10. George Washington Planning Region Local Action Plan Summary

Wildlife Action Plan and Local Summaries Overview

Wildlife Action Plan

Virginia is fortunate to contain a wide variety of natural resources and landscapes that provide Virginians with a range of benefits, services, and economic opportunities. Natural resource conservation in Virginia, as in most states, is implemented by government agencies, non-governmental organizations, private institutions, academic institutions, and private citizens. These groups work to enhance the quality of life within the Commonwealth by conserving Virginia's air, land, water, and wildlife. Adequate funding and human capital needed to manage and conserve these valuable resources are not always available. In 2005, Virginia's conservation community first came together to maximize the benefits of their actions and created the state's first Wildlife Action Plan (Action Plan). It was written to prioritize and focus conservation efforts to prevent species from declining to the point where they become threatened or endangered (DGIF 2005). The 2015 Action Plan is an update of the original Plan. The Action Plan must address eight specific elements mandated by Congress. They are:

> *1. Information on the distribution and abundance of species of wildlife, including low and declining populations as the state fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the state's wildlife; and*
>
> *2. Descriptions of locations and relative condition of key habitats and community types essential to conservation of species identified in (1); and*
>
> *3. Descriptions of problems which may adversely affect species identified in (1) or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats; and*
>
> *4. Descriptions of conservation actions determined to be necessary to conserve the identified species and habitats and priorities for implementing such actions; and*
>
> *5. Proposed plans for monitoring species identified in (1) and their habitats, for monitoring the effectiveness of the conservation actions proposed in (4), and for adapting these conservation actions to respond appropriately to new information or changing conditions; and*
>
> *6. Descriptions of procedures to review the Plan-Strategy at intervals not to exceed ten years; and*
>
> *7. Plans for coordinating, to the extent feasible, the development, implementation, review, and revision of the Plan-Strategy with federal, state, and local agencies and Indian tribes that manage significant land and water areas within the State or*

administer programs that significantly affect the conservation of identified species and habitats.

8. Congress has affirmed through the Wildlife Conservation and Restoration Program (WCRP) and State Wildlife Grants (SWG), that broad public participation is an essential element of developing and implementing these Plans-Strategies, the projects that are carried out while these Plans-Strategies are developed, and the Species in Greatest Need of Conservation (SGCN) that Congress has indicated such programs and projects are intended to emphasize.

Each species included in the 2015 Action Plan (Species of Greatest Conservation Need or SGCN) has been evaluated and prioritized based upon two criteria: degree of imperilment and management opportunity.

To describe imperilment, SGCN are grouped into one of four Tiers: Critical (Tier I), Very High (Tier II), High (Tier III), and Moderate (Tier IV).

Tier I - *Critical Conservation Need. Species face an extremely high risk of extinction or extirpation. Populations of these species are at critically low levels, face immediate threat(s), and/ or occur within an extremely limited range. Intense and immediate management action is needed.*

Tier II - *Very High Conservation Need. Species have a high risk of extinction or extirpation. Populations of these species are at very low levels, face real threat(s), and/ or occur within a very limited distribution. Immediate management is needed for stabilization and recovery.*

Tier III - *High Conservation Need. Extinction or extirpation is possible. Populations of these species are in decline, have declined to low levels, and/ or are restricted in range. Management action is needed to stabilize or increase populations.*

Tier IV - *Moderate Conservation Need. The species may be rare in parts of its range, particularly on the periphery. Populations of these species have demonstrated a declining trend or a declining trend is suspected which, if continued, is likely to qualify this species for a higher tier in the foreseeable future. Long-term planning is necessary to stabilize or increase populations*.

While degree of imperilment is an important consideration, it is often insufficient to prioritize the use of limited human and financial resources. In order to identify and triage conservation opportunities, development of the updated Action Plan (2015) included assigning a Conservation Opportunity Ranking to each species identified within the Plan. Rankings were assigned with input from taxa or species experts (biologists) and other members of Virginia's conservation community. They also are based on conservation or management actions and research needs identified for the species within the 2005 Action Plan. In addition, a literature review was conducted to garner any new information available since the first version of the Action Plan. The three Conservation Opportunity Rankings are described as follows:

A – Managers have identified "on the ground" species or habitat management strategies expected to benefit the species; at least some of which can be implemented with existing resources and are expected to have a reasonable chance of improving the species' conservation status.

B – Managers have only identified research needs for the species or managers have only identified "on the ground" conservation actions that cannot be implemented due to lack of personnel, funding, or other circumstance.

C – Managers have failed to identify "on the ground" actions or research needs that could benefit this species or its habitat or all identified conservation opportunities for a species have been exhausted.

Over 880 SGCN are listed in the 2015 Action Plan and found in varying densities across the state (Figure 1). Of the Plan's SGCN, 23.4 percent are classified as Conservation Opportunity Ranking A; 7.1 percent are classified Conservation Opportunity Ranking B; and 69.5 percent are classified as Conservation Opportunity Ranking C. Additionally, of the 883 SGCN:

- Approximately 25% of the SGCN are already listed as threatened or endangered under the Federal or Virginia Endangered Species Act,
- Approximately 60% are aquatic,
- Approximately 70% are invertebrates, and
- All are impacted by the loss or degradation of their habitats.

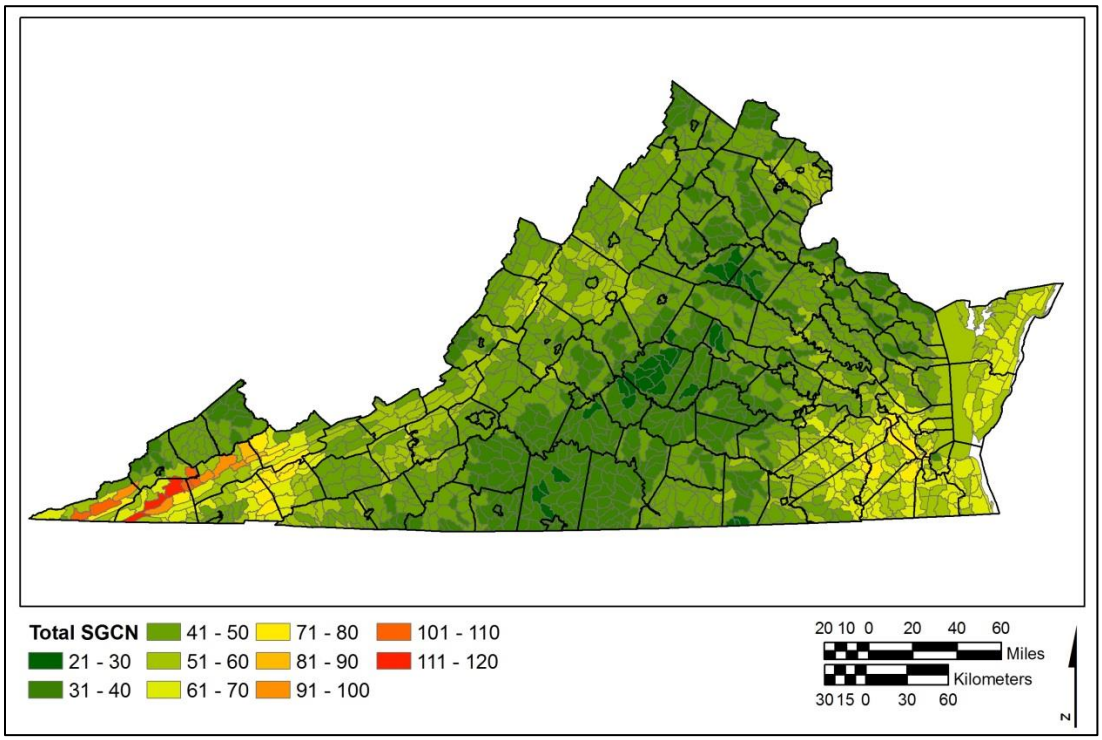

Figure 1. State distribution of Species of Greatest Conservation Need by HUC12 Watersheds.

Wildlife Action Plan Implementation

Since its creation, the Action Plan has helped Virginia acquire over $17 million in new conservation funding through the State Wildlife Grants Program. These resources have been used to implement significant research, advance species recovery efforts via captive propagation, and restore and conserve important wildlife habitats. Despite these successes, many conservation practitioners feel the original Wildlife Action Plan never reached its full potential. One common concern is that it failed to focus at the habitat level where the needs of many species could be addressed at once. Further, many partners indicated the original Action Plan did not provide sufficient details to help prioritize conservation needs and opportunities at a local scale, where many land use decisions are made, and conservation efforts are implemented. Lacking these local insights, it was often difficult for agencies, municipalities, organizations, academic institutions, and landowners to identify and focus on the highest priority wildlife conservation opportunities for their geographic area. To address this concern and make the Action Plan more user-friendly and relevant at a finer scale, this version (2015) of the Action Plan was developed to include locally-based summaries. These summaries identify species that are local priorities, habitats required to conserve those species, regional threats impacting species and habitats, and priority conservation actions that can be taken to address those threats. The goal of these summaries is to facilitate and benefit the work of local governments, conservation groups, landowners, and other members of the conservation community who wish to support wildlife conservation within their regions.

Local Action Plan Summaries

In creating the updated Action Plan, the Virginia Department of Game and Inland Fisheries (DGIF) adopted a model developed by the Virginia Department of Conservation and Recreation (DCR) for the Virginia Outdoors Plan. The Virginia Outdoors Plan describes recreational resource issues for 21 multi-county Recreational Planning Regions. Each Recreational Planning Region is roughly analogous to one of Virginia's 21 local Planning District Commissions (PDC). The PDCs are voluntary associations of local governments intended to foster intergovernmental cooperation by bringing together local officials, agency staff, the public, and partners to discuss common needs and develop solutions to regional issues. With its focus on local-scale actions, the Virginia Outdoors Plan has become an important tool for identifying and addressing local recreational issues. This DCR model was adapted and used in this Action Plan to address wildlife and habitat issues for the benefit of planning region residents. More broadly, the new Action Plan's Local Action Plan Summaries will create a framework that Virginia's diverse conservation community can use to identify issues and locations of mutual conservation interest, enhance collaborative opportunities, develop new conservation resources, and craft "win-win" situations that can be beneficial for both the people and wildlife of Virginia.

George Washington Planning Region Summary Overview

The George Washington Planning Region consists of 916,270 acres (1,432 square miles) and includes the counties of Caroline, King George, Spotsylvania, and Stafford, and the city of Fredericksburg. The human population in this planning region is estimated to be over 352,000 people. All counties in this planning region are projected to experience intense population growth by 2030, especially Caroline and Spotsylvania counties (U.S. Census Bureau 2015). Much of this growth is due to their proximity to the Washington, DC metro area.

Less developed and more rural areas often provide a diversity of valuable wildlife habitats, which can be degraded or lost as human populations grow, especially in planning regions such as George Washington near a large metropolitan area. This planning region is important to the conservation of various SGCN such as the common rainbow snake, American bittern, and dwarf wedgemussel, among others. The region also includes a variety of habitat types, including mature mixed hardwood forests, young forests, retired agricultural land, tidal and non-tidal wetlands, and tidally influenced and freshwater streams and riparian habitats (Figure 2).

In developing conservation actions for habitats and priority species within this planning region, a number of factors must be considered to determine how limited resources can be allocated to best effect. A project's likely impact and probability of success, the effectiveness of historic and ongoing conservation actions, as well as logistical, economic, and political factors will all influence the selection and prioritization of conservation actions. Virginia's Wildlife Action Plan advocates a proactive approach that focuses conservation resources to manage species before they become critically imperiled and to implement projects that can simultaneously benefit multiple species and human communities. These factors were considered in development of the conservation actions included in the following sections as well as in analyzing the existing threats facing SGCN and their habitats. Threats and conservation actions are organized based on the habitat types found within this planning region upon which priority SGCN depend.

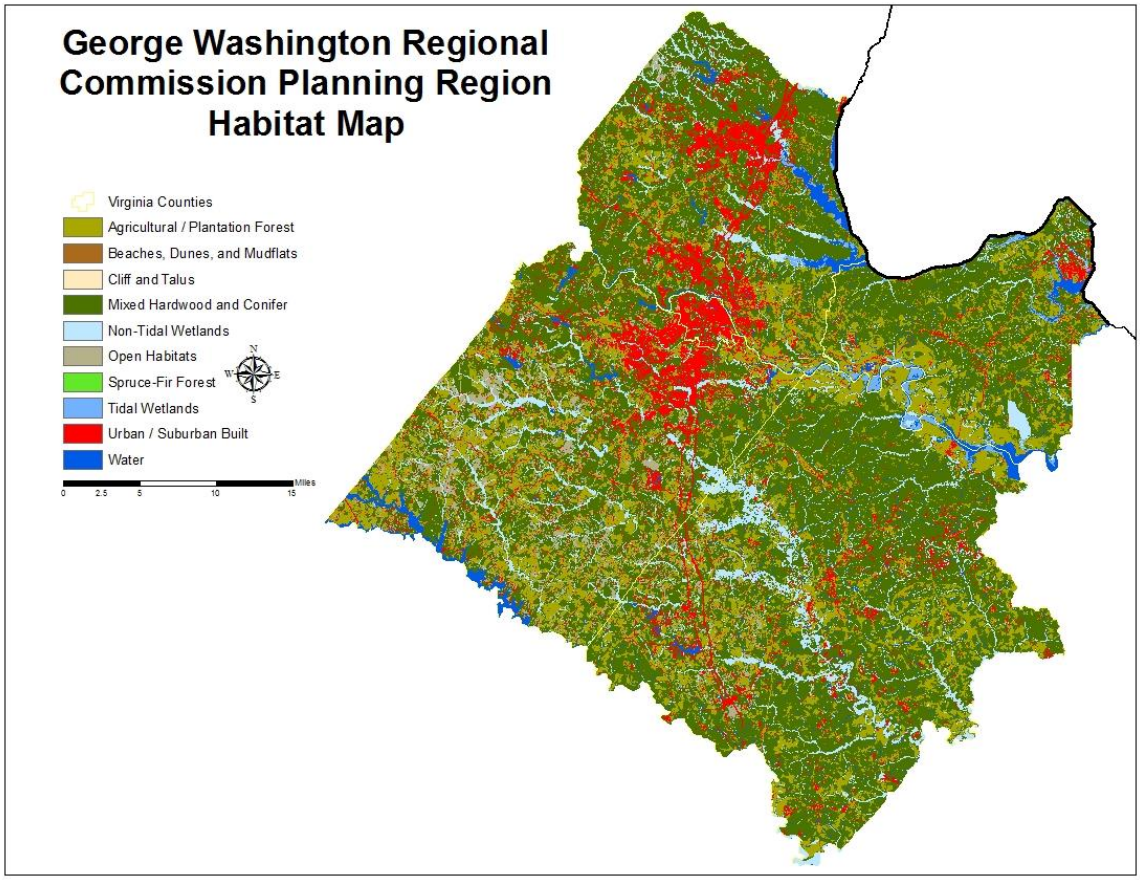

Figure 2. George Washington Planning Region Habitats (Anderson et al. 2013).

Priority Species of Greatest Conservation Need

Of Virginia's 883 SGCN, 76 are believed to either occur, or have recently occurred, within the George Washington Planning Region (Appendix A). Of these 76 species, ***30 SGCN are dependent upon habitats provided within the George Washington Planning Region (Table 2). These species constitute the priority SGCN for the planning region.*** A summary of SGCN Tier and Conservation Opportunity Rankings is provided in Table 1, while Figure 3 demonstrates the density of the 30 priority species within this region.

Priority SGCNs within this Local Summary include species for which this planning region comprises a significant portion of its range in Virginia. To determine species priority, the authors implemented a 10 percent rule to identify locally important species. Under the 10 percent rule, an SGCN is included in a Local Summary if the planning region provides at least 10 percent of that species' range in Virginia. However, there are several other instances that warrant inclusion on a planning region's priority SGCN list. First, several SGCN occur statewide but in low numbers in each planning region and will never reach the 10 percent threshold in any single planning region. Species that fall in this category were manually added to priority SGCN lists where appropriate. Some species only occur in three or fewer planning regions. These SGCN are also included on priority lists for the planning regions in which they are found due to their rarity in

the state and the importance of those few planning regions to their survival. For migrant species that may only be in Virginia for a matter of days, these migratory habitats are considered critical for their long-term conservation. When these circumstances were identified, specific migratory species were manually added to local SGCN lists as well. Finally, where a species may have a particularly strong population in a relatively small portion of a planning region, the population may be determined to be significant enough to warrant inclusion on the local SGCN list. Again, when these circumstances were identified, species were manually added to the local priority SGCN list.

Table 1. Tier and Conservation Opportunity Ranking Distribution among Priority SGCN.

Tier and Conservation Opportunity Rank	Number of SGCN
Ia	2
IIIa	5
IIIb	1
IIIc	1
IVa	13
IVb	5
IVc	3

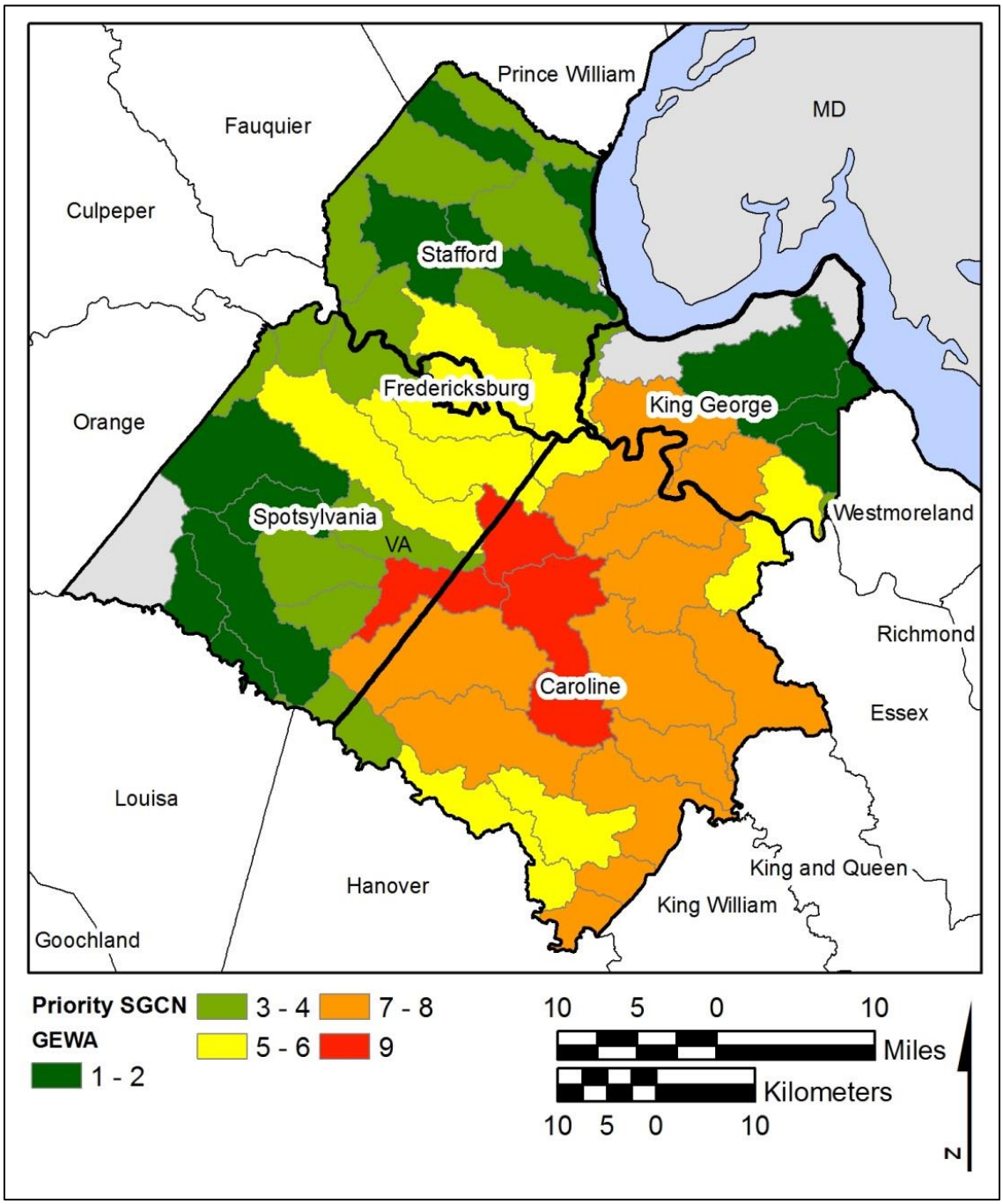

Figure 3. Priority SGCN Density in the George Washington Planning Region (HUC12 Watersheds).

Table 2. Priority Species of Greatest Conservation Need Distribution within the George Washington Planning Region.

Taxa	Conservation Status	Tier	Opportunity Ranking	Common Name	Scientific Name	Habitat
Amphibian		III	a	Carpenter frog	*Lithobates virgatipes*	Freshwater wetlands with sphagnum moss
Amphibian		IV	a	Greater siren	*Siren lacertina*	Tolerates a variety of warm aquatic habitats with abundant vegetation
Amphibian		III	a	Lesser siren	*Siren intermedia intermedia*	Tolerates a variety of warm aquatic habitats with abundant vegetation
Bird		III	c	Bank swallow	*Riparia riparia*	Habitat includes open and partly open situations, frequently near flowing water. Nests are in steep sand, dirt, or gravel banks, in burrows dug near the top of the bank, along the edge of inland water, or along the coast, or in gravel pits, road embankments, etc.
Bird		III	b	Belted kingfisher	*Megaceryle alcyon*	Primarily along water, both freshwater and marine, including lakes, streams, wooded creeks and rivers, seacoasts, bays, estuaries, and mangroves. Perches in trees, on over hanging branches, posts and utility wires.
Bird		IV	a	Black-and-white warbler	*Mniotilta varia*	Habitat generalist with broad habitat tolerances
Bird		IV	a	Brown thrasher	*Toxostoma rufum*	Thickets and bushy areas in deciduous forest clearings and forest edge, shrubby areas and gardens; in migration and winter also in scrub.
Bird		IV	b	Chimney swift	*Chaetura pelagica*	Inhabits rural and urban environments having both an abundance of flying arthropods and suitable roosting/nesting sites
Bird		IV	a	Eastern kingbird	*Tyrannus tyrannus*	Forest edge, open situations with scattered trees and shrubs, cultivated lands with bushes and fencerows, and parks; in winter more closely associated with forest clearings and borders.
Bird		IV	a	Eastern meadowlark	*Sturnella magna*	Grasslands, savanna, open fields, pastures, cultivated lands, sometimes marshes
Bird		IV	a	Eastern towhee	*Pipilo erythrophthalmus*	Inhabits forest and swamp edges, regenerating clearcuts, open-canopied forests, particularly those with a well-developed understory, reclaimed strip mines, mid-late successional fields, riparian thickets, overgrown fencerows, shrub/small-tree thickets, and other brushy habitats.
Bird		III	a	Eastern whip-poor-will	*Antrostomus vociferus*	Forest and open woodland, from lowland moist and deciduous forest to montane forest and pine-oak association
Bird		IV	b	Eastern wood-pewee	*Contopus virens*	Inhabits a wide variety of wooded upland and lowland habitats including deciduous, coniferous, or mixed forests
Bird		IV	a	Field sparrow	*Spizella pusilla*	Old fields, brushy hillsides, overgrown pastures, thorn scrub, deciduous forest edge, sparse second growth, fencerows
Bird		IV	a	Grasshopper sparrow	*Ammodramus savannarum*	Grassland obligate

Bird		IV	a	Gray catbird	*Dumetella carolinensis*	Thickets, dense brushy and shrubby areas, undergrowth of forest edge, hedgerows, and gardens, dense second growth
Bird		IV	b	Green heron	*Butorides virescens*	Swamps, mangroves, marshes, and margins of ponds, rivers, lakes, and lagoons
Bird		III	a	Kentucky warbler	*Geothlypis formosa*	Humid deciduous forest, dense second growth, swamps
Bird		IV	b	Northern Flicker	*Colaptes auratus*	Open forest, both deciduous and coniferous, open woodland, open situations with scattered trees and snags, riparian woodland, pine-oak association, parks.
Bird		IV	b	Wood thrush	*Hylocichla mustelina*	Deciduous or mixed forests with a dense tree canopy and a fairly well-developed deciduous understory, especially where moist
Bird		III	a	Yellow-billed cuckoo	*Coccyzus americanus*	Open woodland (especially where undergrowth is thick), parks, deciduous riparian woodland
Bird		IV	a	Yellow-breasted chat	*Icteria viren*	Second growth, shrubby old pastures, thickets, bushy areas, scrub, woodland undergrowth, and fence rows, including low wet places near streams, pond edges, or swamps; thickets with few tall trees; early successional stages of forest regeneration; commonly in sites close to human habitation.
Fish		IV	c	American brook lamprey	*Lampetra appendix*	Requires clear flowing water but can tolerate a range of temperatures and substrates
Fish		IV	a	American shad	*Alosa sapidissima*	Large unfragmented migratory rivers for spawning
Fish		I	a	Bridle shiner	*Notropis bifrenatus*	Slow clear water with aquatic vegetation
Fish		IV	c	Least brook lamprey	*Lampetra aepyptera*	Warm small streams with slow flows and sand/ silt substrates
Fish		IV	c	Mud sunfish	*Acantharchus pomotis*	Swamps, ponds, and slow moving water
FW Mollusk		IV	a	Alewife floater	*Anodonta implicata*	Alewife obligate - coastal streams and lakes with sand or gravel substrates
FW Mollusk	**FESE**	I	a	Dwarf wedgemussel	*Alasmidonta heterodon*	Clean warm streams and rivers with low to moderate current and unsilted substrates
Reptile		IV	a	Rainbow snake	*Farancia erytrogramma erytrogramma*	Riparian forest - eel obligate

** Federal Endangered (FE), State Endangered (SE), Federal Threatened (FT), State Threatened (ST), Federal Species of Concern (FS), Federal Candidate (FC), Federal Proposed (FP), and Species of Collection Concern (CC)

Conserved Lands in George Washington Planning Region

Recognizing the importance of the local habitats to resident and migratory wildlife, state, federal, and private entities have made significant investments to conserve lands within this planning region. Conservation mechanisms range from conservation easements to state parks, forests, and wildlife management areas to National Wildlife Refuges (NWR). Significant conservation assets, in terms of size, include:

- Rappahannock River Valley National Wildlife Refuge,
- Fredericksburg and Spotsylvania National Military Park,
- Lands End Wildlife Management Area,
- Mattaponi Wildlife Management Area,
- Pettigrew Wildlife Management Area,
- Lake Anna State Park,
- Widewater State Park,
- Prince William Forest Park,
- Crow's Nest Natural Area Preserve
- Chotank State Natural Area Preserve, and
- Caledon State Natural Area.

These properties contain a diversity of open water, forest, agricultural, and wetland habitats (Figure 4). They have been conserved to provide a range of conservation, recreational, and economic benefits such as habitat protection and restoration, ecotourism, and fishing and hunting opportunities. Additionally, various military installations, such as Marine Corps Base Quantico and Fort A.P. Hill, support viable habitats and wildlife populations.

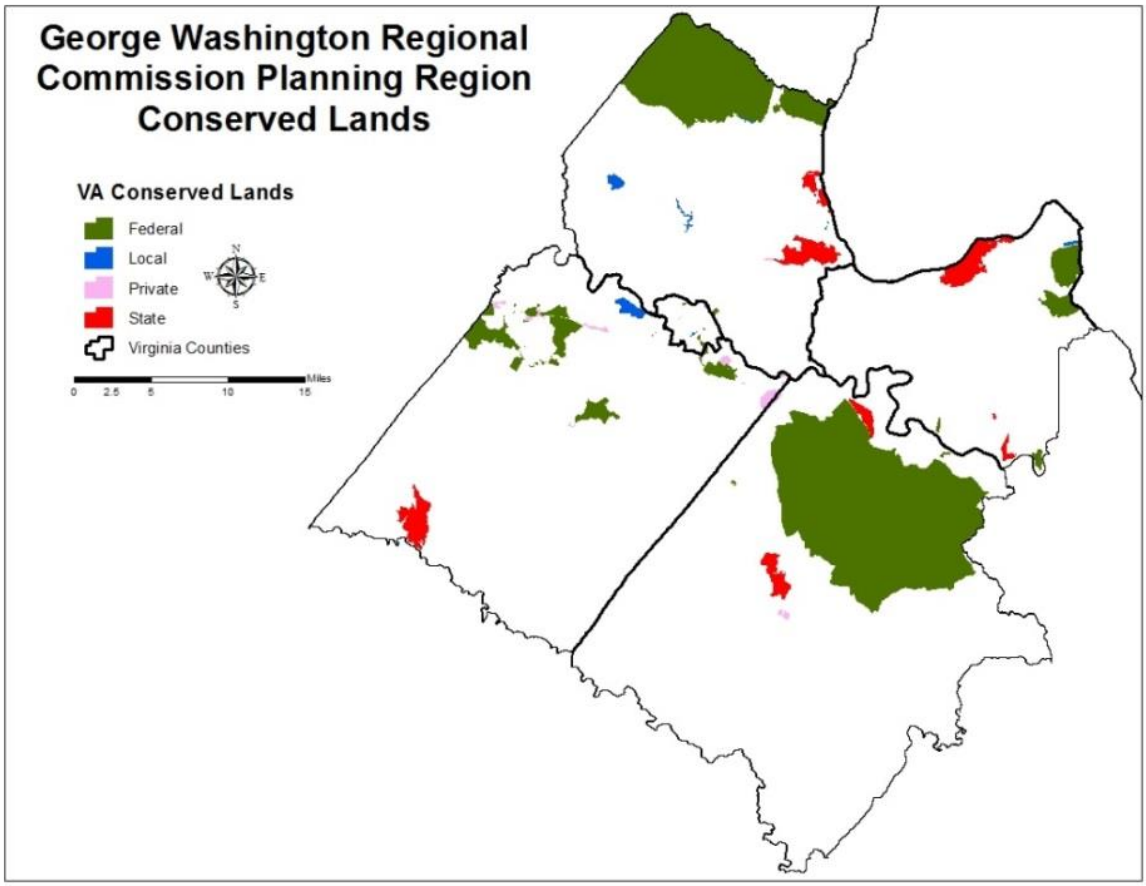

Figure 2. Conservation Lands in the George Washington Planning Region (DCR, Natural Heritage 2014).

These properties serve as an important component of wildlife conservation efforts on within George Washington Planning Region. Healthy and important habitats have been conserved within their boundaries; however, working to conserve other lands could be beneficial for many SGCN and habitats within the region. Additionally, although there may be concern over the economic and social impacts of putting lands into conservation, many of these areas provide recreation and ecotourism benefits (DCR 2013; Carver and Caudill 2013). Through these mechanisms local economies could be bolstered; however, insufficient data exist to fully describe the benefits and drawbacks specific to these lands held in conservation. To balance these interests, especially as conditions change, it will be critical for the conservation community to actively engage with local governments and stakeholders to ensure that conservation spending is beneficial for both wildlife and localities.

Climate Change Impacts in George Washington Planning Region

Changes in temperature and precipitation will likely negatively affect habitats and SCGN in the George Washington Planning Region Based on scientific reports and research, it is clear that temperatures in the state will get warmer. The National Climate Assessment (NCA) is a national climate assessment that provides state level information. The NCA indicates Virginia's average temperature could increase by as much as 7°F by 2100 (Melilo et al. 2014). Earlier models developed

for Virginia's 2008 Climate Action Plan project that average temperatures may increase by 3.1°C (5.6°F) by the end of the century in Virginia (Governor's Commission on Climate Change 2008).

Increased temperatures may lead to heat stress for species and decreased water quality and dissolved oxygen content as well as changes to food availability (Boicourt and Johnson 2011; Kane, 2013). Temperature increases may also be problematic for species at the edge of their ranges. For example, if species are at the more southern end of their range, they may not survive significant increases in temperature that are greater than they can withstand (Pyke et al. 2008). Warmer temperatures may also result in warmer waters, which could favor parasites and other pests in aquatic environments (Pyke et al. 2008; Najjar et al. 2010; Kane 2013). Additionally, if temperatures and precipitation change such that season length is altered, fish and other species reproductive cycles and other phenological processes may be affected. Ecological conditions may also be altered, including food supplies and sympatric animal behaviors (e.g., fish migrations and nest building).

Because George Washington Planning Region is located further inland and much of the area along the Potomac is protected, impacts from sea-level rise will likely be less intense than in other coastal regions of the state (VIMS, 2013). However, over time, it is possible areas along the Potomac will experience some effects from sea-level rise and storm surge from more intense storm events (VIMS, 2013). A report published by the Virginia Institute of Marine Science (VIMS) (2013) used climate scenarios from the Intergovernmental Panel on Climate Change to determine a range of sea-level rise projections for Virginia. Based on this analysis, a range of approximately 1.5 feet to over 7 feet of sea-level rise is projected in the state by 2100, and the report recommends considering a foot and a half of sea-level rise over the next 20 to 50 years for planning purposes (VIMS 2013). Tropical storm events are expected to become more intense (VIMS 2013; Staudinger et al. 2015). Sea-level rise and more intense storm events are likely to increase shoreline erosion, facilitate salt water intrusion, destroy habitats and ecological systems, and increase stormwater overflows and sewage contamination (VIMS 2013). VIMS also estimates that given these projections, George Washington Planning Region has approximately 5 miles of road that will likely be vulnerable to sea-level rise (in King George and Caroline counties) (VIMS 2013).

Conservation Threats and Actions for Wildlife in the George Washington Planning Region

The following sections on threats, conservation actions, and conservation priorities are subdivided based on habitat type. Key habitat conservation strategies, actions, threats, and other impacts are summarized in Table 3. In many cases, actions taken to protect or enhance habitat will positively affect many George Washington Planning Region priority SGCN and other species. Many of these activities are also expected to benefit landowners and communities.

Table 1. Summary of Conservation Strategies and Actions for George Washington Planning Region.

Conservation Strategies	Conservation Actions	Threats Addressed	Economic/ Human Benefits	Priority Areas
Maintain and restore wetland habitats	1) Work with appropriate entities on wetlands permitting process to ensure adequate mitigation and restoration procedures are in place; 2) Implement living shorelines where feasible; 3) Establish or enhance vegetative buffer areas inland of existing wetlands; 4) Utilize relevant data (e.g., Virginia Department of Conservation and Recreation's wetlands catalog) to identify priority areas for conservation, acquisition, and restoration; and 5) Control invasive species.	Water quality degradation, habitat/ land use conversion, climate change, non-native and exotic invasive species, predators	Flood control; filtration services; erosion and sediment control; supports recreational and commercial fisheries; ecotourism/ wildlife watching and fishing/ hunting opportunities	Watershed with priority wetlands and areas adjacent to priority watershed that allow inland migration of wetlands
Enhance, maintain, and restore aquatic and riparian habitats	1) Establish riparian vegetative buffers along waterways; 2) Reforest erodible cropland and pastures; 3) Establish waste storage facilities (such as dairy lagoons or waste sheds) to better manage animal waste and prevent flow into the river; 4) Establish retention ponds, impoundments, or other features to manage and slow storm water runoff from cropland, pastures, forests, and barren lands; 5) Implement projects to slow urban storm water flowing into steams such as vegetative buffers, reducing impervious surface, rain gardens, and low impact development techniques; 6) Repair or replace failing septic systems and pit privies; 7) Work to prevent pet and kennel waste from entering waterways; 8) Identify additional impaired waters within planning region; 9) Restore aquatic connections;10) Monitor and address invasive species impacts; and 11) Adopt land use practices or policies through zoning or other means to help improve the health of aquatic systems.	Sedimentation, contaminants loading, water chemistry alteration, stream nutrient dynamics alteration, land conversion/ alteration, invasive species, water withdrawals, climate change	Address TMDL concerns by reducing amounts of sediment, nutrients, pesticides, and other pollutants that enter water ways; Sustain sport fisheries and recreation opportunities; contribute to clean water supply	Deep Run, Fairview Beach, Plentiful Creek
Maintain and restore forest habitat	1) Protect land through acquisition, easement, incentives, or other mechanisms; 2) Implement vegetative buffers around extractive practices and development; 3) Work with state and federal agencies to ensure implementation of appropriate best management practices; 4) Maintain forest health to help ensure forest viability; and 5) Monitor and control invasive species.	Land use change and conversion, invasive species, climate change	Flood control; water quality; and ecotourism/ wildlife viewing/other outdoor recreation	Forest patches adjacent to already protected parcels

Maintain and restore open habitats	1) Restore native grasses, shrubs, and forbs; 2) Maintain existing open habitats with periodic disturbance (e.g., prescribed burning, mowing, disking, etc.); and 3) Conserve, via acquisition, easement, collaboration, or agreement, patches from 20 acres to 100 or more acres.	Land use changes, invasive species	Conservation of native pollinators; erosion control; sequestration of nutrients, pesticides, and other pollutants before they enter river systems	Areas supporting SGCN that are not already protected

Maintain and Restore Wetland Habitats

Tidal and non-tidal wetlands are found throughout the George Washington Planning Region. In addition to providing habitat for a diversity of aquatic and terrestrial species, wetlands help maintain water quality and quantity within a watershed, limit erosion caused by floods, and provide recreational opportunities for hunters, anglers, and wildlife watchers. Non-tidal marshes are the most common wetland type in this area, and they provide valuable habitats for SGCN such as the carpenter frog, mud sunfish, and a variety of other species (Table 4).

Table 4. Wetland Acreage in the George Washington Planning Region (Anderson et al. 2013).

Wetland Type	Acreage	Percent of Planning Region
Non-Tidal Wetland	70,720.88	7.72%
Tidal Wetland	7,419.90	0.81%

Threats

The health and quality of tidal and non-tidal wetlands are affected by a variety of issues, both natural and anthropogenic. As the quality of a wetland degrades, so does the value of that wetland to Virginia's wildlife.

1. Water Quality: Wetlands help filter nutrients and other pollutants from watersheds, but they are also sensitive to activities that impair water quality and overload the system (Hemond and Benoit 1986). When best management practices (BMP) are not implemented upstream, runoff laden with nutrients, sediment, and other pollutants enter the system in concentrations that hinder the wetland's filtering capacity. Storm water runoff from urban and developed areas also contributes to water quality issues that degrade wetlands (Hemond and Benoit 1986). Nutrient pollution and sedimentation are important issues for tidal and non-tidal wetlands throughout the planning region.

2. Land Use Changes: One of the most significant threats to tidal and non-tidal wetlands is conversion to other uses and hardening of shorelines that can harm wetland integrity and function. As more areas are developed for additional human uses, wetland areas will likely be lost.

3. Invasive Species: Invasive species often degrade the quality of tidal wetland habitat through damage or loss to wetland vegetation. Invasive plant species such as *Phragmites* can overtake wetlands, changing vegetative composition to a monoculture and diminishing wetland function and value. Examples of invasive species affecting non-tidal wetlands include: *Phragmites,* purple loosestrife, Japanese stilt grass, and exotic invertebrates.

4. Climate Change: As sea levels rise, marshes can be inundated and convert to shallow open water habitats. Shallow open water habitats and salt marshes likely will not support the same vegetative composition as the non-tidal and tidal wetlands in this planning region, affecting the wildlife species that depended on these habitats (CCSP 2009). Additionally, as storms become more intense, more frequent inundation may also pose problems for vegetation and fish and wildlife species (CCSP 2009).

Conservation Management Actions

A number of actions can be taken to address threats affecting wetlands in the George Washington Planning Region. To address development and fill impacts, the federal government and the Commonwealth of Virginia have established an extensive wetlands permitting process to help landowners and developers avoid impacts to wetlands while pursuing their management objectives. The Virginia Tidal Wetlands Act gives authority to the Virginia Marine Resource Commission (VMRC) to issue tidal wetland permits with the option to for local governments to assume this responsibility (DEQ 2011). The U.S. Army Corps of Engineers has authority to issue permits for impacts to non-tidal wetlands through the federal Clean Water Act, while DEQ has authority under Virginia's State Water Control Law. Permits are issued through a Joint Permit Application Process that can be initiated with DEQ (DEQ 2011). Mitigation to compensate for wetland loss is often required under these permits. However, wetlands restoration to reestablish or rebuild former wetland areas or restore functions to a degraded wetland also are voluntary conservation actions agencies and conservation partners can implement outside of required wetlands mitigation and are an important component to protecting wetlands (DEQ 2011). These types of conservation actions also help provide migration corridors for migratory birds that depend on wetlands for nesting, roosting, and foraging. Various programs implemented by the Natural Resources Conservation Service (NRCS) and other partners also provide guidance related to conserving wetlands, establishing oyster reefs, and implementing other actions.

In certain situations, living shorelines can be a viable alternative to hardened or armored shorelines. By using native vegetation, rock sills, bank grading, or other more natural methods, living shorelines can help protect private property from erosion while also providing opportunities for wetlands to migrate inland as conditions change (Kane 2011) (VIMS 2010). Establishing or protecting vegetative buffers upland of wetlands also is important to protect health of the existing wetlands as well as to provide a potential inland migration route as conditions change (Kane 2011). Protection of additional wetland areas through acquisition, easement, or agreement would allow for further conservation of this important habitat and associated SGCN. Finally, working to limit invasive plants and animals and predators that might degrade the quality of these habitats will be important conservation actions.

Priority areas for wetlands protection and restoration within the George Washington Planning Region include those wetlands that are inland of tidal wetlands that may provide some opportunity for inland migration as sea levels rise. These more inland areas also allow for large wetland complexes to be protected, ensuring larger habitat patches remain available for wildlife. Areas identified by conservation partners, such as the Virginia Department of Conservation and Recreation (DCR), as outstanding opportunities for conservation should also be considered priorities for protection and conservation. An initial review of the Virginia Wetlands Catalog identifies priority wetlands for conservation and restoration (Weber and Bulluck 2014). Designation of these areas was based on several factors, including existing plant and animal diversity, presence of significant natural communities, presence of natural lands providing ecosystem services, presence of corridors and stream buffers, proximity to conserved lands, inclusion within or downstream of healthy watersheds, and location of drinking water sources (Figure 5) (Weber and Bulluck 2014). DCR also designates potential restoration sites, identified based on similar factors as conservation areas, but also including consideration of inclusion within degraded watersheds, proximity to impaired waters, location of existing wetland mitigation banks, presence of prior converted and farmed wetlands, and inclusion of stream reaches with lower aquatic biodiversity (Figure 7) (Weber and Bulluck 2014). Some areas with high priority wetlands for conservation are adjacent to already protected areas such as in King George and Spotsylvania counties.

High priority restoration potential exists in King George and Caroline, and opportunities to restore wetlands adjacent to already conserved lands appear greatest in Stafford County.

Climate-Smart Management Actions

Additional wetlands climate-related conservation actions include: restoring and enhancing vegetation within the wetlands to support changing conditions (e.g., using vegetation species that can withstand a broader array of conditions like more frequent inundation), restoration of wetlands to increase their elevation along the coast where feasible or needed, and enhancement of wetland migration by targeted restoration or acquisition in areas where wetlands may migrate (both inland and upstream).

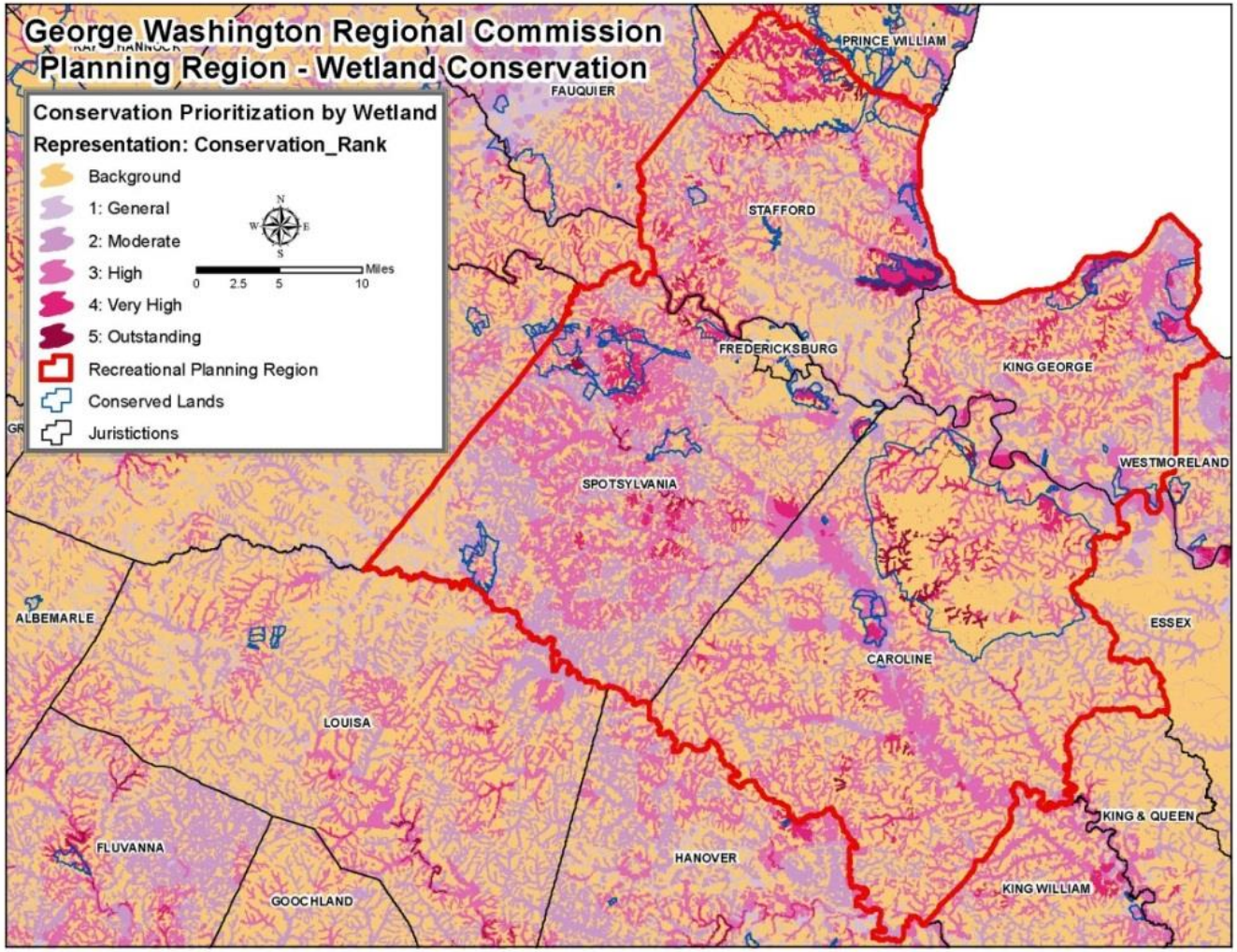

Figure 5. Wetland Conservation Priorities in George Washington Planning Region (Weber and Bulluck 2014).

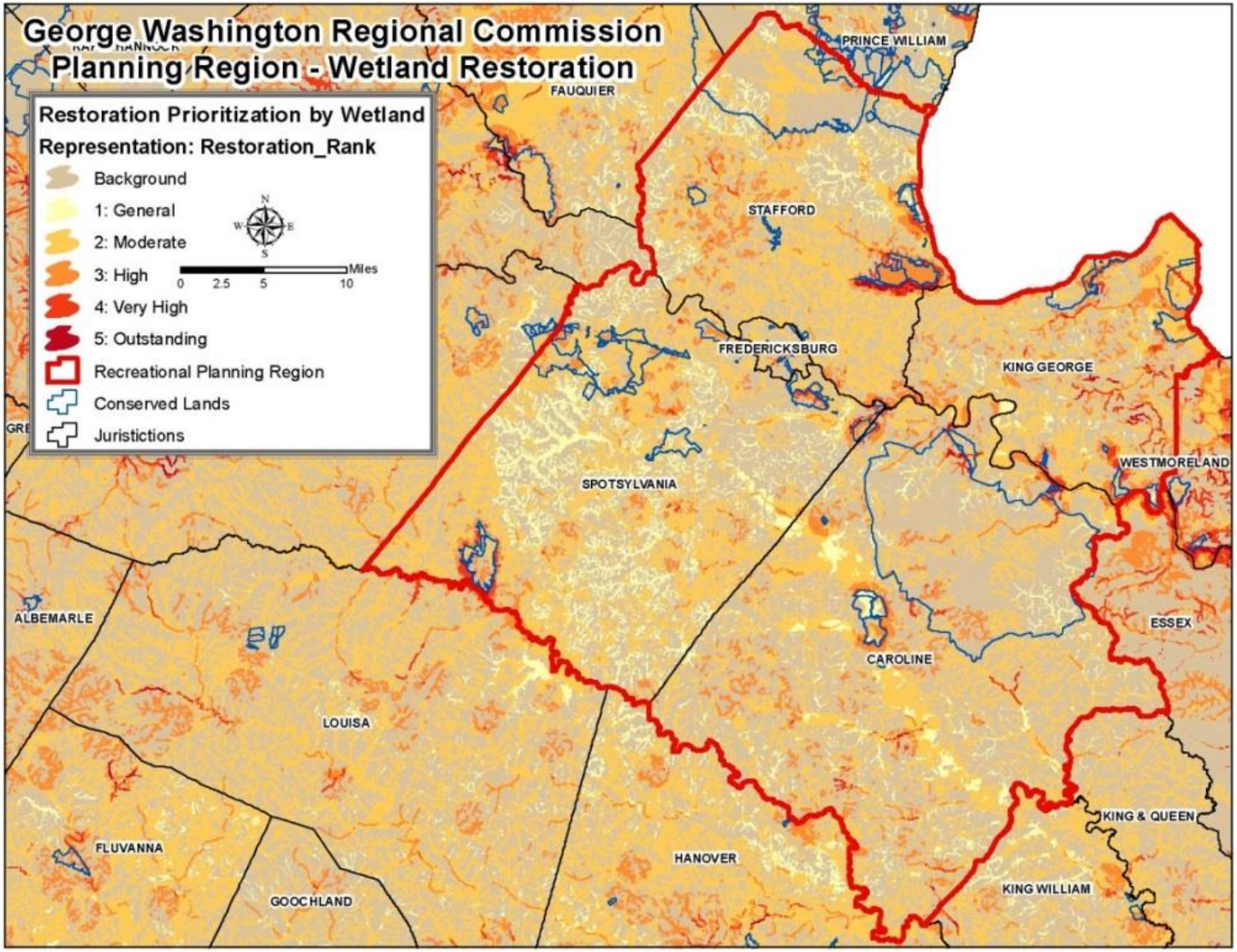

Figure 6. Wetland Restoration Priorities in George Washington Planning Region (Weber and Bulluck 2014).

Enhance, Maintain, and Restore Aquatic and Riparian Habitats

Aquatic systems in the George Washington Planning Region include tidal and non-tidal freshwater creeks and streams. The majority of the planning region falls within the Rappahannock River Watershed. Approximately 31,700 acres (3.5 percent) of the planning region is considered aquatic (Anderson et al. 2013). These systems provide important habitat for numerous species of wildlife, fish, and invertebrates. Priority SGCN that depend on these habitats include the dwarf wedgemussel, greater siren, eastern lesser siren, least brook lamprey, American brook lamprey, and a variety of other species.

Threats

Aquatic and riparian habitats within the George Washington Planning Region face multiple threats from water quality related issues to invasive species.

1. Water Quality Degradation: Pollution is the most significant threat to aquatic species and riparian habitats within the George Washington Planning Region. Polluting materials include fertilizers, eroded sediment, and human and animal waste flowing into the region's creeks and rivers from storm water runoff, failing septic systems, and agricultural practices that do not conform to standard best management practices (DEQ 2014). In many cases, watersheds have insufficient riparian buffers and vegetative areas to stop these materials from flowing into the creek or stream (ACJV 2005). Once present in aquatic systems, these materials may concentrate in sediment and bottom-dwelling organisms where they can result in reduced levels of dissolved oxygen and altered pH levels (Chesapeake Bay Foundation 2014). In addition to the impacts on aquatic life, many of these substances pose a risk to human health and local economies (Chesapeake Bay Foundation 2014).

2. Impervious Surface: Impervious surfaces (i.e., land covers that do not permit water to permeate the ground) give a useful measure of the environmental condition of an area (Figure 9). In a developed watershed there is often significant impervious surface cover; thus, a greater amount of surface water, often laden with pollutants, arrives into a stream at a faster rate than in less developed watersheds, increasing the likelihood of more frequent and severe flooding. Substantial amounts of impervious surface area can also lead to degradation of water quality, changes in hydrology, habitat structure, and aquatic biodiversity. Additionally, impervious surfaces often run along areas that directly interact with the stream or river through flooding, geomorphology, or material inputs. Much of the George Washington Planning Region has a low percentage of impervious surface cover; however, the larger population centers have a higher percentage of impervious surfaces (Figure 7).

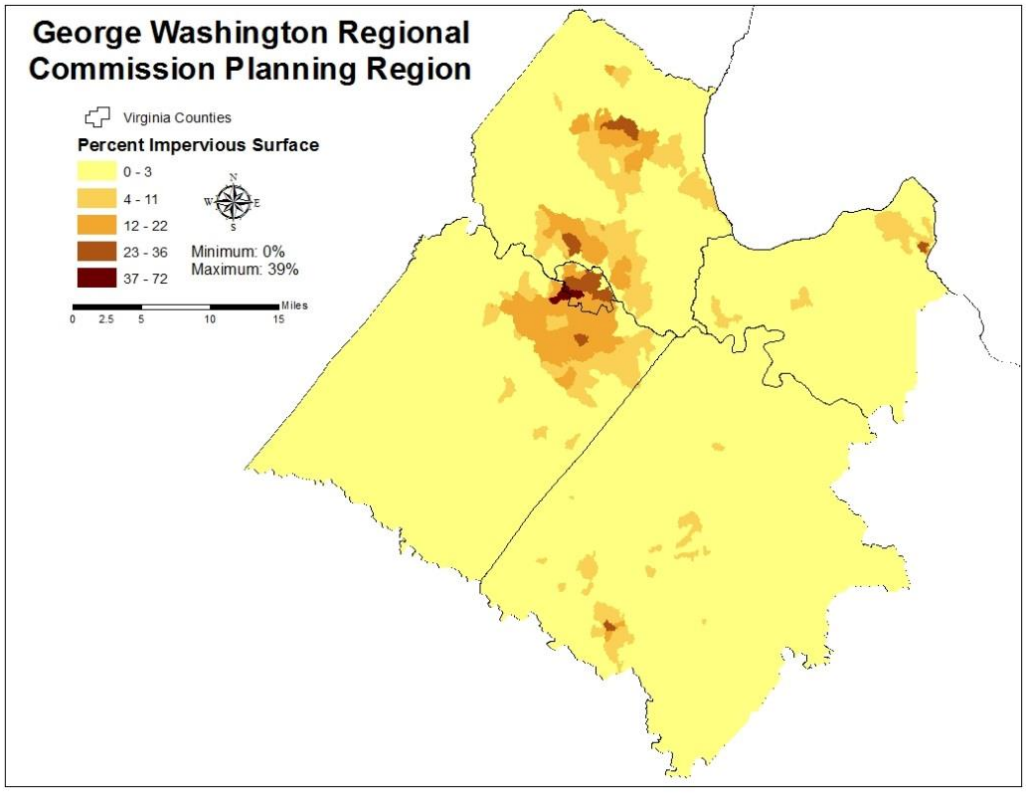

Figure 7. Impervious Surface Cover in George Washington Planning Region (SARP 2014).

3. Invasive Species: Additional threats to aquatic systems within George Washington Planning Region include invasive species such as blue catfish, snakeheads, Asian carp (e.g., big head carp and grass carp) that either consume native species or aquatic vegetation, altering the quality of these aquatic habitats.

4. Habitat Conversion and Alteration: Rivers are fragmented by dams, culverts, and other impediments that limit the connectivity of these aquatic habitats. This fragmentation can prevent aquatic species from accessing important aquatic habitats crucial to various life stages. Channelization, shoreline alteration, and extractive land use practices can alter aquatic habitats in terms of changes to hydrology, chemistry, and water temperature. These practices may also directly alter habitats through loss of vegetative riparian cover, filling of streams, or hardening of stream banks.

5. Water Withdrawals: Water withdrawals for human and land uses can also alter stream hydrology and cause stress to aquatic species that depend on specific water levels and flow rates. Additionally, over-use of groundwater could lead to saltwater intrusion into the aquifer that could degrade the quality of both subterranean and surface water.

6. Climate change: Climate change will also affect aquatic systems in this planning region. Changes in temperature and precipitation regimes could result in drier more drought prone summers. Water temperatures may also be affected, resulting in potential harm to fish and other aquatic species.

Conservation Management Actions

Water Quality Improvement Plans have been developed by the Virginia Department of Environmental Quality (DEQ) and various partners. Watersheds within the planning region that have Water Quality Improvement Plans include: Deep Run (Engineering Concepts 2006), Fairview Beach (ICPRB 2014), and Plentiful Creek (Blue Ridge Environmental Solutions, Inc. 2011) (Figure 8).

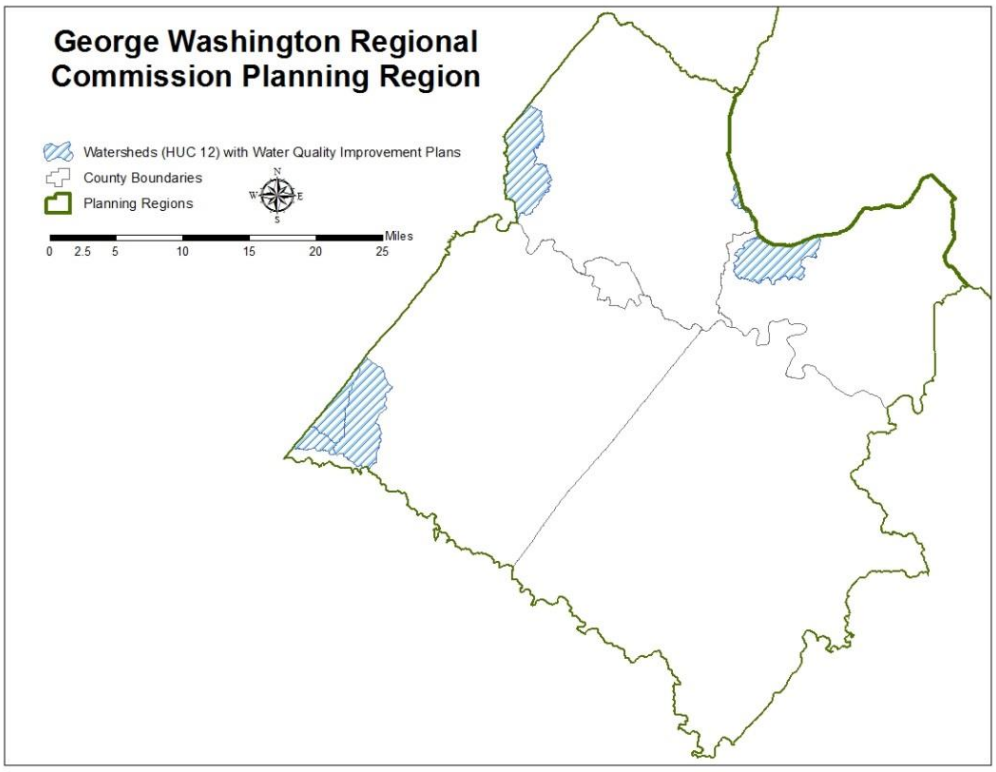

Figure 8. Watersheds with Water Quality Improvement Plans.

Each of these watersheds is designated as being impaired, and the primary actions needed to improve water quality within these watersheds include:

- Establishing riparian vegetative buffers along waterways;
- Reforesting erodible cropland and pastures;
- Establishing waste storage facilities (such as dairy lagoons or waste sheds) to better manage animal waste and prevent flow into the river;
- Establishing retention ponds, impoundments, or other features to manage and slow storm water runoff from cropland, pastures, forests, and barren lands;
- Implement projects to slow storm water flowing into steams such as vegetative buffers, reducing impervious surface, rain gardens, and low impact development techniques;
- Repairing or replacing failing septic systems and pit privies; and
- Working to prevent pet and kennel waste from entering waterways.

Members of Virginia's conservation community may consider working in other watersheds of local significance that may not have a Water Quality Improvement Plan. The Virginia Watershed Integrity

Model identifies high value watersheds within the planning region for conservation based on their proximity to headwater streams, drinking water source protection, and biological integrity indices (Ciminelli and Scrivani 2007). These areas provide a starting point for identifying additional areas to focus conservation efforts (Figure 9).

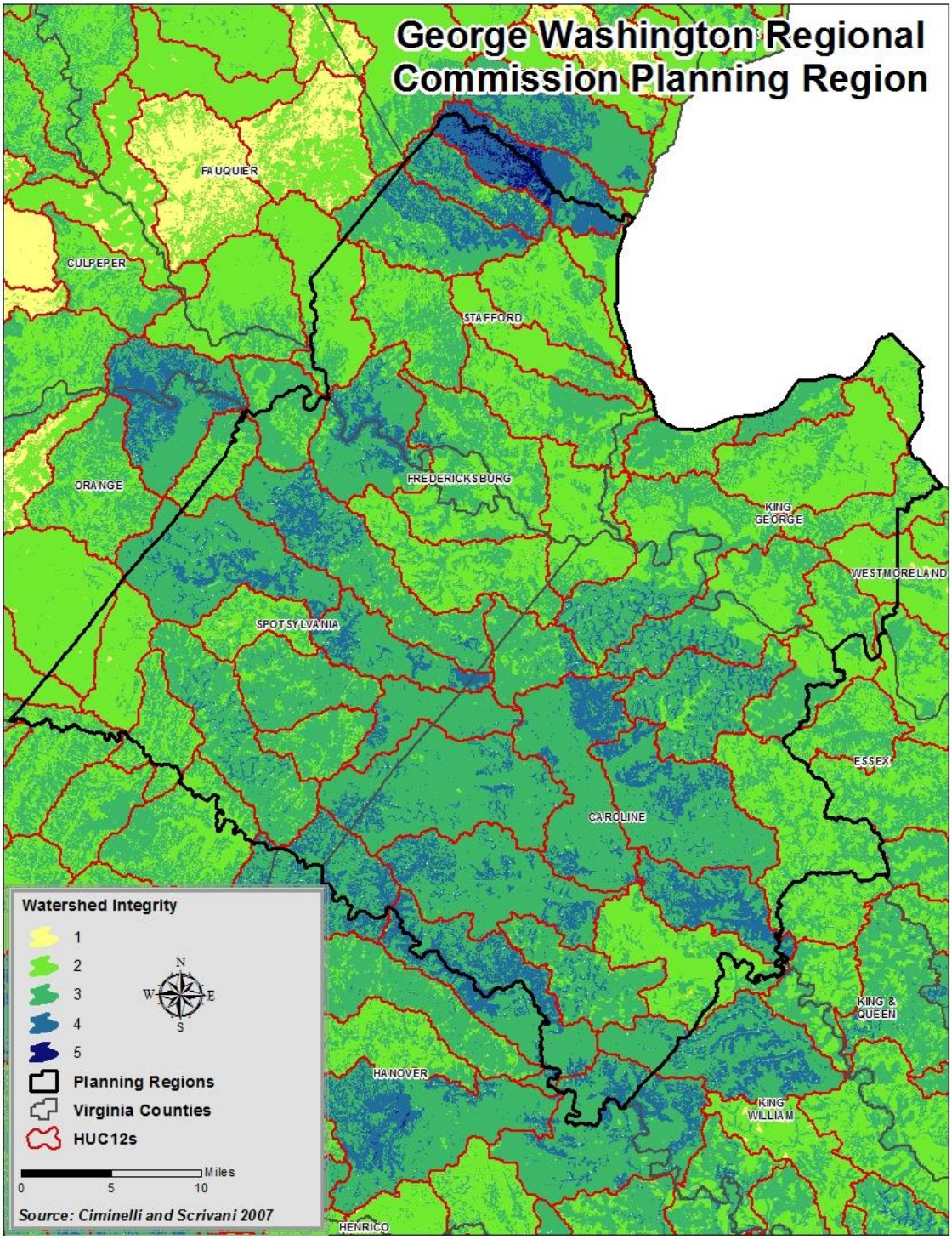

Figure 9. Watershed Integrity Model for George Washington Planning Region (Ciminelli and Scrivani 2007).

Several conservation actions common to most water quality and instream habitat enhancement plans can be implemented with little chance of ill consequence to wildlife or human communities downstream in these areas. Some of the most beneficial actions would include:

- Working with landowners to exclude livestock from streams;
- Restoring or enhancing vegetated riparian buffers;
- Reducing impervious surface by replacing with more porous materials or vegetation; and
- Working to enhance the health of upland forests and grassland habitats.

Additionally, many agencies help landowners in the George Washington Planning Region establish vegetative buffers along waterways flowing through their properties. The Virginia Department of Forestry (DOF), Virginia Department of Agriculture and Consumer Services (VDACS), and DCR have established BMPs for various land uses which, if implemented serve to minimize land use impacts upon adjacent and downstream waters. In addition, landowners are encouraged to work with DOF through the Forest Stewardship Program to utilize timber production BMPs, such as implementation of buffers and careful planning of roads and stream crossings, and agricultural producers are encouraged to work with VDACS and the local Soil and Water Conservation Districts to control erosion and limit runoff through the various available programs (DOF 2014; DCR 2014). NRCS provides landowners with other opportunities, including the Environmental Quality Incentives Program.

Stream restoration and connectivity projects (e.g., removing dams and culverts or modifying them to allow for passage) help improve and provide additional aquatic habitats for fish species within the state; however, there are many dams, and not all can or should be removed. Priority watersheds that would benefit from enhanced connectivity have been identified by the Chesapeake Bay Fish Prioritization Tool and the Southeast Aquatic Connectivity Assessment Tool (Figure 10) (Martin and Apse 2013).

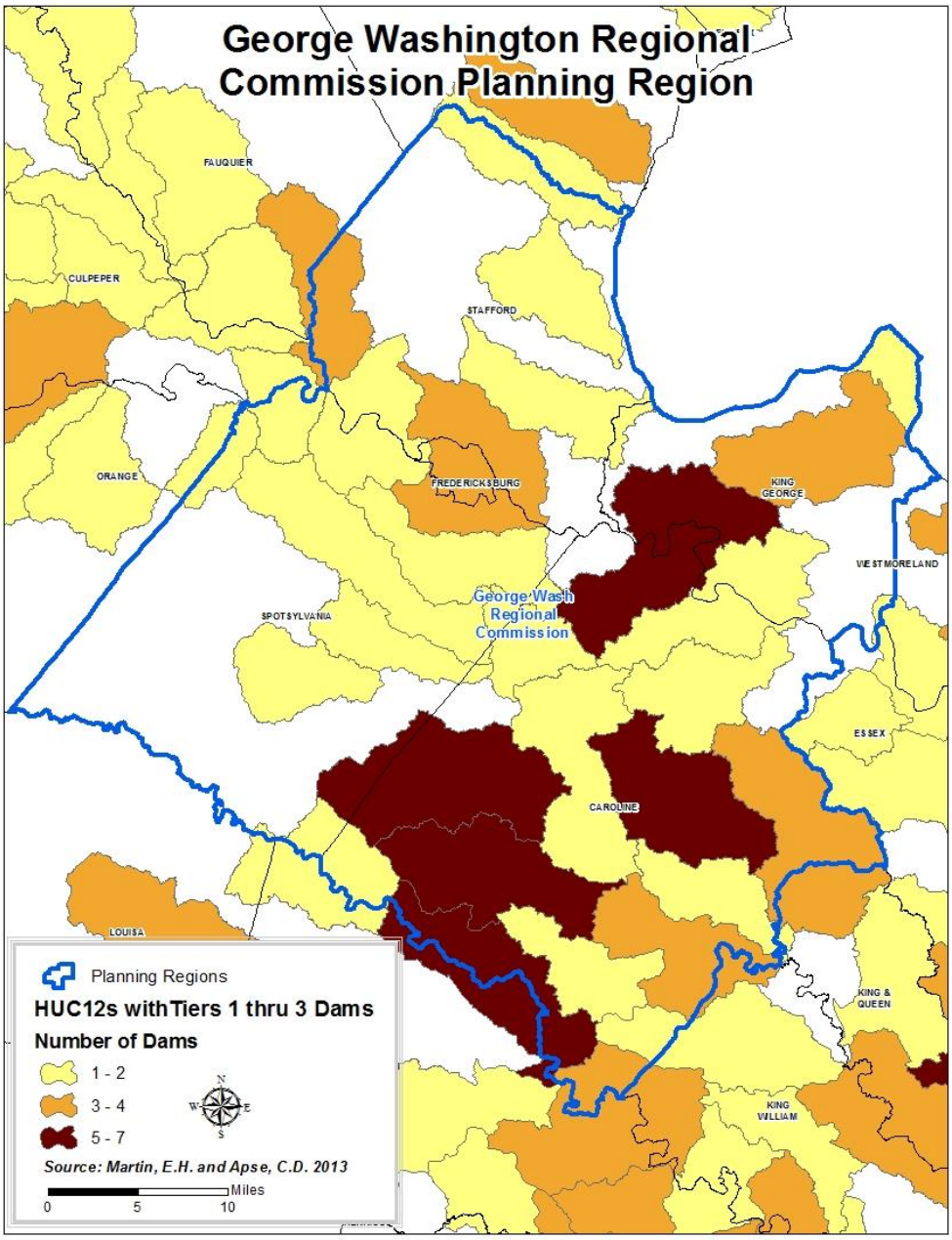

Figure 10. HUC12 Watersheds with Priority Dams for Removal/ Modification for Enhanced Connectivity (Martin and Apse 2013).

Additional actions to improve aquatic systems in the George Washington Planning Region include: restoring aquatic connections (i.e., removing culverts, dams, etc.), monitoring and addressing invasive species impacts, and working with the planning region to adopt land use practices or policies through zoning or other guidelines (e.g., impervious surface limits) to help improve the health of aquatic systems within and downstream of regions have significant impervious surface areas. Additionally, land acquisitions or easements that will help protect the land surrounding creeks should also be considered.

Climate-Smart Management Actions

When planting, restoring, or maintaining riparian buffers, managers should consider how conditions may change in the area and work with appropriate vegetation. For example, if stream flow is expected to become erratic due to increased precipitation or more frequent flooding as is projected to occur, native tree and shrub species that can tolerate flood conditions and inundation should be included in the selected plant species. Utilizing native species that may provide better erosion control (broader, deeper roots) than other species should be encouraged. Techniques and tools may be needed (e.g., fencing, biomats, etc.) to ensure success. Additionally, as stream temperatures will likely increase and hydrologic regimes may shift, it will be important to focus on maintaining and/ or improving stream connectivity to ensure aquatic organism can move to preferred habitats as these conditions change. Minimizing impervious surface will be even more important under climate change as increased storm intensity will likely result in increased levels of stormwater runoff. Improving stormwater control methods, to ensure they account for predicted changes in precipitation and flow, could help minimize the future impacts of storm water under climate change (Kane 2013).

Conserve and Manage Forest Habitat

Mixed hardwood and conifer forests make up over half of George Washington Planning Region (approximately 494,035 acres or 54 percent of the planning region) and are important for a broad range of species (Anderson et al. 2013). Within this forest type the majority of the trees are mature. Young forest habitat can be loosely defined as referring to areas dominated by woody seedlings and saplings (Oehler et al. 2006). Previously, young forests may have been referred to as an early successional habitat for eastern portions of North America. Lack of young forest habitat has detrimental effects on the wildlife species that depend on this forest stage for survival. Mixed hardwood and conifer forests help protect water resources within the region and provide habitats for a variety of priority SGCN species, including the common rainbow snake, Eastern whip-poor-will, Kentucky warbler, yellow-billed cuckoo, among others.

Threats

Forests within this planning region face a range of threats.

1. Land Use Changes and Conversion: The largest threat to mixed hardwood and conifer forests within George Washington Planning Region is fragmentation, which is mainly due to expanding development out of the Washington D.C. metropolitan area and resulting roads and infrastructure. In many cases, as with urban or commercial development, the losses can be complete and have profound impacts on local wildlife species composition, water quality, and outdoor recreational opportunities. In other situations, such as conversion to pine plantations, the mixed forest habitat is lost, but the newly planted forest can be managed for several years to provide open young forest habitats that support a diversity of landowner goals, wildlife species, and recreational opportunities. If established BMPs are followed, impacts to waterways and adjoining properties can be prevented or mitigated such as through implementation of vegetative buffer areas (see below).

2. Invasive Species: Invasive plant species, such as privet and Japanese stilt grass, and pests are also a significant problem in this region. Of particular note is the gypsy moth. Although more prevalent in the western portion of the state, it may still affect oaks and other species within these forests (DOF 2014).

3. Climate Change: More intense storm events, higher temperatures, and the potential for droughts may exacerbate existing stressors as well as damage intact forests and result in more forest fires and an increase in incidence of pests.

4. Overabundance of Deer: Virginia's Draft 2015-2024 Deer Management Plan indicates deer populations in Stafford and King George Counties need to be reduced in order to meet a variety of social and ecological goals (DGIF 2015). An overabundance of deer often hinders forest regeneration, impacts populations of sensitive native plants, and eliminates habitats for ground-nesting birds and other understory species. Deer overbrowse can facilitate colonization by invasive species such as privet or Japanese stilt grass. These invasive plants are not palatable to deer, easily colonize these disturbed habitats, and provide few habitat benefits to native wildlife. Urban and suburban environments compound the issue as they often limit hunting opportunities that might otherwise help control deer numbers.

Conservation Management Actions

Actions for conserving mixed hardwood and conifer forests in the George Washington Planning Region may include working to conserve, either through acquisition, easement, cooperative management, or incentives, intact forest patches capable of supporting a variety of Action Plan species. Land protection will help reduce conversion of forests to development. Additionally, working with landowners to ensure BMPs such as vegetative buffers are in place around agricultural operations or timber harvest areas will help prevent erosion and run off of sediments and nutrients into adjacent streams. Research demonstrates that vegetative riparian buffers can filter significant amounts of nutrient run off from timber operations and agricultural fields (DOF 2014). Some BMPs recommend a 50 foot buffer and allow some timber harvest within the buffers, while other BMPs encourage a 100 foot buffer with no harvest (DOF 2014; A. Ewing, Virginia Department of Game and Inland Fisheries, personal communication, 2015). BMPs also recommend building roads on areas with minimum slope and minimizing or avoiding stream crossings (DOF 2014). The *Upper York River Basin Watershed Implementation Plan* developed for DEQ specifically highlights reforesting areas around eroding crop lands and pastures within the Plentiful Creek watershed to help decrease sediment run off as well as provide wildlife habitat (Blue Ridge Environmental Solutions 2011).

Working to maintain forest health (balance age classes and diversity of tree species) is also integral to ensuring forest habitat is available to be conserved and protected. DOF makes several key recommendations that relate to habitat health, including but not limited to using species within their native ranges, if feasible using a mix of tree species to help minimize susceptibility to pests, preventing unnecessary site disturbance, and protecting unusual (rare) forest habitats (DOF 2014). In terms of invasive species and pests, monitoring and control will be important to prevent its spread. Some of these forest habitats should be managed with thinning and prescribed burns to minimize outbreaks while also improving quality of wildlife habitats (Brooks and Lusk 2008; DOF 2014).

In terms of addressing deer and their impacts to forested habitats, hunting is the most expedient and efficient means of controlling their populations. DGIF staff and partners feel there are sufficient numbers of hunters to affect a reduced population within this planning region. However, the efficiency of hunting is often limited by a lack of access to areas in need of herd reduction, such as portions of Stafford County. DGIF currently works with various public and private landowners, property managers, and public officials to facilitate hunting opportunities within the planning region. These efforts will continue. The control of deer numbers is also hindered by a lack of a practical and efficient means to assess deer impacts to local habitats across the state, making it difficult to prioritize areas in need of population control. This issue is discussed several times within Virginia's current Deer Management Plan and will be similarly addressed in the revised 2015-2024 Deer Management Plan (DGIF 2015). DGIF has initiated research to better understand deer impacts to local ecosystems.

Climate-Smart Management Actions

To best manage forests in the George Washington Planning Region as the climate changes, it will be imperative to understand how climate may affect potential future composition of forests in Virginia and how that may affect SCGN. Conservation and management efforts may need to focus on trees that can better withstand increased temperatures and drought, among other impacts. Managers may wish to consult the U.S. Forest Service's tree atlas when planning management and conservation of these forests. Additionally, harvest guidelines may need to be revised, depending on projections for future tree composition. Invasive species monitoring and prevention will also become even more important to include in forest management as climate change may favor some tree pests, diseases, and invasive species.

In terms of considering how to best manage for birds, mammals, and other species that depend on these forests, managers may want to try to provide refugia for SGCN as habitat is lost as well as establishing corridors both north/ south and east/west between protected areas to assist with species movements as conditions change (King and Finch 2013). Some SGCN will not be able to migrate without contiguous forests, so some species may still be lost, but implementing conservation management actions and developing corridors can help provide can them the best chance at continued existence. It will also be important to work to maintain species diversity and continue to reduce existing stressors that will likely exacerbate impacts from climate change (McKelvey et al. 2013).

Maintain and Restore Open Habitats

Open habitats represent an assortment of habitat types that are botanically characterized by grasses, forbs, and shrubs. Trees may be present, but they tend to be widely spaced and crowns do not form a canopy. DGIF biologists and partners have indicated several varieties of open habitats are important for Action Plan species. Open habitats are often comprised of post-agricultural lands, savannas, barrens, and glades and make up approximately 32,000 acres (2.3 percent) of the planning region (Anderson et al. 2013). These habitats are becoming rare in Virginia as agriculture and timber harvest practices change; however, they are important to a range of species that depend on these areas for nesting, feeding, and protection. Although a small portion of this planning region (less than three percent), these habitats are important for priority SGCN, including the tawny crescent and Persius duskywing butterfly.

Threats

Changing land use patterns has played a large role in the loss of open habitats as has alteration to natural disturbance regimes.

1. Land Use Changes: Dozens of open habitat species have been affected by changing land use and agricultural practices that resulted in either degraded or destroyed open habitats. The most serious threats to remaining open habitats within the planning region involve either development (where habitats are converted for human use) or natural succession (where trees are allowed to dominate and the site eventually becomes forest).

2. Invasive Species: Invasive species are also problematic, especially tree of heaven, Japanese stilt grass, garlic mustard, and privet. These species can out-compete native open habitat species and take over the landscape. Some species such as tree of heaven can change the landscape from an open habitat to a more closed habitat relatively quickly due to its ability to spread and colonize areas rapidly (VISWG 2012). Japanese stilt grass also grows quickly and in mats that can crowd out native grasses. It also alters soil pH inhibiting growth of other native plants (VISWG 2012).

Conservation Management Actions

Specific management practices could include the removal of non-native grasses, encouraging the growth of native warm-season grasses, shrubs and forbs, and periodic disturbance (e.g., burning, mowing, disking, etc.) to maintain the early successional communities and prevent the growth of forest trees (DGIF 2015b). Opportunities also exist with forest managers. Silviculture creates young forest conditions that can be managed to provide open habitat opportunities for the first 10 to 15 years after harvest (WMI 2014). Additional actions include working to protect open land patches at a minimum of 20 acres (Wolter et al. 2008). Focus also should be placed on protecting circular or square patches rather than rectangular areas to minimize edge effect (Wolter et al. 2008). The NRCS provides landowners with opportunities to improve or restore open habitats via programs like the Conservation Reserve Program and the Environmental Quality Incentive Program.

Climate-Smart Management Actions

Changes in temperature and precipitation regimes could negatively affect open lands as temperatures increase and summers become drier and more prone to drought. However, research demonstrates that many species that make up open habitats are already relatively drought tolerant, meaning that open lands may not be as affected by climate change as other habitats if they can maintain their diverse make up of vegetation species (Craine et al. 2013). It is important to note that if there is extended severe drought, open lands may succumb over time (Craine et al. 2013). To maintain diversity and help build resiliency in open lands within this planning region, it will be important to implement the management options above, especially focusing on removing non-natives and ensuring a diverse mix of vegetation species. Additionally, working to protect and preserve larger tracts of grasslands will help provide refugia for the species that depend on this habitat.

Effectiveness Measures Examples

As discussed within the Action Plan's Introduction (see Measuring the Effectiveness of Conservation Actions), it is increasingly important for the conservation community to demonstrate the effectiveness of conservation actions. Elected officials, budget authorities, private donors, and members of the public want to know that their investments in wildlife conservation are having the desired effects. During 2011, the Association of Fish and Wildlife Agencies developed and tested a series of effectiveness measures meant to support the Wildlife Action Plan implementation and the State Wildlife Grants program (AFWA 2011).

Virginia's 2015 Wildlife Action Plan describes a diversity of conservation actions that should help keep species from becoming endangered. The majority of these involve habitat protection, habitat restoration, controlling invasive species, or implementing efforts to keep pollutants from flowing into Virginia's waterways. Important data that can demonstrate the effectiveness of these conservation actions can include the following:

Conservation Action	Indicators of Effectiveness
Creation of Vegetative/ Forest Buffers along Streams or Wetlands	• Before/ after photos of project site; • Photos documenting changes as vegetation matures over multiple years; • Before/ after measurements of sedimentation immediately downstream of site; and • Changes in the number and diversity of species utilizing the site.
Installation of Living Shorelines	• Before/ after photos of project site; • Photos documenting changes as vegetation matures over multiple years; • Before/ after measurements of shoreline loss; and • Before/ after comparison of the number and diversity of species utilizing the site.
Control of Invasive Plants	• Before/ after photos of project site; • Photos documenting changes as restored vegetation matures over multiple years; and • Before/ after comparison of the number and diversity of species utilizing the site.
Remove Cattle from Streams	• Before/ after photos of project site; • Photos of alternative watering systems (if appropriate) • Photos documenting changes in shoreline as restored vegetation matures over multiple years; • Before/ after comparison of sediment and water chemistry immediately downstream of site; and • Before/ after comparison of the number and diversity of species utilizing the site.
Creating or Improving Open Habitats	• Before/after photos of project site; • Photos documenting changes to the site as the vegetation matures; and • Before/ after comparison of the number and diversity of species utilizing the site.

CONCLUSION

The development of the Virginia Wildlife Action Plan presented a unique opportunity for the Commonwealth—an opportunity not only to assess the condition and status of the state's wildlife and habitat resources, but to provide a shared vision and purpose in the management and conservation of this "common wealth." The true value of this initiative is this recognition of common interests and the enhancement of existing and fostering of new partnerships to address issues of mutual concern. The Action Plan's long-term success will depend on the implementation of the recommended actions by partners across the state and the effectiveness with which conservation partners collectively manage these natural resources.

This Local Action Plan Summary aims to prioritize species, habitats, and conservation actions within this planning region, so that partners working within this region can use limited resources to greatest effect. However, Virginia faces serious issues. Not addressing these problems would risk more species becoming threatened or endangered, the quality of our land and water would decline, and Virginians could lose important pieces of our natural heritage that contribute to our quality of life. However, there are significant conservation opportunities benefit wildlife and people in the planning region. Our problems are not insurmountable, and most can be addressed with proven conservation management techniques.

Working to maintain and protect existing high quality habitat will be a priority before restoration; however, restoration is still an important action and necessary in many cases. Within the George Washington Planning Region, priority conservation opportunities include:

- Protecting and restoring tidal and non-tidal wetlands; Improving the quality;
- Conserving water quantity in creeks and rivers through best management practices and implementing water quality improvement mechanisms; and
- Conserving tracts of mature hardwood forests and mature pine forest.

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APPENDIX A. COMPLETE LIST OF SPECIES OF GREATEST CONSERVATION NEED IN GEORGE WASHINGTON PLANNING REGION

Complete SGCN list for the George Washington Planning Region (SGCN=76). Table includes federal and state statuses, Wildlife Action Plan Tier, and Conservation Opportunity Rankings. Species are listed in alphabetical order by taxa.

Taxa	Conservation Status	Tier	Opportunity Ranking	Common Name	Scientific Name
Amphibian		III	a	Carpenter frog	*Lithobates virgatipes*
Amphibian		IV	a	Eastern mud salamander	*Pseudotriton montanus montanus*
Amphibian		IV	c	Eastern spadefoot	*Scaphiopus holbrookii*
Amphibian		IV	a	Greater siren	*Siren lacertina*
Amphibian		III	a	Lesser siren	*Siren intermedia intermedia*
Bird		II	a	American black duck	*Anas rubripes*
Bird		II	a	American woodcock	*Scolopax minor*
Bird		III	a	Brant	*Branta bernicla*
Bird		III	c	Bank swallow	*Riparia riparia*
Bird		III	a	Barn owl	*Tyto alba*
Bird		III	b	Belted kingfisher	*Megaceryle lcyon*
Bird	**SE**	I	a	Black rail	*Laterallus jamaicensis*
Bird		IV	a	Black-and-white warbler	*Mniotilta varia*
Bird		IV	a	Black-bellied plover	*Pluvialis squatarola*
Bird		III	a	Black-crowned night-heron	*Nycticorax nycticorax*
Bird		IV	a	Brown thrasher	*Toxostoma rufum*
Bird		IV	b	Canada warbler	*Wilsonia canadensis*
Bird		IV	b	Chimney swift	*Chaetura pelagica*
Bird		II	a	Common tern	*Sterna hirundo*
Bird		IV	a	Dunlin	*Calidris alpina hudsonia*
Bird		IV	a	Eastern kingbird	*Tyrannus tyrannus*
Bird		IV	a	Eastern meadowlark	*Sturnella magna*
Bird		IV	a	Eastern towhee	*Pipilo erythrophthalmus*
Bird		III	a	Eastern Whip-poor-will	*Caprimulgus vociferus*
Bird		IV	b	Eastern wood-pewee	*Contopus virens*
Bird		IV	a	Field sparrow	*Spizella pusilla*
Bird		III	a	Forster's tern	*Sterna forsteri*
Bird		I	a	Glossy ibis	*Plegadis falcinellus*
Bird		IV	a	Grasshopper sparrow	*Ammodramus savannarum*
Bird		IV	a	Gray catbird	*Dumetella carolinensis*

Bird		IV	a	Greater scaup	*Aythya marila*
Bird		IV	b	Green heron	*Butorides virescens*
Bird		III	a	Kentucky warbler	*Oporornis formosus*
Bird		III	a	Northern bobwhite	*Colinus virginianus*
Bird		III	a	Northern harrier	*Circus cyaneus*
Bird		IV	c	Northern rough-winged swallow	*Stelgidopteryx serripennis*
Bird		IV	b	Rusty blackbird	*Euphagus carolinus*
Bird		IV	a	Short-billed dowitcher	*Limnodromus griseus*
Bird		IV	b	Wood thrush	*Hylocichla mustelina*
Bird		III	a	Yellow-billed cuckoo	*Coccyzus americanus*
Bird		IV	a	Yellow-breasted chat	*Icteria virens*
Fish		IV	a	Alewife	*Alosa pseudoharengus*
Fish		IV	c	American brook lamprey	*Lampetra appendix*
Fish		III	a	American eel	*Anguilla rostrata*
Fish		IV	a	American shad	*Alosa sapidissima*
Fish		I	a	Bridle shiner	*Notropis bifrenatus*
Fish		IV	c	Least brook lamprey	*Lampetra aepyptera*
Fish		IV	c	Mud sunfish	*Acantharchus pomotis*
FW Mollusk		IV	a	Alewife floater	*Anodonta implicata*
FW Mollusk		IV	c	Atlantic spike	*Elliptio producta*
FW Mollusk	**SE**	I	a	Brook floater	*Alasmidonta varicosa*
FW Mollusk		IV	c	Carolina lance mussel	*Elliptio angustata*
FW Mollusk		IV	a	Carolina slabshell mussel	*Elliptio congaraea*
FW Mollusk		IV	a	Creeper	*Strophitus undulatus*
FW Mollusk	**FESE**	I	a	Dwarf wedgemussel	*Alasmidonta heterodon*
FW Mollusk		IV	a	Eastern pondmussel	*Ligumia nasuta*
FW Mollusk		IV	c	Gravel elimia	*Elimia catenaria*
FW Mollusk	**ST**	II	a	Green Floater	*Lasmigona subviridis*
FW Mollusk		IV	b	Northern lance mussel	*Elliptio fisheriana*
FW Mollusk	**FS**	II	b	Roanoke slabshell	*Elliptio roanokensis*
FW Mollusk		IV	a	Tidewater mucket	*Leptodea ochracea*
FW Mollusk		IV	a	Triangle floater	*Alasmidonta undulata*
FW Mollusk		II	a	Yellow lampmussel	*Lampsilis cariosa*
FW Mollusk	**FS**	II	a	Yellow lance	*Elliptio lanceolata*

Insect	**FS**	I	c	Regal fritillary	*Speyeria idalia idalia*
Mammal	**SE**	I	a	Rafinesque's eastern big-eared bat	*Corynorhinus rafinesquii macrotis*
Reptile		IV	a	Common ribbonsnake	*Thamnophis sauritus sauritus*
Reptile		III	a	Eastern box turtle	*Terrapene carolina carolina*
Reptile		IV	c	Eastern hog-nosed snake	*Heterodon platirhinos*
Reptile		IV	a	Eastern slender glass lizard	*Ophisaurus attenuatus longicaudus*
Reptile	**CC**	II	a	Northern diamondback terrapin	*Malaclemys terrapin terrapin*
Reptile		IV	a	Queen snake	*Regina septemvittata*
Reptile		IV	a	Rainbow snake	*Farancia erytrogramma erytrogramma*
Reptile		IV	a	Scarletsnake	*Cemophora coccinea copei*
Reptile	**CC**	III	a	Spotted turtle	*Clemmys guttata*
Reptile	**CC**	IV	a	Timber rattlesnake	*Crotalus horridus (timber)*

APPENDIX B. SGCN SPATIAL ANALYSIS METHODS

Analysis Units

The species data was analyzed within three spatial units for Virginia: county, planning region, and hydrologic unit (HUC12). The source spatial data for these units were provided by Virginia Department of Game and Inland Fisheries (DGIF). The analysis extent was constrained to that of the Virginia counties, so that portions of the planning region and HUC12 units falling outside of the county boundaries were eliminated from the analysis. Each of the 21 planning region units was assigned an alphabetic code (e.g. Accomack-Northampton = "ACNO"). Nottoway County does not fall within the jurisdiction of any Virginia planning region and was not included in any of our analyses.

Species Data

The source data for the species analysis consisted of three datasets, all of which were provided by DGIF: aquatic tier I-II plus species, terrestrial potential and confirmed species, and peer-reviewed HUC12 species. Within these datasets, individual species are identified by Biota of Virginia (BOVA) code.

Methods

Aquatic Species

The aquatic species are represented in the source dataset by linear stream segments, or reaches. For each BOVA code present, the total length was calculated for all assigned reaches within the analysis extent. The dataset was then divided by the three analysis units, and the total BOVA length was summarized again by county, planning region, and HUC12. The BOVA percent of total length was calculated by dividing the species length for the analysis unit by the total species length.

Terrestrial Species

The terrestrial species are represented in the source dataset by area. For each BOVA code present, the total area was calculated within the analysis extent. The dataset was then divided by the three analysis units, and the total BOVA area was summarized again by county, planning region, and HUC12. The BOVA percent of total area was calculated by dividing the species area for the analysis unit by the total species area in Virginia.

Peer-Reviewed HUC12 Species

The peer-reviewed species are represented in the source dataset by 6th order hydrologic units. For each BOVA code present, the total area was calculated within the analysis extent. The dataset was then divided by the county and planning region analysis units, and the total BOVA area was summarized by county, planning region, and HUC12. The BOVA percent of total area was calculated by dividing the species area for the analysis unit by the total species area.

Priority SGCN

For each planning region, priority species were identified as those SGCNs with a total planning region unit area or length ≥ 10% of the total SGCN area or length for Virginia. SGCN unit calculations were drawn from only one of the source datasets: if an SGCN was present in both the aquatic dataset and the HUC12 dataset, then the aquatic dataset took preference; and if an SGCN was present in the terrestrial dataset and the HUC12 dataset, then the terrestrial dataset took preference.