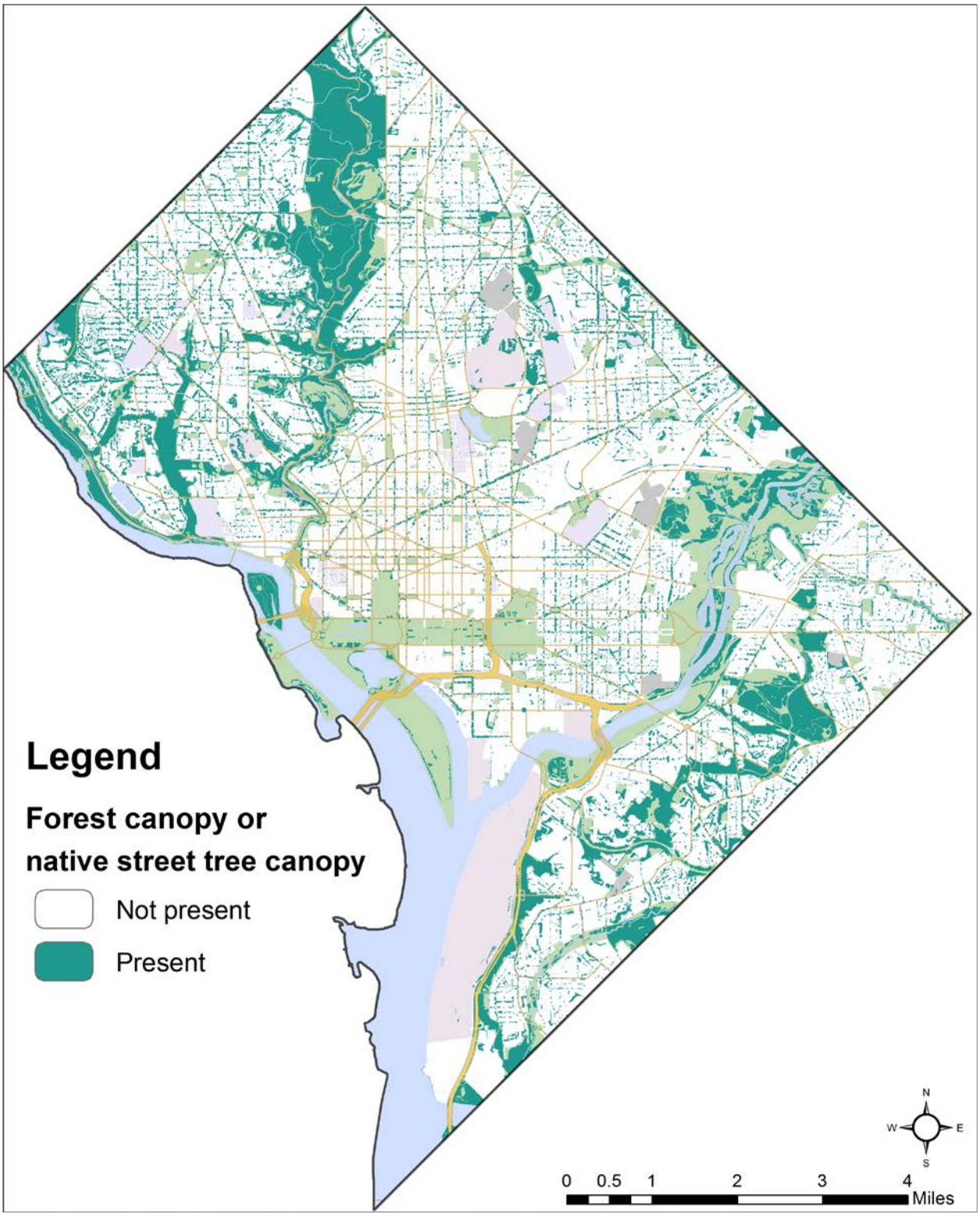


Figure 16 Wooded areas of the District. Mature tree canopy from classification of aerial imagery by DCGIS, combined with native street tree canopy. 1 = no canopy; 10 = canopy. The underlying basemap is from DCGIS (2015b).

3.4.5 Deer Browse Data Layer

The impact of deer browse on vegetative and developed habitats was estimated using site visits in the field, data from deer spotlight surveys, data from NPS deer browse plots, and other observations.

1. Areas with no habitat value were given the lowest rank of 1.
2. Vegetative habitat areas with severe impacts from deer browse were ranked as 2.
3. Residential areas with severe deer browse and known high deer densities were ranked 3.
4. Areas of good vegetative habitat and moderate deer browse were ranked 4.
5. Developed residential areas west of the Anacostia River with low deer density were ranked 5.
6. Riparian habitat and residential areas east of the Anacostia River with low deer density were ranked 6.
7. Vegetative habitat areas with low impacts from deer browse were ranked as 7.
8. Vegetative habitat areas with very low impacts from deer browse were ranked as 8.
9. Vegetative habitat areas where deer have been actively managed for more than five years were ranked as 9.

The deer browse layer is shown in Figure 17.

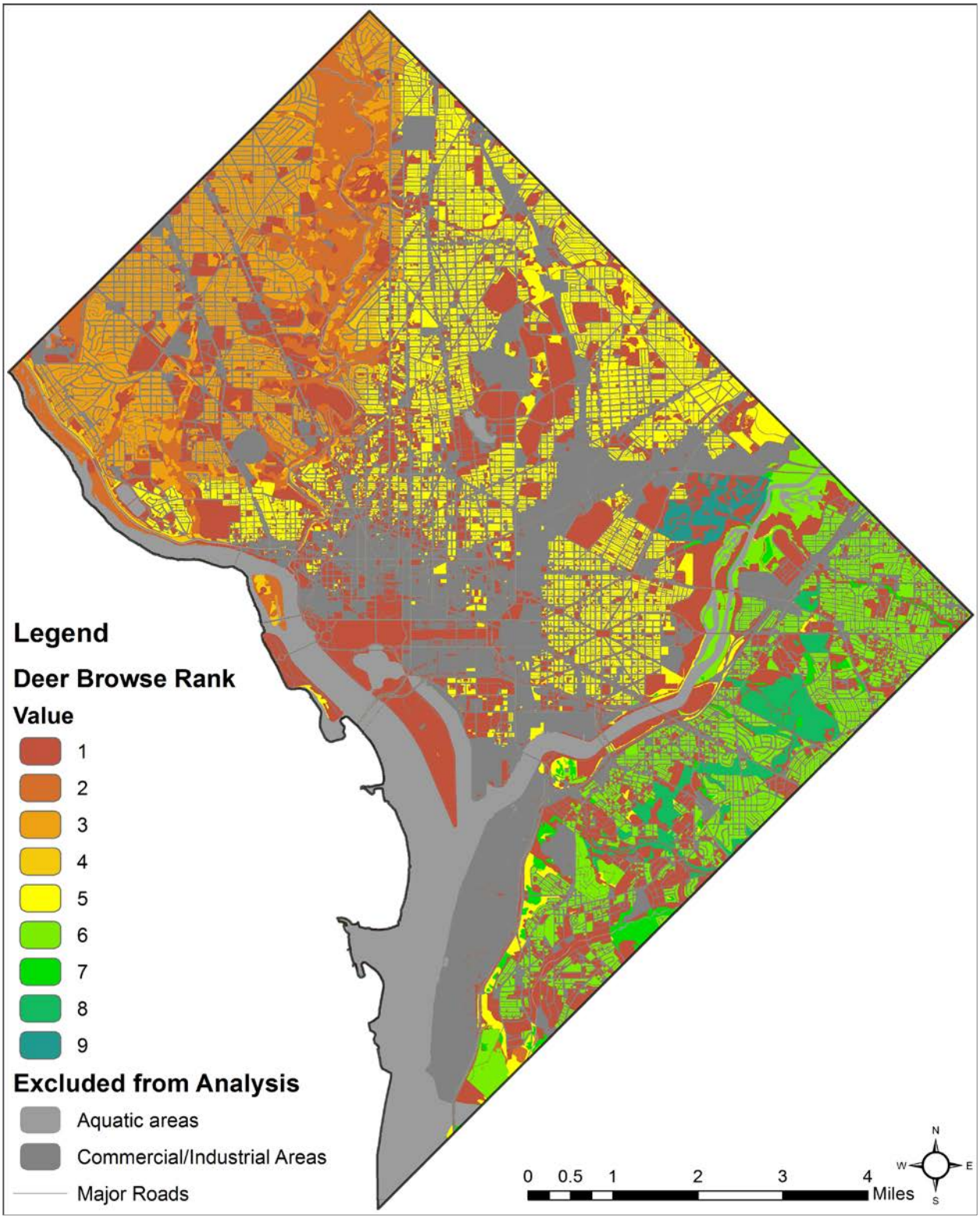


Figure 17 Areas of the District ranked by impact of deer browse. Areas where no or few deer browsed ranked high, while habitats impacted by overabundance of deer ranked low. Commercial, industrial, and high-density residential areas were excluded.

3.4.6 Ranking Process for Habitats

The classified values of the six layers used in the analysis were weighted based on data quality and value to the analysis. The species richness and abundance data were collected by DOEE biologists and represent known locations where habitat already supports SGCN. These layers were weighted high. The core habitat/invaded areas layer represents known areas of good forested and other habitats in good condition, as well as known locations where habitat condition is poor. This layer was also weighted high. The three other layers were weighted low. The six layers with their final weighted values are:

- Species richness (30)
- Abundance, normalized by units of effort (20)
- Core habitat/Invaded areas (20)
- Soils (10)
- Mature tree canopy (10)
- Deer browse (10)

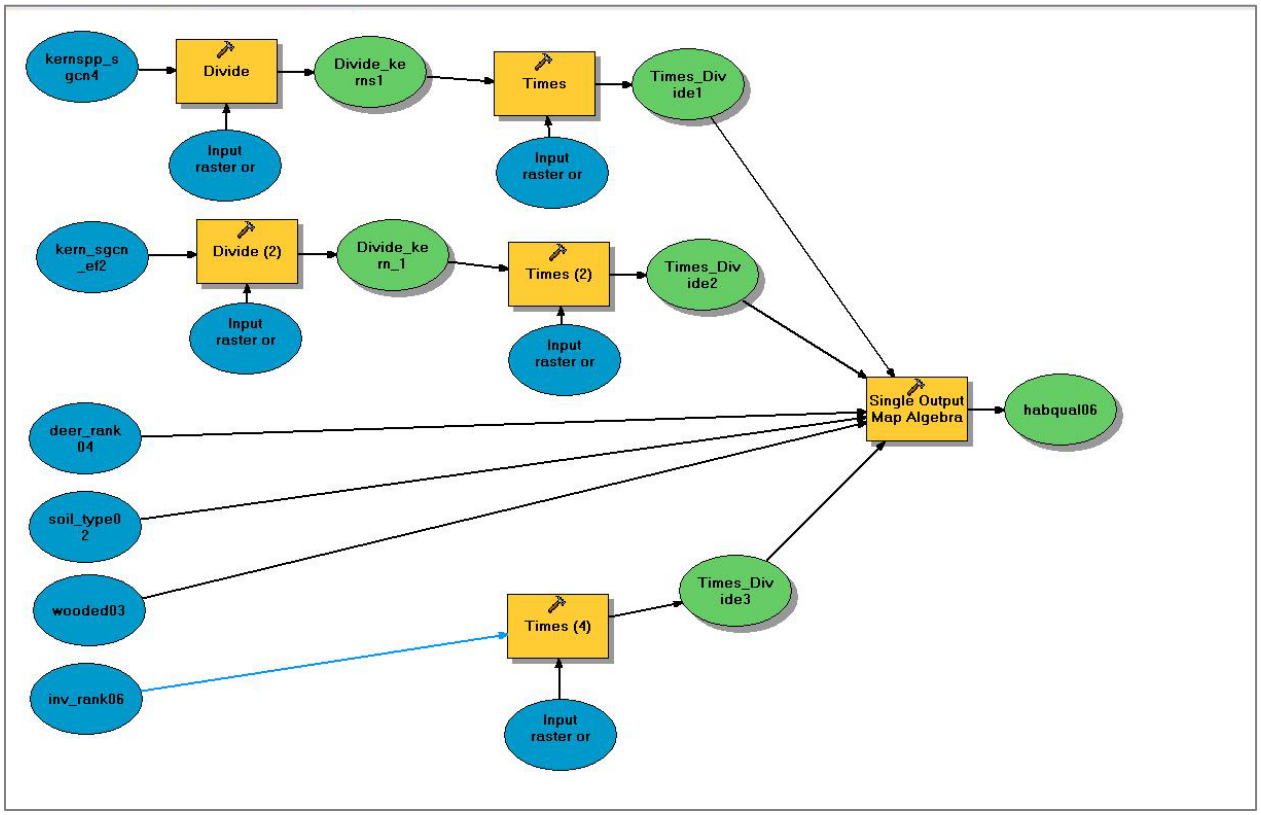


Figure 18 Model for determining values for final District map.

3.4.7 Final Map

The classified rasters were normalized and reclassified to their weighted value using Arc GIS and summed using Map Algebra in ArcGIS. The model that this process followed is shown in Figure 18. The raw output of the model is shown in Figure 19.

3.4.8 Results and Discussion

The raw output of the habitat condition assessment is a raster that indicates locations where good habitat and SGCN species are concentrated. The output was categorized into six levels based on the condition assessment score. The top three levels are called Tier I, Tier II, and Tier III (see Figure 20). Tier I areas are critical for the conservation of biodiversity, Tier II areas are extremely significant for the conservation of biodiversity, and Tier III areas are highly significant for the conservation of biodiversity.

Tier I areas should be targeted for resource management actions that will prevent degradation of habitats. These locations should also be protected from development; especially where the land is administered or owned by the District government. Tier II are locations where some SGCN are found but habitat is marginal. These areas should be targeted for resource management actions that will improve habitat. For example, the riparian forests along the Potomac River have good SGCN diversity and abundance in some places, but the habitats are impacted by invasive plants and deer browse. Management of deer populations and invasive plants in this habitat may increase the density and diversity of SGCN. Tier III locations are often locations where habitat is good or marginal, but SGCN were not represented in the analysis. It is possible that these locations do have SGCN, and their absence simply indicates areas that have not yet been targeted for inventory and monitoring. These locations should be targeted for both monitoring and resource management. The output of this assessment was the major factor in the designation of Conservation Opportunity Areas (COA) in Section 3.6.

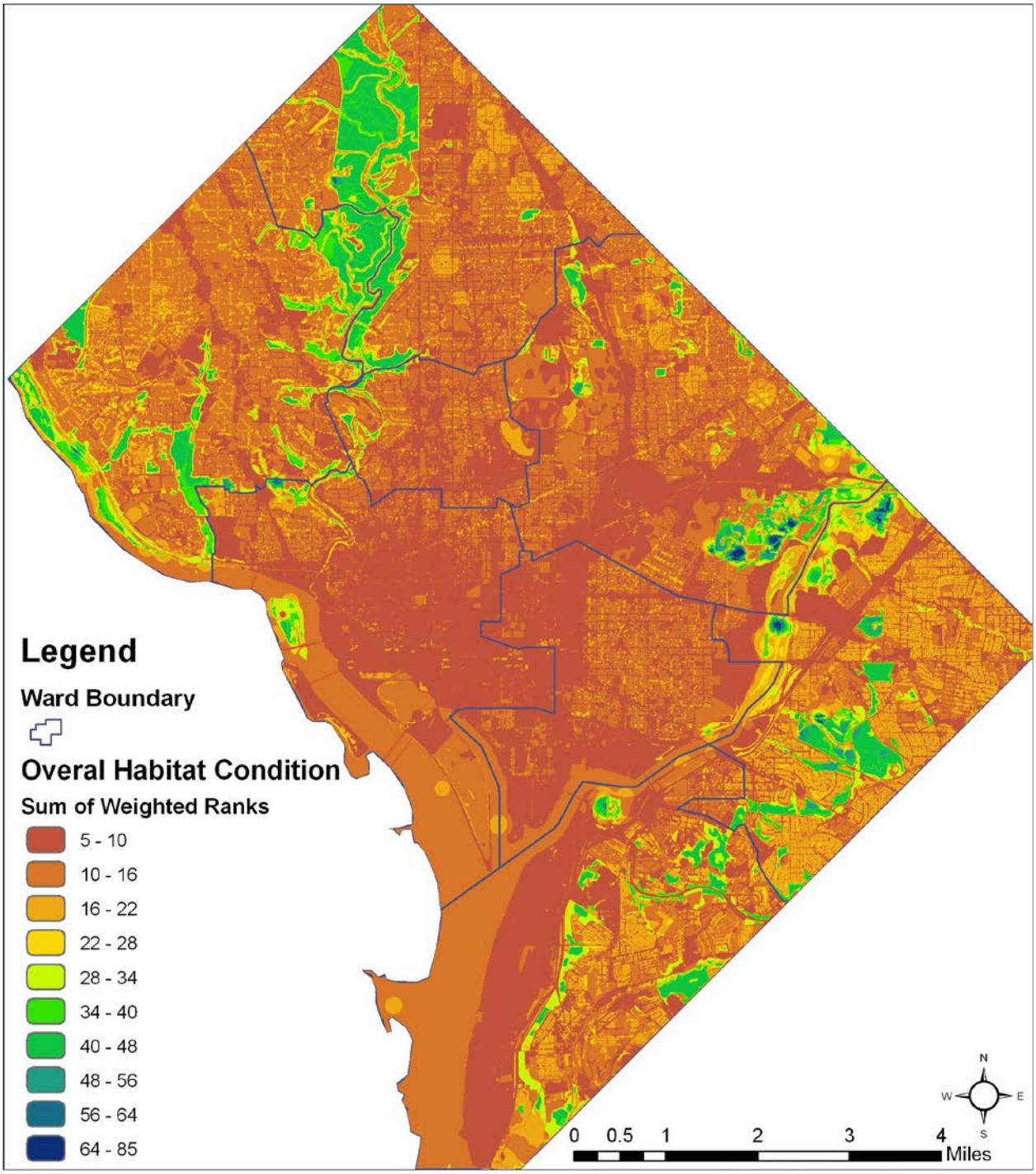


Figure 19 Raw output of the habitat condition assessment (3.4.7a). Map of habitat condition using the previous six data layers weighted and summed. Highest value habitats are blue.

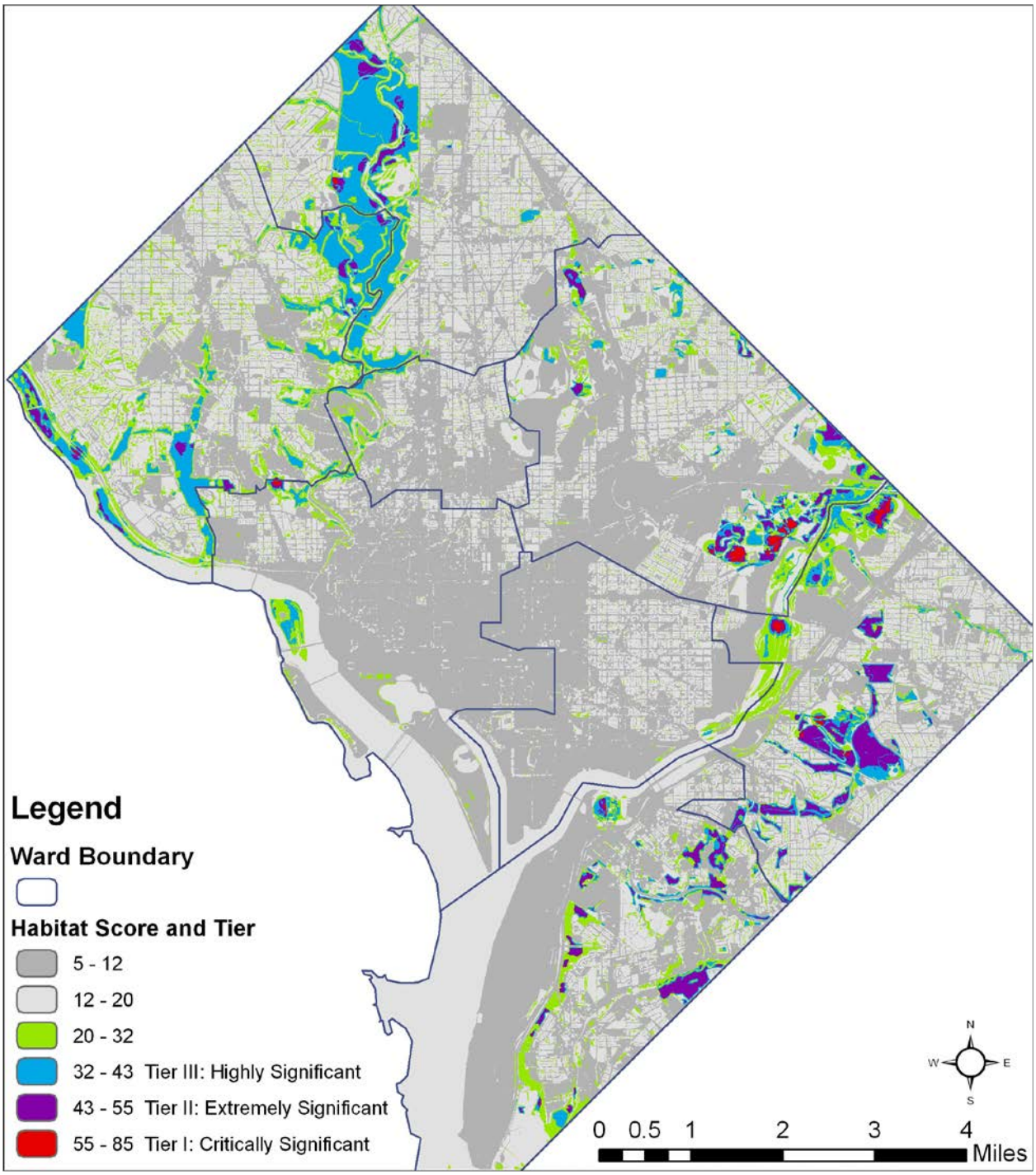


Figure 20 Output of the habitat condition assessment categorized and ranked.

Tier I areas are critical for the conservation of biodiversity.
Tier II areas are extremely significant for the conservation of biodiversity.
Tier III areas are highly significant for the conservation of biodiversity

3.5 Condition of Aquatic Habitats

The condition of aquatic habitats in the District is very poor, but still supportive of aquatic life in the larger water bodies and some smaller water bodies. Rockfish, shad, catfish, American eels, and smaller fish, as well as a variety of turtles, snails, crayfish and mussels can be found in the Potomac River. Catfish, northern snakehead, and turtles can be found in the Anacostia River. Rock Creek supports some game fish, smaller fish, snails, crayfish, turtles and salamanders. Some small streams and vernal pools support salamanders, but diversity is low in most due to poor conditions.

The DOEE Water Quality Division monitors water quality in the District at 47 locations and reports on 36 waterbody segments. The following text is paraphrased from the District of Columbia Water Quality Assessment 2014 Integrated Report to the U.S. Environmental Protection Agency and Congress, pursuant to Sections 305(b) and 303(d) of the Clean Water Act ((DOEE Water Quality Division 2014, pp. 97–117):

> *Thirty-six waterbody segments were monitored for the goals of the Clean Water Act that apply to the District. Each of the waterbodies has been assigned "designated uses" in the District's water quality standards. These include Overall Use, Swimmable Use, Secondary Contact Recreational Use, Aquatic Life Use, Fish Consumption Use and Navigation Use. The use standards outline numeric and narrative criteria that must be met if a waterbody is to support its uses. Various types of water quality data collected during the period of 2009 to 2013 were evaluated to assess use support of the waterbodies. The evaluation found that the designated uses that directly relate to human use of the District's waters were generally not supported. The uses related to the quality of habitat for aquatic life were not supported. No waterbody monitored by the Water Quality Division fully supported all of its designated uses. The water quality of the District's waterbodies continues to be impaired.*
>
> *The major causes of impairment to the District's rivers, streams, and lakes are organic enrichment/low dissolved oxygen. The sources with major impacts on District waters are combined sewer overflows (CSO), and urban runoff/storm sewers. Municipal point sources on the estuaries also have a major impact. Rivers and streams are also impacted by bacteria and toxics.*
>
> *Both of the main waterbodies, the Potomac and Anacostia Rivers support fish and other wildlife populations. But the small streams aquatic communities are still*

stressed. The Potomac River continues to benefit from the CSO improvements and the implementation of improvements and biological nutrient removal at the Blue Plains wastewater treatment plant. The Anacostia River remains aesthetically and chemically polluted. Much remains to be done.

There have been considerable changes in the submerged aquatic vegetation (SAV) attributes from year to year including; species diversity, cover density, and total acreage values for the grass beds that are observed. The one thing that has remained consistent is the direct relationship that exists between the relative abundance of certain fish species and the presence or absence of viable SAV beds.

Rivers and Streams

All of the rivers were impaired for one or more of their designated uses. The aquatic life use was fully supported along 0.8 square miles of river, and not supported along 5.13 square miles of river. No river in the District supported its primary contact use due to pH, turbidity and or E. coli violations. Both rivers have low DO or turbidity impairments, but they are most pronounced in the Anacostia River. No District stream supported its aquatic life use. No stream in the District supported its primary contact use due to pH, turbidity and or E. coli violations.

The causes of impairment to streams and rivers are varied, and include pathogens, oxygen depletion, flow alterations, stream bed or streamside habitat alterations, toxic inorganic chemicals, toxic organic chemicals, heavy metals, pesticides, acidity, and sedimentation. A source of impairment that is common to the District's rivers and streams is urban runoff from imperviousness. Habitat modification still has an impact on many of the streams as riparian vegetation is removed and stream banks are destabilized due to heavy runoff. Combined sewer overflow affects small streams as well as Rock Creek, the Anacostia River and the Potomac River.

Embayed Areas

Three enclosed or embayed waterbodies were monitored for designated use support. These are Kingman Lake, C&O Canal, and the Tidal Basin. All of these waterbodies were impaired for one or more of their designated uses. Based on physical/chemical data, the aquatic life use was fully supported in the C&O Canal and Kingman Lake. No lake in the District supported its primary contact use due to pH, turbidity and or E. coli violations. All the lakes are highly impacted by turbidity and pH levels.

Submerged Aquatic Vegetation

The DOEE Fisheries Management Branch has been monitoring submerged aquatic vegetation (SAV) since 1993. In this time, DOEE has compiled an extensive amount of data that reflects the growth and decline of SAV species within the District. Not only does SAV provide an important habitat for aquatic life, it provides sediment stabilization as well as improvements in water quality. It is

an important component to the health of the District's aquatic ecosystem. Nutrient and sediment pollution are both limiting factors for SAV viability.

2013 observations revealed 8 species of SAV including: Ceratophyllum demersum, Hydrilla verticillata, Najas guadlupensis, Najas minor, Heteranthera dubia, Vallisneria americana, Potamogeton crispus, and Stuckenia pectinata. This is an increase of three species since 2011. A total of 203.9 acres of SAV were reported in 2013, this is a dramatic increase from 2011 when the reported acres was 31.41. Overall, SAV species diversity and cover densities vastly improved in 2013.

SAV beds provide an important habitat for both juvenile and adult fish in the District. SAV beds are ecologically important in a watershed system. They are necessary to fish and other aquatic organisms as areas for refuge, feeding, and reproduction (Kraus and Jones 2012). DOEE's records of SAV area and fish diversity from electrofishing data collected during the months SAV is present have demonstrated the important relationship between fish and SAV in the Potomac.

3.6 Conservation Opportunity Areas

AFWA and the USFWS recommend that states designate discrete, spatially distinct areas that offer the best opportunities and potential for SGCN conservation and label them Conservation Opportunity Areas (COA) (AFWA 2012). DOEE selected eight COA's based on habitat condition analysis and SGCN diversity (also see Figure 21):

1. Potomac River and Floodplain: Potomac River and the forested floodplain from the District boundary to Three Sisters Island; approximately 490 acres (Table 8).

   This COA includes diverse ice-scour shrublands and forests, riverine pools, vernal pools, tidal mudflats, rocky shoals, deep water habitat and fish spawning areas. Exemplary SGCN include: striped bass, American shad, prothonotary warbler, yellow-throated vireo, northern river otter, mocha emerald, wood frog and northern copperhead.

Table 8 Habitats found in the Potomac River & Floodplain Conservation Opportunity Area

Formation	Macrogroup	Habitat System	Area (acres)
Developed	Maintained Grasses and Mixed Cover	Urban and Recreational Grasses	10
Northeastern Upland Forest	Plantation and Ruderal Forest	Northern and Central Hardwood and Conifer - Ruderal Forest	0.1
Northeastern Wetland Forest	Northeastern Floodplain Forest	Central Appalachian River Floodplain	228
Shrubland and Grassland	Modified/Managed Marsh	Modified/Managed Marsh	0.6
	Ruderal Shrubland & Grassland	Introduced Shrubland	0.6
		Ruderal Upland - Old Field	4
Aquatic	Riverine	Great River	209
		Rocky Shoals	27
		SAV Bed	2
		Creek & Headwater Creek	0.1
	Pond	Riverine Pond	9
		Vernal Pool	1.3

2. Theodore Roosevelt Island Area: Theodore Roosevelt Island and surrounding aquatic habitats; approximately 180 acres (Table 9).

   This COA includes several upland and wet forest types, a tidal emergent wetland, mudflats and SAV beds. Exemplary SGCN include: lesser yellowlegs, American eel, gray tree frog, eastern painted turtle, little brown bat, and triangle floater.

Table 9 Habitats found in the Theodore Roosevelt Island Conservation Opportunity Area

Formation	Macrogroup	Habitat System	Area (acres)
Developed	Maintained Grasses and Mixed Cover	Urban and Recreational Grasses	5
Northeastern Upland Forest	Northern Hardwood & Conifer	Southern Atlantic Coastal Plain Mesic Hardwood Forest	16
	Plantation and Ruderal Forest	Northern and Central Hardwood and Conifer - Ruderal Forest	24
Northeastern Wetland Forest	Coastal Plain Swamp	Northern Atlantic Coastal Plain Tidal Swamp	7
	Northeastern Floodplain Forest	Central Appalachian River Floodplain	37
Shrubland and Grassland	Emergent Marsh	Northern Atlantic Coastal Plain Fresh and Oligohaline Tidal Marsh	4
	Ruderal Shrubland & Grassland	Introduced Shrubland	1.3
Aquatic	Riverine	Great River	54
		SAV Bed	31

3. Kingman and Heritage Islands and Tidal Wetlands: Kingman and Heritage Islands and the surrounding tidal wetlands and riparian areas; approximately 390 acres (Table 10).

   This COA includes wet forest in Heritage Island, successional upland forests on Kingman Island and other riparian areas, including vernal pools and restored freshwater tidal wetlands. Exemplary SGCN include: American black duck, eastern redbelly, spotted salamander, tricolored bat, unicorn clubtail, and brown bullhead.

Table 10 Habitats found in the Kingman and Heritage Islands and Wetlands Conservation Opportunity Area

Formation	Macrogroup	Habitat System	Area (acres)
Developed	Maintained Grasses and Mixed Cover	Urban and Recreational Grasses	22
Northeastern Upland Forest	Plantation and Ruderal Forest	Northern and Central Hardwood and Conifer - Ruderal Forest	49
Northeastern Wetland Forest	Coastal Plain Swamp	Northern Atlantic Coastal Plain Tidal Swamp	0.6
		Successional Woody Wetland	0.6
	Northeastern Floodplain Forest	Central Appalachian River Floodplain	18
Shrubland and Grassland	Emergent Marsh	Northern Atlantic Coastal Plain Fresh and Oligohaline Tidal Marsh	3
	Modified/Managed Marsh	Modified/Managed Marsh	40
	Ruderal Shrubland & Grassland	Introduced Shrubland	2
		Ruderal Upland - Old Field	35
Aquatic	Riverine	Creek & Headwater Creek	26
		Embayed River Area	65
		Intertidal Mudflat	54
		Small River - Anacostia	77
	Pond	Vernal Pool	0.4

4. Northern Rock Creek Park: approximately 230 acres (Table 11).

   This COA includes the northern floodplain of Rock Creek Park and the surrounding upland forests. There are several forest Habitat Systems, including upland and wet forests, two groundwater-fed wetlands, and several large vernal pools. Exemplary SGCN include: red-headed woodpecker, eastern box turtle, redback salamander, northern long-eared bat, southern flying squirrel, Baltimore checkerspot, and pearl dace.

Table 11 Habitats found in the Northern Rock Creek Park Conservation Opportunity Area

Formation	Macrogroup	Habitat System	Area (acres)
Developed	Maintained Grasses and Mixed Cover	Urban and Recreational Grasses	0.9
Northeastern Upland Forest	Central Oak-Pine	Central Appalachian Dry Oak-Pine Forest	1.4
		Southern Interior Low Plateau Dry - Mesic Oak Forest	10
	Northern Hardwood & Conifer	Southern Atlantic Coastal Plain Mesic Hardwood Forest	139
	Plantation and Ruderal Forest	Northern and Central Hardwood and Conifer - Ruderal Forest	5
Northeastern Wetland Forest	Northeastern Floodplain Forest	Central Appalachian Stream and Riparian	64
Aquatic	Riverine	Creek & Headwater Creek	1.2
		Small River - Rock Creek	8

5. Poplar Point: approximately 45 acres (Table 12).

   This COA includes successional wet forests, successional upland forests, and several meadow and scrub habitats. Exemplary SGCN include: willow flycatcher, queen snake, Fowler's toad, striped skunk, comet darner, and rusty-patched bumble bee.

Table 12 Habitats found in the Poplar Point Conservation Opportunity Area

Formation	Macrogroup	Habitat System	Area (acres)
Developed	Maintained Grasses and Mixed Cover	Urban and Recreational Grasses	4
Northeastern Upland Forest	Plantation and Ruderal Forest	Northern and Central Hardwood and Conifer - Ruderal Forest	16
Northeastern Wetland Forest	Coastal Plain Swamp	Successional Woody Wetland	3
Shrubland and Grassland	Modified/Managed Marsh	Modified/Managed Marsh	1.4
	Ruderal Shrubland & Grassland	Introduced Shrubland	10
		Ruderal Upland - Old Field	9

6. Kenilworth and Fort Lincoln Wetland complex: approximately 400 acres (Table 13).

   This COA includes the restored tidal wetlands and wet forests in Kenilworth Aquatic Gardens, riparian forests on both banks of the Anacostia, two infrequently flooded wetlands along the western shore of the Anacostia River, and several large meadow and scrub habitats in Kenilworth Park. Exemplary SGCN include: American woodcock, eastern mud turtle, eastern newt, American beaver, lilypad forktail, devil crawfish, and hickory shad.

Table 13 Habitats found in the Kenilworth and Fort Lincoln Wetlands Conservation Opportunity Area

Formation	Macrogroup	Habitat System	Area (acres)
Developed	Maintained Grasses and Mixed Cover	Urban and Recreational Grasses	59
Northeastern Upland Forest	Central Oak-Pine	Central Appalachian Dry Oak-Pine Forest	16
		Southern Interior Low Plateau Dry - Mesic Oak Forest	2
	Plantation and Ruderal Forest	Northern and Central Hardwood and Conifer - Ruderal Forest	27
Northeastern Wetland Forest	Coastal Plain Swamp	Northern Atlantic Coastal Plain Tidal Swamp	17
		Successional Woody Wetland	3
	Northeastern Floodplain Forest	Central Appalachian River Floodplain	73
		Central Appalachian Stream and Riparian	0.6
Shrubland and Grassland	Emergent Marsh	Northern Atlantic Coastal Plain Fresh and Oligohaline Tidal Marsh	2
	Modified/Managed Marsh	Introduced Wetland and Riparian Vegetation	0.7
		Modified/Managed Marsh	46
	Ruderal Shrubland & Grassland	Introduced Shrubland	2
		Ruderal Upland - Old Field	42
Aquatic	Riverine	Creek & Headwater Creek	2
		Embayed River Area	14
		Freshwater Pond	11
		Intertidal Mudflat	31
		Small River - Anacostia	48
	Pond	Vernal Pool	0.1

7. Large Fort Circle Parks: Fort Dupont, Fort Chaplin, and Fort Mahan; approximately 410 acres. (Table 14)

   This COA includes the most undisturbed upland forests in the District. These sites are dominated by Oak-Heath forests. One site includes rare white ladyslipper orchids, and large stands of pinxter azalea, blueberry and mountain laurel. Exemplary SGCN include: ovenbird, blue-winged warbler, rough green snake, upland chorus frog, gray fox, and capital area groundwater amphipod.

Table 14 Habitats found in the Large Fort Circle Parks Conservation Opportunity Area

Formation	Macrogroup	Habitat System	Area (acres)
Developed	Maintained Grasses and Mixed Cover	Urban and Recreational Grasses	49
Northeastern Upland Forest	Central Oak-Pine	Central Appalachian Dry Oak-Pine Forest	187
		Southern Interior Low Plateau Dry - Mesic Oak Forest	46
		Successional Virginia Pine Forest	3
	Northern Hardwood & Conifer	Southern Atlantic Coastal Plain Mesic Hardwood Forest	12
	Plantation and Ruderal Forest	Northern and Central Hardwood and Conifer - Ruderal Forest	96
Northeastern Wetland Forest	Northeastern Floodplain Forest	Northern Atlantic Coastal Plain Stream and River	3
Shrubland and Grassland	Ruderal Shrubland & Grassland	Introduced Shrubland	9
		Ruderal Upland - Old Field	0.8
Aquatic	Riverine	Creek & Headwater Creek	3

8. Oxon Run Magnolia Bog and Forests: approximately 105 acres (Table 15).

   This COA contains groundwater-fed bogs, floodplain forests, and a remnant globally rare plant community that is endemic to the District and surrounding counties in Maryland and Virginia that requires restoration. Exemplary SGCN include: hooded warbler, eastern worm snake, southern leopard frog, silver haired bat, sphagnum sprite, and bronze copper.

Table 15 Habitats found in the Oxon Run Magnolia Bog Conservation Opportunity Area

Formation	Macrogroup	Habitat System	Area (acres)
Developed	Maintained Grasses and Mixed Cover	Canopy Trees and Recreational Grasses	0.1
		Urban and Recreational Grasses	7
Northeastern Upland Forest	Central Oak-Pine	Central Appalachian Dry Oak-Pine Forest	14
		Southern Interior Low Plateau Dry - Mesic Oak Forest	6
		Successional Virginia Pine Forest	2
	Plantation and Ruderal Forest	Northern and Central Hardwood and Conifer - Ruderal Forest	17
Northeastern Wetland Forest	Coastal Plain Swamp	Successional Woody Wetland	29
	Northeastern Floodplain Forest	Central Appalachian Stream and Riparian	0
		Northern Atlantic Coastal Plain Stream and River	23
Shrubland and Grassland	Modified/Managed Marsh	Modified/Managed Marsh	0.6
	Ruderal Shrubland & Grassland	Ruderal Upland - Old Field	0.7
Aquatic	Riverine	Creek & Headwater Creek	3

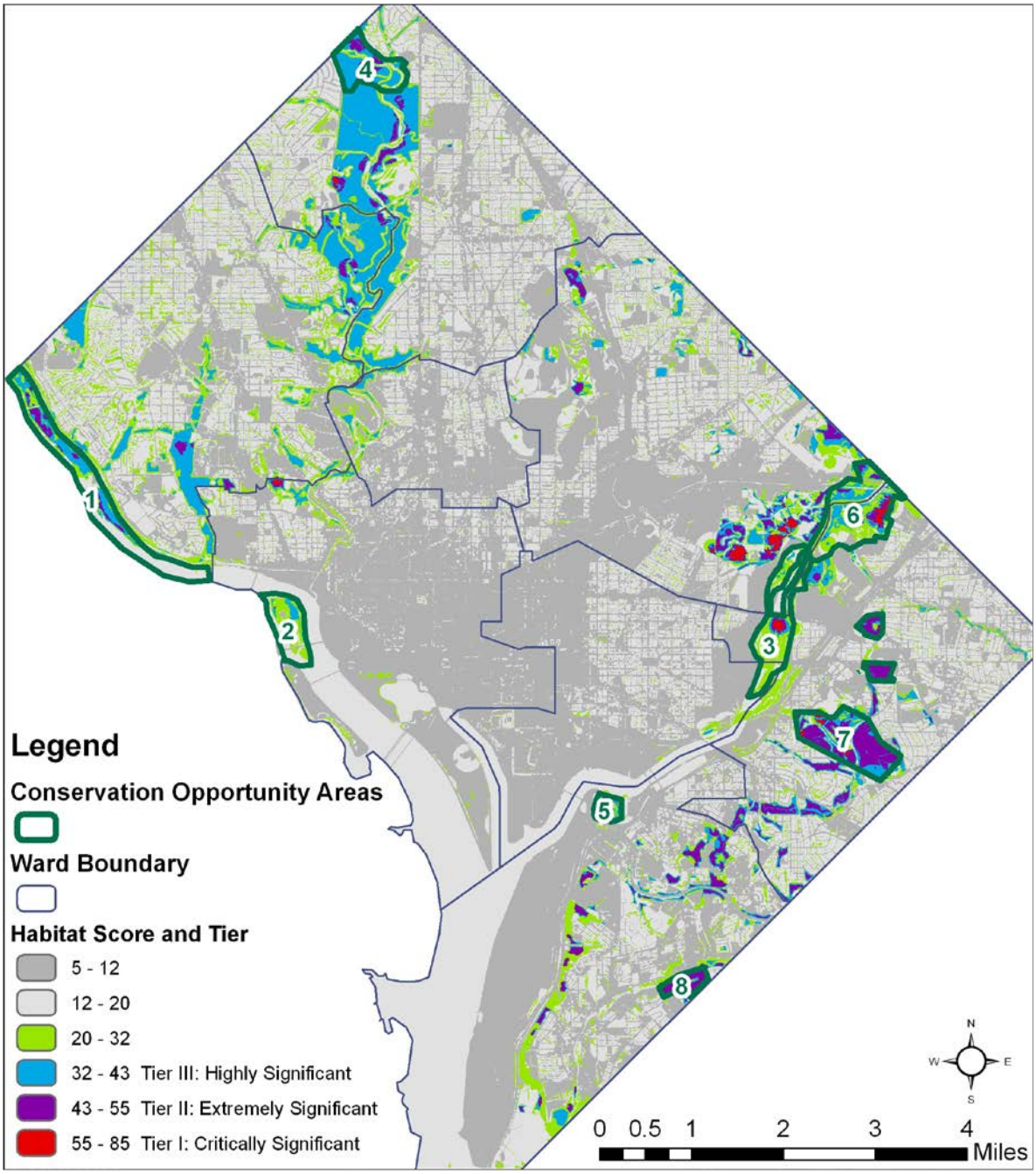


Figure 21 Conservation opportunity areas in the District.

1. Potomac River and Floodplain
2. Theodore Roosevelt Island Area
3. Kingman and Heritage Islands and Tidal Wetlands
4. Northern Rock Creek Park
5. Poplar Point
6. Kenilworth and Fort Lincoln Wetland Complex
7. Large Fort Circle Parks
8. 8.Oxon Run Magnolia Bog and Forests