2. Approach and Methods

Virginia's revised Action Plan utilizes a habitat approach to address threats and conservation actions for the state's fish and wildlife resources. This approach helps to ensure that conservation actions benefit a diversity of species within the Commonwealth. A habitat approach also allows for more species to be addressed by any single conservation action and for the more efficient use of limited resources. Additionally, this Action Plan is designed to facilitate implementation at a scale where conservation most often occurs – the local level. The novel approach of including Local Action Plan Summaries provides users the opportunity to "put themselves into the Plan" and understand what specific actions are needed to conserve species and habitats near where they live and work.

Throughout the process, DGIF administrators and the Action Plan's authors worked with the understanding that an effective Action Plan could only be created with input and guidance from DGIF staff, sister agencies, partner organizations, and the public. When creating the first Action Plan, DGIF established multiple teams and panels to build various portions of the Plan. While that process was effective, current circumstances and personnel limitations prevented the use of a similar process in developing a new Action Plan. Instead, the Action Plan's authors compiled draft materials for every aspect of the Action Plan and then reviewed those materials with staff and conservation partners to determine how those materials could be improved and refined. For some issues, this process required several iterations, but it did not require partners and staff to commit the same level of time and energy as the previous model. Draft materials created with partner input were then made available for public review and comment. Specifics of this process are detailed in the following sections.

Species of Greatest Conservation Need List Revision

Congress mandates that each Action Plan identify, "the distribution and abundance of species of wildlife, including low and declining populations as each State fish and wildlife agency deems appropriate that are indicative of the diversity and health of wildlife of the state" (USFWS 2006). These species are commonly referred to as Species of Greatest Conservation Need (SGCN). Within Virginia's original Wildlife Action Plan (2005), DGIF and partners identified 925 SGCN that represented 11 broad taxonomic groups. Because the updated Action Plan's SGCN list is based off the original list developed for the 2005 Wildlife Action Plan, it is important to understand how that list was created prior to describing the changes.

For the 2005 SGCN list, all animal species that use any terrestrial and/or freshwater habitats in the Commonwealth were considered for selection. This potential list included anadromous and catadromous fish, invertebrates, migrants, and all breeding or wintering species. To determine which species would actually be selected as SGCN, a matrix was developed that included all wildlife species in Virginia and their ranks on various lists of conservation concern. Species were divided into major taxonomic groups, and within each taxonomic group all SGCN were assigned a Tier ranking (1 to 4), based on rarity and imperilment.

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

Tier II. Very High Conservation Need. Has a high risk of extinction or extirpation. Populations of these species are at very low levels, face real threat(s), 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, 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.

These four tiers became a starting point for review by the Taxonomic Advisory Committees (TACs). These standing committees, arranged by taxonomic group, were maintained by DGIF at the time of the 2005 Action Plan. The TACs were established to provide input on taxonomy, conservation, and other species issues. The TACs included Bird, Fish, Herpetofauna, Mammal, Mussel, and Invertebrate, the last of which included all non-mussel aquatic and terrestrial invertebrates. The final list was reviewed and modified as necessary by the TACs and then submitted to the internal and external steering committees for the 2005 Action Plan for approval as the final SGCN list.

While the original Tier system was sufficient to meet Congressional requirements, it proved to be insufficient to help DGIF and partners set and implement actionable conservation priorities. Threatened and endangered species often require many more resources and time with a smaller chance of recovery within a state than species that are less imperiled (AFWA 2012). To address this issue, the Association of Fish and Wildlife Agencies recommended adopting a triage approach, where costs, benefits, and likelihood of the conservation action being successful are considered together (AFWA 2012). Virginia's updated Action Plan builds upon the Tier ranking process from the original Plan by incorporating a Conservation Opportunity Ranking to document management needs and opportunities for each species.

Conservation Opportunity Ranking

In addition to a Tier ranking (see above), all SGCN are assigned a Conservation Opportunity Ranking (A, B, or C) in the updated Action Plan. These rankings are defined 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.

Draft rankings were created based upon the 2005 Action Plan as well as any new information garnered through research and literature review to determine if more recent actions or plans have been developed for each of the SGCN. Draft materials were then provided to biologists and academic researchers knowledgeable of Virginia's species. This process enhances the original Tier system, and the increased number of categories allows the conservation community to better prioritize based upon actions that can be taken to address species' needs.

SGCN Review

In addition to modifying the species prioritization system, DGIF staff also reviewed and updated the SGCN list. To facilitate this review, the authors first reorganized the SGCN based on species type (mammals, birds, etc.) in an Excel spreadsheet. Each spreadsheet entry included: common name, scientific name, the 2005 Tier, and the draft Conservation Opportunity Ranking. The authors also included any relevant actions taken from the 2005 Action Plan, applicable research findings, and research needs identified either within the original Action Plan or from other sources. This effort resulted in a draft SGCN list and prioritization that was used to assist agency and stakeholder review. A comment section also was included for each species.

This Excel spreadsheet was provided to applicable DGIF staff and partners for review. Recipients were encouraged to share these draft materials with anyone they felt appropriate. Recipients of the draft materials were asked to review the species and consider whether the Tier and/or Conservation Opportunity Ranking should be modified based on their knowledge and expertise of the each species' biology and ecology. They were also asked to consider if any species should be removed from the SGCN list or added to the list based upon new information, changing circumstances, or management understanding. All proposed changes were accompanied by a justification based on a template designed by DGIF. Each justification required the following information:

- Complete contact information for the individual or official contact person for the agency or organization submitting the request.
- Common name and scientific name for the species in question.
- One sentence clearly indicating the change that is being proposed (e.g., Add ____ to the list of SGCN as a tier __ species, Remove _____ from the list of SGCN, or adjust the Tier ranking for (species) from Tier __ to Tier __.).
- A (maximum) two-page description indicating why the recommended change is being proposed. This should include reference to the tier/category definitions and justification for change should be in terms of population and/or habitat trends affecting the species in question. Additionally, the justification for a proposed change needs to:
    - Identify issues driving the population and/or habitat trends;
    - Quantify how those trends affect the perceived level of imperilment for that species in Virginia; and
    - Identify conservation actions that can be taken to address the issues impacting the species in question and/or its habitats.
- Relevant citations and copies of executive summaries (maximum of two pages) for peer-reviewed resources.

Once all input was received from DGIF staff and partners, the comments were taken into consideration. The SGCN list was revised based on all partner and public input (See Stakeholder and Public Participation).

HABITAT FOCUS

Throughout Virginia's original Wildlife Action Plan, habitat loss and degradation were identified as the most critical issues hindering SGCN conservation (DGIF 2005). Over the last decade, water quality degradation, habitat fragmentation, and habitat loss have become more acute and widespread. In 2013, DGIF conducted a review of game, fisheries, and diversity programs. This review recognized that a significant amount of game and nongame species are increasingly affected by the loss of, access to, or degradation of their habitats. Responding to these findings, DGIF administrators agreed it was necessary to focus more efforts on habitat conservation and habitat restoration (DGIF 2013). The updated Action Plan works to achieve this goal. By focusing on habitats and the suite of species that depend on each of them, more SGCN will benefit from individual conservation actions. Furthermore, focusing on habitats will enhance opportunities to work with a variety of partners within Virginia's conservation community.

A number of tools developed or identified by DGIF staff and partners have informed the habitat approach designed for the Action Plan. These resources assisted in defining habitats, describing the status of those habitats, as well as identifying threats and conservation priorities for habitats within the Action Plan. The primary materials include:

Northeast Terrestrial and Aquatic Habitat Maps and the Habitat Classification Guide (Anderson et al. 2013) – This classification system was designed by staff of The Nature Conservancy (TNC) and provides a map of aquatic and terrestrial ecological systems for the 13 states represented by the Northeastern Association of Fish and Wildlife Agencies. This system is hierarchical and identifies 121 ecological systems within the Northeast region which are organized into 35 macrogroups (Anderson et al. 2013). A significant portion of the Action Plan update involved reviewing TNC's data and compiling that information in ways that facilitate land management and habitat conservation. In addition to distribution, TNC's data describes how much of each habitat has been conserved by acquisition or easement, patch size, age class distribution, predicted loss due to development, and degree of connectedness among the individual habitat patches. This mapping system and its corresponding classification guide were used to develop regional habitat maps for the Local Action Plan Summaries (described below) and to help define the habitat groups used within this Action Plan. The 61 ecological systems present in Virginia were reorganized into approximately 8 habitat groups (e.g., wetland, mixed hardwood/ conifer forest, open habitat, etc.) that align with the Commonwealth's resource management efforts.

Virginia Water Quality Improvement Plans (DEQ 2014) – Virginia's Department of Environmental Quality (DEQ) monitors water quality throughout the Commonwealth. When water quality problems are identified, watersheds are designated as impaired based upon the load of a variety of physical and chemical factors (e.g., nitrogen, phosphorus, fecal coliform, etc.). Many of the impaired watersheds require a metric known as a Total Maximum Daily Load (TMDL). A TMDL designates a maximum acceptable load of the chemical and physical inputs that a watershed can accommodate without posing a risk to human health or other resources. When a TMDL has been established for a watershed, DEQ staff, in collaboration with communities, partners, and private individuals, work to create a Water Quality Improvement Plan that identifies the types of impairments impacting a watershed, the sources of those impairments, and what actions can be taken to address those impairments. Many of the water

quality issues discussed within the TMDL designations and subsequent plans are consistent with threats and conservation actions identified within Virginia's first Wildlife Action Plan and modern discussions with conservation partners. Commonly prescribed conservation actions in the Water Quality Improvement Plans include restoring riparian buffers, working to exclude cattle from streams, reducing nutrient-laden runoff, revegetating upland sites, and reducing erosion. In addition to improving water quality, these actions also benefit a great diversity of aquatic and terrestrial SGCN. Absent other priorities, the updated Wildlife Action Plan treats watersheds with Water Quality Improvement Plans as priority areas for aquatic and riparian habitat restoration efforts.

Virginia Watershed Integrity Model (Ciminelli and Scrivani 2007) – In 2007, the Virginia Department of Conservation and Recreation's Division of Natural Heritage, the Virginia Department of Forestry, the Virginia Commonwealth University Center for Environmental Studies, and the Virginia Coastal Zone Management Program developed the *Virginia Watershed Integrity Model* to identify land-based areas that should be conserved to help improve or maintain water quality. Water quality is greatly influenced by adjacent land use, and this model's inputs focus on terrestrial factors that influence water resources and watershed integrity. These inputs include information related to headwater streams, drinking water sources, ecological core information, stream/ river/ floodplain data, and indices of biological integrity. The model compiles this information to rank watersheds across the state in terms of their integrity value. The model outputs are meant to help target conservation efforts, prioritize or provide justification for acquisition and protection, assist with local planning, help with project assessments, be used by land managers, and provide an education resource. The watershed integrity model is used within this Action Plan to identify high quality watersheds that may be conservation priorities within individual planning regions. It is important to note that this model is currently being updated, and new material should be available during 2016. The maps found within this Action Plan were created from the 2007 data. As new maps become available, they will be included in the Action Plan's online version.

Virginia Wetlands Catalog (Weber and Bulluck 2014) – In 2014, staff with Virginia Department of Conservation and Recreation's Natural Heritage Program completed an inventory of wetlands and potential wetlands within the Commonwealth. This inventory is known as the Virginia Wetlands Catalog and was developed to identify and prioritize wetlands based upon their habitat value and ecological function. These data are used to identify high quality wetlands that are considered a priority for conservation as well as degraded wetlands that could be improved or restored with conservation actions. The conservation and restoration priorities identified in this catalog informed development of wetland specific conservation priorities in the Local Action Plan Summaries.

SGCN Watershed Distribution Maps – Within Virginia's original Action Plan, authors provided distribution maps for the most critically imperiled SGCN. These maps include buffered point locations where individual animals had been documented as well as areas designated as potential habitat. While these maps were informative, they were limited in their ability to inform multi-species conservation actions. In 2009, DGIF staff developed new distribution maps for each SGCN identified within the original Action Plan whose distribution was known. These new maps were based on fine scale watersheds referred to as HUC12 watersheds (Weary and Doctor 2014). Virginia's HUC12 watersheds range in size from approximately 15 square miles to 70 square miles. Each of Virginia's counties typically encompasses 10 to 15 HUC12 watersheds. HUC12 maps were created for approximately 500 of the original 925 SGCN. The majority of these were vertebrates, freshwater mollusks, and crayfish. By mapping SGCN distributions within HUC12 watersheds, the updated Action Plan is able to identify areas that support multiple SGCN (Figure 2.1). Likewise, HUC12 maps are at a fine enough scale to identify priority areas within a county or planning region, but at the same time are coarse enough to hinder

illegal collections or be perceived as a threat to private landowners. SGCN distribution maps are provided in each Local Action Plan Summary.

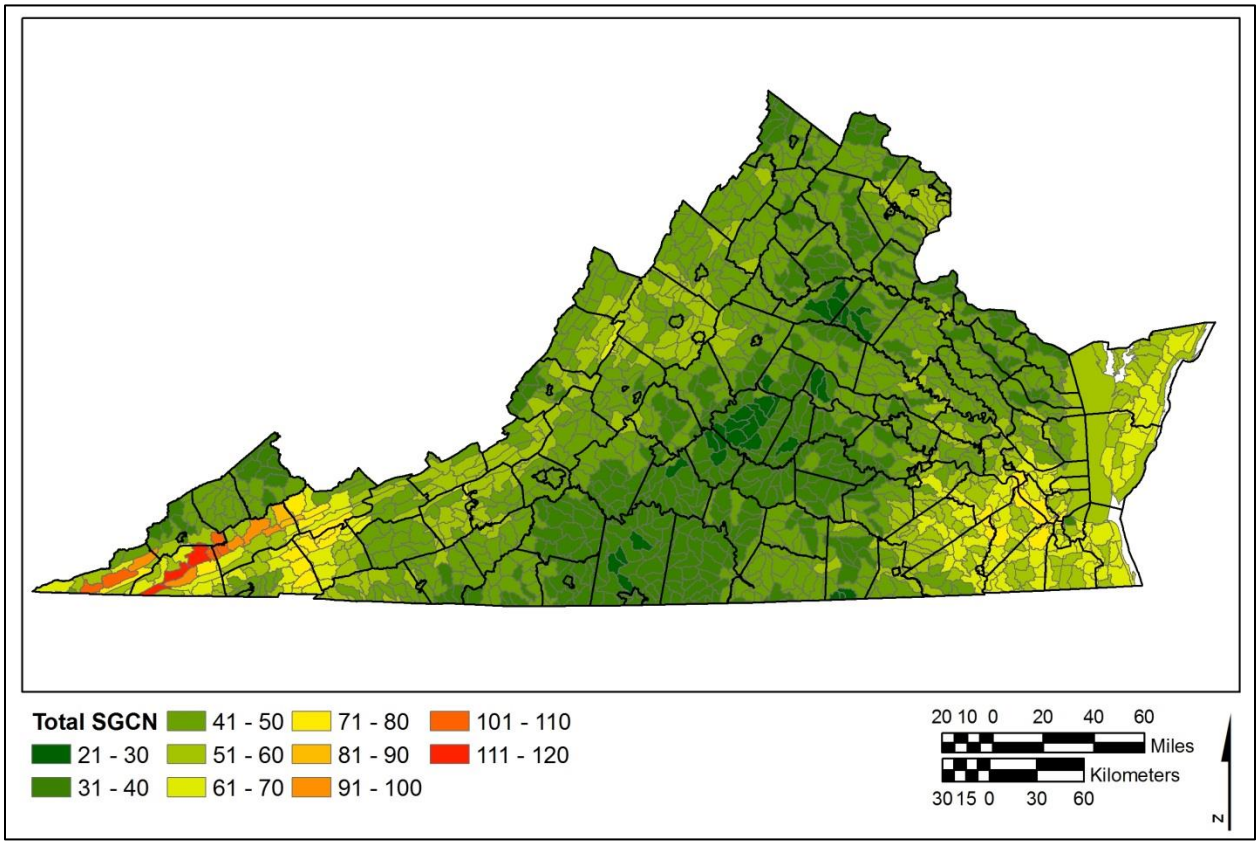

Figure 2.1. SGCN Density by HUC12 Watersheds.

Northern Bobwhite Quail Action Plan for Virginia (DGIF 2007) – In 2007, responding to a dramatic loss of open habitats and the subsequent declines in northern bobwhite quail and other open habitat species, DGIF staff and partners completed Virginia's first Quail Action Plan (DGIF 2007). This document identifies six focus areas where habitat restoration efforts are focused. Although quail are a primary focus, it has always been DGIF's assertion that providing habitats suitable for quail will also benefit scores of SGCN that utilize glade, grassland, savanna, and shrubland habitats. Absent other priorities, efforts to conserve and restore open habitats within the Action Plan will focus on these six priority areas.

Management-Based Habitat Categories

Habitats are often described by managers at the scale in which they work. To determine the habitat categories appropriate for the Action Plan, the authors first reviewed available literature and developed a brief description of each SGCN's habitat requirements. This process relied upon data from the Virginia Fish and Wildlife Information System (http://vafwis.org/fwis/), the Audubon Society's Online Guide to North American Birds (http://www.audubon.org/field-guide/bird/), Freshwater Fishes of Virginia (Jenkins and Burkhead 1993), and the NatureServe Explorer (http://explorer.natureserve.org/). Using this information, the authors drafted a list of potentially important SGCN habitat types within the state. The authors organized a series of meetings with DGIF staff from across the state to review the draft materials and discuss how they could be improved. The authors also met with key conservation partners to further refine the habitat list. Priority habitats discussed during these meetings included:

- Marine habitats
- Dunes, Beaches, and Mudflats
- Tidal wetlands
- Non-tidal wetlands
- Freshwater aquatic and riparian habitats
    - Tidally influenced warm water streams and rivers
    - Coldwater streams and rivers
    - Non-tidal warm water streams and rivers
    - Blackwater streams and rivers
- Open habitats
- Piedmont and coastal mixed hardwood/ conifer forests
- Western mixed hardwood/ conifer forests
- High elevation forests (spruce and other high elevation)
- Karst and subterranean habitats
- Other fine-scale microhabitats

During each of the habitat meetings, participants were asked to help identify threats impacting each of these habitats, describe actions that could be taken to address those threats, and identify any priority areas or micro-habitats that should be specifically identified within the updated action plan. Descriptions of each habitat type are provided within the Statewide Section. The Northeast Terrestrial Habitat Map was used to map the primary habitat types for each Local Planning Region Summary.

LOCAL ACTION PLAN SUMMARIES

Since Virginia's original Action Plan was completed, a number of DGIF staff and partners expressed concerns regarding its format. Many found the Action Plan difficult to use and, thus, were unable to identify local priorities and develop "on the ground" projects to address conservation needs. DGIF recognized this issue and has worked to address it by incorporating Local Action Plan Summaries (Local Summaries) into this version of the Action Plan.

Each of these Local Summaries will provide localities with information regarding priority SGCN, the habitats those species require, threats impacting species and/or habitats, and actions that can be taken to address those threats. Whenever possible, each Local Summary will indicate which areas have been identified as being a priority either for conservation or for restoration efforts.

To achieve this goal, DGIF adopted a model developed by the Virginia Department of Conservation and Recreation (DCR) for the Virginia Outdoors Plan (DCR 2013). The Virginia Outdoors Plan describes recreational resource issues for 21 multi-county Recreational Planning Regions (Figure 2.2). Each Recreational Planning Region is roughly analogous to one of Virginia's 21 Planning District Commissions (PDC).[1] The PDCs are voluntary associations of local governments established 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.

[1] More information on Planning District Commissions can be found at: (Virginia Association of Planning District Commissions, http://www.vapdc.org/?page=About).

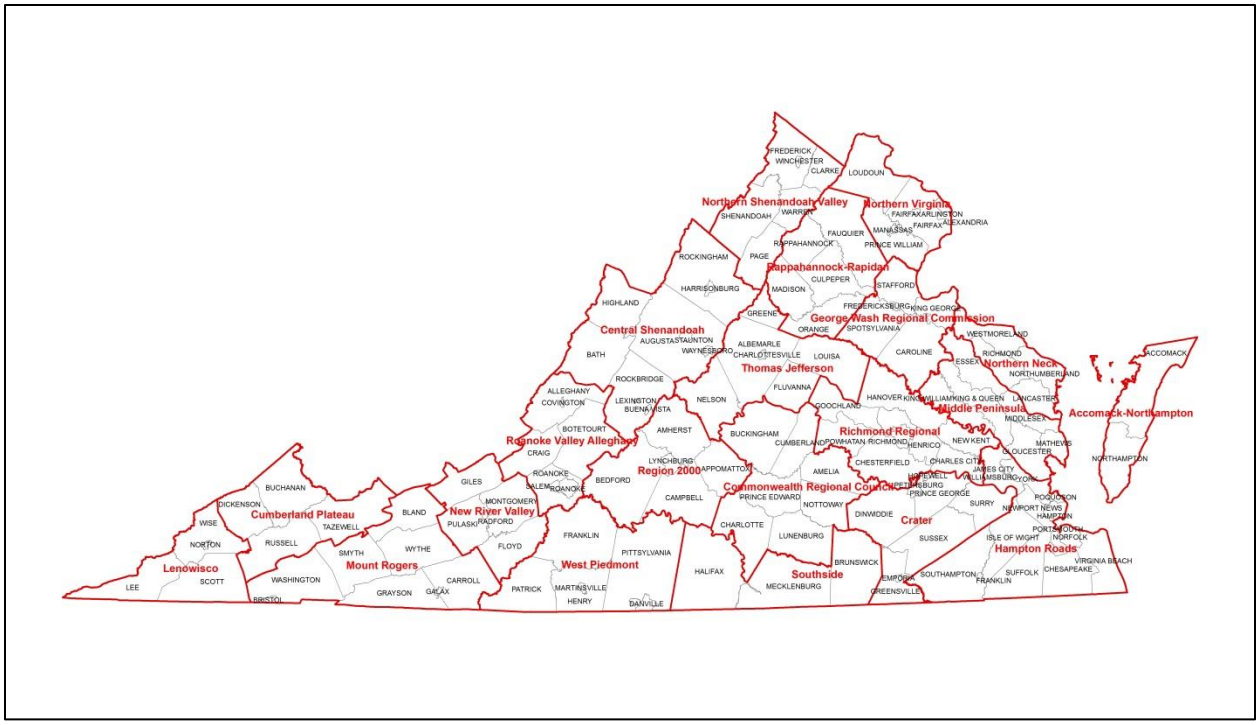

Figure 2.2. Local Planning Regions.

With its focus on local-scale actions, the Virginia Outdoors Plan has become an important tool for identifying and addressing local recreational issues. By using DCR's model to identify and address local wildlife and habitat issues, it is anticipated that the updated Action Plan will complement and enhance an existing planning infrastructure, better identify local priorities and multi-species conservation opportunities, and facilitate "on the ground" conservation actions that benefit local communities and their local wildlife resources.

Local Summary Development

The Local Summaries were developed through a multi-year iterative process, involving DGIF staff and the Conservation Management Institute (CMI) at Virginia Tech. The need for a scaled-down, locally relevant summary of Action Plan information was first articulated in 2009 within *Virginia's Strategy for Safeguarding Species of Greatest Conservation Need from the Effects of Climate Change* (a companion document to the original Action Plan that identified 10 initial climate change adaptation strategies) (DGIF et al. 2009). Summaries were identified as an important resource needed to identify local conservation issues and support implementation of local conservation efforts.

Local Summaries use information from the original Action Plan, new species distribution maps, and other input gathered through modeling, research, and meetings with both DGIF staff and partners. Specific data included in each Local Summary are described below. DGIF staff and partners were also given the opportunity to review and provide input on the early draft versions of the Local Summaries, during the Action Plan update process. The Local Summaries were revised based upon this review. Revised Local Summaries were a part of full Wildlife Action Plan draft that was provided to conservation partners and the public for review in spring of 2015. All comments and revisions were considered for inclusion.

Priority SGCN within the Local Summaries

The Local Summaries focus attention on those SGCN for which the individual planning region comprises a significant portion of the Virginia range. First, SGCN distribution maps (see Habitat Approach) were used to identify which SGCN occur within each of the 21 planning regions by HUC12 watersheds. The entire SGCN list for each planning region is included as Appendix A within each Local Summary. In some cases, hundreds of species were identified as occurring within an individual planning region. Upon reviewing the local SGCN lists and conferring with partners, it was determined that the initial local SGCN lists were too long to provide a meaningful prioritization, because these lists included numerous species that were on the fringe of their range. As such, 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. This modification reduced the size of many SGCN lists by half or more and allows local conservationists to focus efforts on those species for which they can make the greatest impact.

It should be noted that the 10 percent rule is arbitrary. In discussions, DGIF staff and partners recommended using values ranging from 2 percent to 40 percent. A literature review and follow-up discussions failed to provide any significant guidance as to what value would be most appropriate. Lacking additional input or peer-reviewed justification, DGIF's Wildlife Action Plan Coordinator selected 10 percent as it produced manageable SGCN lists and was acceptable to the majority of staff and partners.

While updating the Action Plan, the 10 percent rule was modified, in specific instances, to address several issues. First, some SGCN occur statewide but in low numbers in each planning region. As such they will never reach the 10 percent threshold in any single planning region. When these incidents were identified, the Action Plan authors worked with DGIF staff and others to determine which planning regions were most appropriate, and the species was manually added to those local lists of priority species. Some species only occur in three or fewer planning regions. These SGCN are also included on priority lists due to their rarity in the state and the importance of those few planning regions to its survival. In several instances, significant properties have been conserved to provide habitats for migratory species. While an individual species 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. Finally, partners identified instances where a species may have a particularly strong population in a relatively small portion of a planning region. While the species might not reach the 10 percent rule for that planning region, the specific populations in question were determined to be significant enough to warrant inclusion on the local priority SGCN list. Again, when these circumstances were identified, species were manually added to the local priority SGCN list.

For each priority SGCN, Tier and Conservation Opportunity Ranking and primary habitat descriptions are included within each Local Summary. Maps depicting the highest density of SGCN throughout each planning region are also included in an effort to help understand where the most species would be conserved or would benefit from conservation action.

Priority Threats and Conservation Actions within the Local Summaries

Threats and conservation actions are described at a habitat level within each Local Summary. To develop these sections, the authors first referred to the original Action Plan, reviewing the threats and actions outlined for the Tier I SGCN and the overall threats and actions described in the 2005 Action Plan's appendices. The greatest threats to the majority of species involve the loss or degradation of habitats. Common causes include fragmentation, nonpoint source pollution, and land development. The authors summarized this information and used it as a baseline for discussions with DGIF staff and partners at meetings to discuss priority habitats (see above). The outcome of these meetings indicated that Virginia's Action Plan could be revised with a greater habitat focus and that implementing habitat conservation and restoration activities could be a viable means of conserving multiple SGCN simultaneously.

The habitat-based meetings were held across Virginia. DGIF staff members who have experience with a particular habitat were invited to each relevant meeting. Many DGIF staff attended multiple meetings. The meetings were structured to elicit feedback from staff on how to divide and describe habitats as well as review the initial list of threats and actions to the habitats. The goal of these meetings was to gain a better understanding of how managers within the state categorize habitats, what they see as threats to habitats, and the conservation actions that could address those threats. The last part of these meetings was focused on working to identify priority areas for conservation actions. The Action Plan authors held 12 meetings with DGIF staff to discuss aquatic and terrestrial habitats. Another 10 meetings were held with conservation partners to discuss specific habitat types and conservation areas. These meetings included discussions with staff from the National Wildlife Refuges in Virginia, USFWS Virginia Offices in Gloucester and Abingdon, the Virginia Department of Forestry (DOF), the U.S. Forest Service (USFS), the Natural Resources Conservation Service (NRCS), The Nature Conservancy (TNC), the Xerces Society, and DCR Natural Heritage program. Meetings with other organizations were requested but could not be arranged (see Stakeholder and Public Participation). Finally, additional threats, actions, and priorities were identified during the Action Plan review process.

Within the Local Summaries, priority habitat types present within the planning region were determined from the local SGCN list (see above). As each SGCN entry includes a basic description of habitat needs, species can be grouped into basic habitat-oriented categories (e.g., wetlands, riparian, open habitats, karst, etc.). Each Local Summary includes a brief narrative that identifies the primary threats impacting each priority habitat within each planning region. Threats were identified from the habitat meeting notes and resources provided by meeting participants. Local Summaries also describe priority conservation actions that can be taken to address the identified threats. These conservation actions were also developed based on habitat meeting notes as well as resources provided by meeting participants, partners, and other resources.

CLIMATE CHANGE

Climate change is a stressor that will exacerbate most other existing threats and affect management actions over the long-term (Klopfer et al. 2012; Kane et al. 2013). The original Action Plan indicates climate change threatens several SGCN; however, the issue is not extensively addressed. In an effort to consider climate change impacts on wildlife and habitats within the state, DGIF began working with the National Wildlife Federation and Virginia Conservation Network in 2008. Together, they planned two

workshops to bring together key partners within Virginia to discuss climate change and conservation. Over 35 groups and agencies participated in this process to create *Virginia's Strategy for Safeguarding Wildlife from Climate Change* (DGIF et al. 2009). The 2009 climate change strategy identified 10 specific recommendations ranging from habitat conservation to research to outreach.

A key research recommendation called for more Virginia-specific climate change information and details about how climate change is likely to impact Virginia's species and habitats. Based on this recommendation, DGIF worked with CMI and the National Wildlife Federation to develop new climate models and conduct a species vulnerability assessment. This project was designed to create spatially explicit climate forecasts, determine the magnitude and occurrence of future climate changes within the Commonwealth, and describe the impacts that those climate changes may have on the distributions of a selection of SGCN and their habitats. Once the climate data were generated and vulnerability assessment was complete, the data were used to go a step further and consider landscapes and habitat conservation more broadly. This effort culminated in the Virginia Conservation Lands and Climate Assessment.

Conservation Lands and Climate Assessment

Habitat loss and habitat degradation are the greatest threats impacting the Commonwealth's SGCN. To help address these threats, Virginia's conservation community has made significant investments to conserve lands that can be managed to provide SGCN with habitats. Unfortunately, recent climate change research and related species vulnerability assessments (Klopfer et al. 2012; Kane et al. 2013) indicate habitat-related issues could become more acute as climatic conditions change. In addition, landscapes will likely be subjected to changing land use patterns driven by the need for ecosystem goods, increased agricultural production, and expanding human development (Klopfer and McGuckin 2015).

During the last century, state and federal agencies, as well as NGO partners, have made significant investments to acquire lands and create wildlife management areas, parks, refuges, and easements to conserve important habitats, provide recreational opportunities, and conserve priority species, including SGCN. These parcels, in aggregate, comprise a "conservation lands portfolio" and provide the backbone for SGCN management strategies in Virginia. Previous studies have indicated many of the nation's priority species are vulnerable to climate change, and that climate change could have profound impacts on conserved lands and the habitats they provide throwing the long-term viability of this portfolio, and conservation strategies dependent on them, into question (Klopfer and McGuckin 2015).

In order to better understand these issues and how land management efforts might be adapted to address these changing circumstances, DGIF partnered with Virginia Tech's Conservation Management Institute (CMI) to implement the Conservation Lands and Climate Assessment project (Klopfer and McGuckin 2015). Per this effort, CMI compiled and analyzed existing data regarding conserved lands, current climatic conditions, and projected future climatic conditions to assess how climatic conditions are expected to change across Virginia and what impacts those changes could have on the conservation lands portfolio/ network (or CLN).

Existing information from the Virginia Conservation Lands Database (VCLNA) was combined with climate data provided by the WorldClim climate data portal (http://www.worldclim.org/)and the CMIP5 (Coupled Model Intercomparison Project Phase 5 (CMIP5) global climate model used in the 5th International Panel on Climate Change. These datasets provide modeled climate scenarios at multiple

spatial scales and time periods (Hijmans et al. 2005). This project also used the "bioclimatic" set of information for both the current and modeled climate data. This set contains 19 variables that have been used in assessing climate impacts on biodiversity designed to asses annual and seasonal climate factors as well as extremes (Hijmans et al. 2005). This analysis used both the annual mean temperature (BIO1) and annual mean precipitation (BIO12) for the study area. The final analysis compares data from 2000 (current) and predictions for the year 2070 (Klopfer and McGuckin 2015). Temperature and precipitation data for 2000 were combined to create a potential 81-class map covering the majority of the Eastern U.S.; although, only a fraction of these climate classes occur in Virginia. This same process was applied to the temperature and precipitation data for the 2070 climate layer.

This assessment is used to highlight how conditions may change within Virginia and projected representation of conservation lands within each climate class in the future so that managers may understand the types of habitats and species that may or may not be resilient and/ or vulnerable as conditions change on existing conservation lands in Virginia. Each parcel of conserved land was evaluated to determine if climatic conditions related to temperature and precipitation are expected to change and how significant those changes are expected to be. This process allowed researchers to summarize the total area of each climate class that was protected by the CLN or not. It also allowed for a comparison of the total composition and change between climate classes at each time period to determine which climate classes would likely be lost, gained, or remain the same within the CLN in 2070. All of these analyses were completed using Microsoft Excel from tables that were exported from the GIS (Klopfer and McGuckin 2015).

This project attempts to illustrate how climate change information can be used to assess climate-related changes on the landscape and related impacts to natural resources. This will likely yield the greatest information when applied under a specific set of circumstances for a particular purpose. Our results are general, but can be easily applied to more specific information needs. This type of information may be useful in informing species-specific climate mitigation adaptation planning. While this analysis has provided some information on where suitable climate conditions may exist in the future, it did not attempt to determine whether species could be expected to shift along with the climate class. Species movement across the landscape is highly dependent on localized factors, so while suitable conditions may be found elsewhere in the study area there is no guarantee that species will be able to access it. Therefore, this information could be an integral part of conservation planning to determine what sorts of targeted management actions would be necessary to establish species populations. Techniques such as assisted migration, corridor design, vegetation management, or other efforts can be considered using the information provided with this technique.

This Action Plan also uses climate change data in two other capacities. First, climate change information is presented within the Statewide Threats Section. This material outlines projected impacts across Virginia and how these changes may impact SGCN and habitats. Climate change is also integrated into each Local Summary. For each priority habitat, the Local Summary includes any relevant climate change-related threats and provides a description of "climate-smart" actions that can be taken to help ensure the benefits of conservation actions in the face of changing climatic conditions.

MONITORING, EFFECTIVENESS MEASURES, AND RESEARCH NEEDS

Monitoring

In terms of monitoring, an Action Plan must describe how each state will monitor the status of species and habitats that have been included within the Action Plan. Information on monitoring within the Action Plan must also identify the mechanisms that will be used to monitor the effectiveness of conservation actions implemented on behalf of the Action Plan. Finally, each Action Plan must describe the mechanisms that will be used to adapt conservation actions in response to new information or changing conditions. While distinct, these concepts are related. Ideally, over time, conservation actions that are implemented will produce detectable improvements for local wildlife populations and/ or their habitats. While the benefits of some projects might not be fully realized for years or even decades, monitoring the changes achieved from conservation efforts will make it possible to evaluate the conservation community's ability to achieve conservation goals. Additionally, information from monitoring will allow managers to adapt those efforts to be more effective as experience is gained and changes are observed. DGIF staff and partners used the following mechanisms to address monitoring within Virginia's second Action Plan.

Monitoring Species Status

Virginia is home to over 30,000 species. These include vertebrates, invertebrates, aquatic, terrestrial, marine, karst, and migratory species. With available resources, it is impossible to maintain an accurate census of this many populations. As an alternative, DGIF staff work with multiple partners to collect species data that are incorporated into data systems and the Action Plan. These efforts include:

Population Monitoring by DGIF Staff – DGIF field staff spend many months each year collecting data on wildlife populations. DGIF staff may also hire academic institutions or private entities to collect species data on the agency's behalf. In many cases, data collection efforts are iterative multi-year projects. Much of the data collected are incorporated into the Virginia Fish and Wildlife Information System – a publicly available database that allows access to data and information about Virginia's wildlife. Among other uses, these data inform species management efforts and the environmental review process. These data, in conjunction with other information, were used to determine if a species should be included within Virginia's Wildlife Action Plan and how a species should be prioritized within the Tier structure (see Methods – Species of Greatest Conservation Need List Revision). Results of individual data collection and species monitoring efforts are reported in annual reports for State Wildlife Grants and Wildlife Restoration Grants provided to the USFWS. Examples of recent monitoring efforts funded with State Wildlife Grants and other resources include the blackbanded sunfish in southeast Virginia, freshwater mussel populations in Copper Creek and other portions of the Clinch River, the Atlantic sturgeon in the Chesapeake Bay watershed, and beach nesting species on Virginia's beaches and barrier islands.

Scientific Collection Permits –DGIF is responsible for regulating the collection of wildlife-related data by researchers and partner organizations within the Commonwealth. The permitting process requires that species distribution data collected during projects performed by permitted individuals be submitted to DGIF annually. These data are reviewed for accuracy and then incorporated into the Virginia Fish and Wildlife Information System – a publicly available database. These data are also used to determine if

species should be included within Virginia's Wildlife Action Plan and how a species should be prioritized within the Tier structure (see Methods – Species of Greatest Conservation Need List Revision).

NatureServe Status Rankings – NatureServe is an international nonprofit organization that works to answer four questions: What species and habitats exist? Where are they found? How are they doing? And which are conservation priorities? NatureServe provides a standardized set of global status rankings for species and habitats. These are commonly referred to as the "G&S" ranks. "G" represents "global" status, and "S" represents "state" status. Both the global and the state rankings utilize a 5-point ranking criteria. A score of 5 indicates a species is "Secure", a score of 4 indicates a species is "Apparently Secure", a score of 3 indicates a species is "Vulnerable", a score of 2 indicates a species is "Imperiled", and a score of 1 indicates a species is "Critically Imperiled." The state ranking might also include SH, which indicates a species is "Possibly Extirpated," or a value of SX indicates a species is "Presumed Extirpated" in Virginia. The S ranks are maintained by the DCR Natural Heritage Program, a member of the NatureServe Network. NatureServe rankings are generally consistent with the Action Plan's Tier system.

Monitoring Habitat Status

Water Quality

The National Clean Water Act requires each state to monitor the quality of its surface and ground waters to determine if they support six designated uses, including aquatic life, fish consumption, public water supplies (where applicable), recreation (swimming), shellfishing, and wildlife (DEQ 2014). Virginia also has instituted subcategories under most of these designated use categories. The U.S. Environmental Protection Agency (USEPA) requires that DEQ prepare biennial reports (305(b)/303(d) Water Quality Integrated Report), describing the status of water quality within the state (DEQ 2014). During the course of their water quality monitoring to prepare these reports, DEQ personnel gather data from 4,328 stations located in Virginia's lakes, reservoirs, rivers, and estuaries. The types of data collected include measurements of temperature, pH, dissolved oxygen, nutrients, suspended solids, bacteria, metals, pesticides, herbicides, and toxic organic compounds. These data allow individual waters to be classified into one of five groups:

- Category 1: Water that fully supports all designated uses.
- Category 2: Water that fully supports some designated uses, but there is either insufficient or no information regarding the remaining designated uses.
- Category 3: There is insufficient information to determine if designated uses are being met.
- Category 4: Waters are impaired or threatened but do not need a TMDL.
- Category 5: Waters are impaired and need a TMDL.

The Water Quality Integrated Report is transmitted to Congress and the USEPA. Based on water quality monitoring and the degree of impairment, a watershed may require a Total Maximum Daily Load (TMDL) figure be calculated (see Statewide Overview; Freshwater Aquatic and Riparian Habitats). The most seriously impaired waters require a Water Quality Improvement Plan (see Statewide Overview; Freshwater Aquatic and Riparian Habitats). Virginia's list of impaired waters and the available water quality improvement plans are available online (DEQ 2014).

Virginia's Healthy Waters Initiative

Virginia's Healthy Waters Initiative, a joint effort of the DCR, Virginia Commonwealth University, and DEQ, is an effort to broaden conservation efforts to maintain critical, healthy resources before they are compromised. This Initiative is meant to work in concert with water quality programs that focus on repairing degraded systems to protect living resources. The approach encompasses protecting everything from aquatic insect larvae and bugs hidden in gravelly stream bottoms to forested buffers alongside streams to natural stream flows to the water we drink in an effort to maintain ecological balance. Healthy streams in Virginia have been identified and ranked through a stream ecological integrity assessment known as the Interactive Stream Assessment Resource (INSTAR). Streams may be ranked as "exceptionally healthy," "healthy," or "restoration candidate." Developed by the Center for Environmental Studies at Virginia Commonwealth University, INSTAR is an online interactive database application that identifies healthy streams using stream data that includes information about fish communities and insects, in-stream habitat, and riparian borders. Healthy waters are incorporated into DCR's Natural Heritage Biotics Database and used for land conservation and land planning purposes.

Virginia Wetlands Catalog

The Virginia Department of Conservation and Recreation/Natural Heritage Program, working with the Natural Resources Conservation Service, the Virginia Department of Transportation, The Nature Conservancy, and Virginia Commonwealth University's Center for Environmental Studies, has developed the Virginia Wetlands Catalog. This tool considers the condition and status of wetlands and ranks them in terms of restoration or conservation priority. Wetland patches are evaluated 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, proximity to 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 (Weber and Bulluck 2014). This material provides the most extensive set of habitat quality data available for Virginia's wetlands, and it is used to identify priority areas for wetlands conservation and wetlands restoration within each of the Local Summaries.

Chesapeake Bay Fish Prioritization Tool and the Southeast Aquatic Connectivity Assessment Tool

Many of Virginia's 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. 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. In recent years, two tools have been developed to explore this issue. The Chesapeake Bay Fish Passage Prioritization Tool was designed by The Nature Conservancy in coordination with the NOAA Restoration Center, the U.S. Fish and Wildlife Service's Maryland Fisheries Resource Office, and other partners (Martin and Apse 2013). The Southeast Aquatic Connectivity Assessment Tool was designed by The Nature Conservancy in coordination with the Southeast Aquatic Resource Partnership, the South Atlantic Landscape Conservation Cooperative, and other partners (Martin et al. 2014).

Both tools were created to evaluate the ecological return on investment of restoring connectivity in streams and rivers. Dams were assessed in terms of their ability to provide ecological benefits for one or more species if removed or altered to allow fish to bypass. Contributors to these tools prioritized dams for removal throughout the study areas based on benefits to three target groups of species – diadromous fish, resident fish, and brook trout. A wide range of metrics were developed and assessed for each of the three targets to help identify which dams were of highest priority for each of the three targets. Metrics for diadromous fish included amount of upstream river length available; upstream and downstream barriers, amount of impervious surface, amount of natural landcover, stream health, and number of diadromous species in the stream network, etc. The prioritization tool for diadromous fish was used to identify the top 3 tiers (top 15%) of priority dams for removal or alteration within Virginia. Most of these dams fall within the Coastal Plain region. Within this Action Plan, where a planning region contains high priority dams for removal or modification, these priorities are identified within its Local Summary, and a map is included to indicate which watersheds would benefit from enhanced connectivity.

Forest Inventory and Analysis

The National Forest Inventory and Analysis effort uses remote sensing data and field data from permanent, confidential plots to determine change in forest cover and productivity (timber volume) nationwide. There are 4,691 permanent plots in Virginia (Rose 2011). Each plot is surveyed once every five years, so that all plots are covered over a five-year survey cycle. Data recorded at each plot include forest type, ownership, tree volume, individual tree species, age, diameter, height, condition, and presence of invasive species. Because this survey effort began in 1940, many changes in methodology have occurred since its inception. These changes make it difficult to draw small-scale (i.e., local) conclusions about trends from these data. However, trends involving multiple planning regions, as well as statewide and national trends, are available.

Northeast Terrestrial Habitat Map

In 2013, The Nature Conservancy, working on behalf of the Northeast Association of Fish and Wildlife Agencies and the North Atlantic Landscape Conservation Cooperative completed *Northeast Habitat Guides: A Companion to the Terrestrial and Aquatic Habitat Maps* (Anderson et al. 2013). This document and the habitat classification system it describes were developed "…as a comprehensive and standardized representation of habitats for wildlife that would be consistent across states and consistent with other regional classification and mapping efforts" (Anderson et al. 2013). As part of each habitat's description, the authors indicate in which states the habitat occurs, how many acres occur within each state, and how many of those habitat acres are managed as some form of conserved land. This report also provides tables indicating patch size, age class distribution, likelihood of loss due to development, and degree of fragmentation. These data provide a snapshot of status for habitats restricted to Virginia, and provide a general overview of status information for habitats that occur more broadly across the Northeast. The status information provided within the Terrestrial habitat map report is supplemented by additional information provided within *Conservation Status of Fish, Wildlife, and Natural Habitats in the Northeast Landscape: Implementation of the Northeast Monitoring Framework* (Anderson et al. 2011).

Natural Communities of Virginia: Classification of Ecological Community Groups

DCR's Natural Communities of Virginia: Classification of Ecological Community Groups is a classification system that represents assemblages of co-existing, interacting species, considered together with the physical environment and associated ecological processes that usually recurs on the landscape. DCR's natural community inventory and classification represent an important "coarse-filter" approach to biological conservation that ensures the protection of intact ecological systems containing diverse organisms. By identifying and protecting excellent examples of all natural community types in Virginia, the majority of our native plant and animal species, including many cryptic and poorly known ones, can be protected without redundant individual attention (Fleming et al. 2013). More information and detailed classification descriptions and images can be found online at http://www.dcr.virginia.gov/natural_heritage/natural_communities/nctoc.shtml.

Measuring the Effectiveness of Conservation Actions

Since Virginia's original Action Plan was completed, monitoring and reporting the effectiveness of conservation actions has become an increasingly important issue. In late 2005, the U.S. House of Representatives initiated a performance review of the USFWS's Wildlife and Sportfish Restoration Programs, including State Wildlife Grants. This report concluded that results, related to the effectiveness of conservation actions, "are not being demonstrated". In subsequent years, funding for State Wildlife Grants has been scrutinized regarding its value to the American public. The USFWS and state wildlife agencies have worked to develop a mechanism to describe the importance and value of this program and the Wildlife Action Plans. In September of 2009, the Association of Fish and Wildlife Agencies (AFWA) recruited staff from a diversity of state wildlife agencies and nongovernmental organizations to develop and test a framework of effectiveness measures to support the State Wildlife Grants program and the implementation of Action Plans. This framework of effectiveness measures was designed to:

- *Provide a means to evaluate conservation actions so that successful activities/programs can be continued and communicated and less successful ones improved or abandoned;*
- *Establish a standardized and accessible body of project performance data to inform and guide actions by current and future wildlife managers; and*
- *Provide a cost-effective mechanism for reporting data through regional and national summaries that will help meet congressional reporting expectations and articulate the value of state wildlife grants, and potentially the wildlife action plans, to policy makers, conservation partners, and taxpayers (AFWA 2011).*

The final Effectiveness Measures report identifies 11 basic conservation actions that have been implemented by states to support their Wildlife Action Plans (AFWA 2011). These include:

- Direct Management of Natural Resources;
- Species Restoration;
- Creation of New Habitat;
- Acquisition/Easement/Lease of Land;
- Conservation Area Designation;
- Environmental Review;
- Management Planning;

- Land Use Planning;
- Training and Technical Assistance; and
- Data Collection and Analysis.

For each project type, the working group used a planning tool called a Results Chain to identify intermediate output measures that can be used to evaluate the quantity and quality of work completed during a project's implementation (FOS 2007). Each results chain also identified longer-term outcome measures that are used to evaluate how successful a project is in meeting its intended goals.

This working group's final report was completed and approved by the AFWA Executive Committee in April 2011. Subsequently, the USFWS's branch of Wildlife and Sport Fish Restoration (WSFR) adopted this framework and coordinated with AFWA and state agency partners to incorporate these measures into the Tracking and Reporting on Actions for Conservation of Species (Wildlife TRACS) reporting system. Once fully operational and implemented, Wildlife TRACS will serve as the mandatory, central repository for all projects implemented using State Wildlife Grant and other WSFR grant programs. As the Wildlife TRACS framework was developed to specifically support Action Plan implementation, and has been integrated into the mandatory project reporting system, DGIF will use these resources to track the effectiveness of conservation actions in the Action Plan as outlined by Congress.

In addition to facilitating DGIF's prioritization and use of State Wildlife Grants and other resources, the Action Plan was also created to serve the broader conservation community and facilitate their actions. These efforts often occur without utilizing federal funds or involving DGIF which presents a vexing challenge. While efforts supported by DGIF can be tracked and evaluated using the resources described above, efforts implemented without DGIF involvement are not always reported or considered when the success of the Action Plan's implementation is being reviewed. This makes it more difficult to monitor the effectiveness of conservation actions and monitor resource changes over time.

Several issues hinder the effectiveness reporting on these non-DGIF projects. First, the issue of effectiveness was not comprehensively addressed within Virginia's original Action Plan. Many partners were not informed that effectiveness reporting was an important factor to consider nor were they provided with insights about the types of data that would be most useful to collect. Second, many partners face budget limitations and personnel shortages. Under such circumstances, voluntary project reporting is rarely considered a priority for the use of these limited human and financial resources. Staff considerations often limit the ability to track changes over time. As staff leave and positions are refilled, new staff members may not be aware of past projects and the need for collecting additional post-project data. Finally, DGIF has never provided the conservation community with a central repository where project and effectiveness data can be quickly and easily uploaded for review and reporting purposes.

DGIF addresses several of these issues within the updated Action Plan. In the language above, the authors describe the political situation regarding effectiveness measures and how critical effectiveness data are when dealing with policy and budget authorities. In the following section, the authors detail the importance of adapting conservation actions to both improve performance and address changing conditions. Virginia's Wildlife Action Plan Coordinator served on the teams that developed the Effectiveness Measures Report and the Wildlife TRACS system to help ensure these systems would be compatible with conservation efforts in Virginia. Based upon this work on effectiveness measures, tables

are included within each of the Local Summaries that identify the types of data that would be most useful to demonstrate the effectiveness of individual conservation projects.

DGIF staff also are exploring two opportunities that partners could use to upload project information for review and reporting purposes. First, the Wildlife TRACS development team has repeatedly discussed the need to provide partner organizations with a public access version they could use to promote projects implemented without federal funds. At the time of this writing, other higher priority portions of the Wildlife TRACS system are being developed and tested. This public version will be discussed when the core systems are functional. DGIF staff are also exploring opportunities to promote partner projects within the online version the 2015 Wildlife Action Plan, which will be developed and made available after the Action Plan's approval by the USFWS.

It is important to note that none of these efforts, however, are able to address how partners will prioritize project reporting and effectiveness measures. Additional outreach will be needed to ensure that the conservation community understands the importance of reporting and determine how reporting efforts can be encouraged and facilitated. Financial support may be required to inspire the collection of effectiveness data.

Adapting Conservation Strategies

As conservation projects are implemented and effectiveness data are collected, it is likely that projects will need to be modified, because experience will be gained, circumstances will change, or new information will become available. When fully operational, the Wildlife TRACS system will provide a mechanism to monitor effectiveness and identify issues. If issues or concerns are identified, DGIF and partners will use one of two mechanisms (updating species specific plans or working through DGIF's science teams) to adapt conservation efforts.

Plans or strategies have been developed for several specific SGCN conservation efforts. Examples of plans include the 2007 Virginia Quail Action Plan, the 2011 Canebrake Rattlesnake Conservation Plan, and the 2010 Virginia Freshwater Mussel Restoration Strategy: Upper Tennessee Basin (DGIF 2007; DGIF 2011; DGIF 2010). These plans are created in collaboration with appropriate partners and contributors. If it is determined that conservation actions are not meeting expectations, or if circumstances dictate that conservation objectives must be altered outside of the scope of the original plan, DGIF will coordinate efforts with partners and stakeholders to amend plans as necessary.

During the next decade, DGIF expects many conservation actions will be implemented using the Local Summaries as a guide. Few of these habitat and research efforts are expected to require a more specific or detailed planning document. As these projects are implemented, the Wildlife TRACS system (see above) is expected to provide the necessary effectiveness reporting framework to allow project managers and administrators to track and evaluate project results. Should a program need to be revised to address changing circumstances or new information, DGIF will rely upon its established science teams (see below) to provide program managers with the necessary guidance.

In 2010, DGIF changed its internal divisional structure. This altered structure enhances DGIF's opportunities to employ adaptive management principles. Prior to restructuring, wildlife conservation efforts had been divided among a Wildlife Division that focused on terrestrial game species and terrestrial and wetland habitats, a Fisheries Division that focused on sport fish and aquatic habitats, and a Wildlife Diversity Division that focused on threatened, endangered, and nongame species and their

habitats. During the restructure, these Divisions were merged into a new unit known as the Bureau of Wildlife Resources (Bureau). The Bureau relies upon a series of Science Teams to review, prioritize, and coordinate the implementation of conservation actions. With regards to the Action Plan and revising programs to address changing situations, the Terrestrial Wildlife and Habitat Science Team, the Aquatic Resources Science Team, the Upland Habitat Science Team, and the Conservation Planning Science Team will be responsible for working with program and land managers to review programmatic and project goals, evaluate performance, identify new goals and strategies to achieve those new goals, and describe how new/revised efforts will be evaluated. DGIF staff and administrators will coordinate with staff from the USFWS WSRP before implementing any changes to SWG-funded projects.

Research Needs

While updating the SGCN list (see Methods), partners were asked to describe actions that could be taken to conserve each species. Many partners identified research needs that fell into two categories. The vast majority of research needs involved collecting data to determine the distribution, status, and life history of SGCN. In most of these cases, no additional conservation actions were specified and species were classified as management opportunity "C". In other cases, specific research needs were identified that must be addressed before "on the ground" actions can be implemented to benefit a species. Under these circumstances, species were classified in management opportunity category "B". Absent other criteria, State Wildlife Grant dollars will be prioritized to address research needs for category "B" species. This is not to indicate that no baseline research will be implemented for category "C" species, but this type of research is expected to be a lower priority unless a compelling rationale can be articulated to explain how such an effort would likely lead to the removal of a species from the Action Plan or contribute to a restoration effort. A list of the category "B" species with specific research needs can be found in the Statewide Section.

During the implementation of this Action Plan, other research needs are likely to be identified as projects are developed and carried out. New research needs will be evaluated and prioritized during DGIF's annual budgeting process. If the research involves a species that is not included within the Action Plan, DGIF staff will coordinate with staff from the WSRP to ensure compliance with USFWS guidelines.

Stakeholder and Public Participation

Two of the Eight Essential Elements each Wildlife Action Plan must address involve outreach. Element 7 indicates that, "…Federal, State, and local agencies and Indian tribes that manage significant land and water resources within the State or administer programs that significantly affect the conservation of identified species and habitats…" must be afforded the opportunity to participate in the development, implementation, review, and revision of the Wildlife Action Plan (Public Law 106-291). In addition to the Federal, State, and local agencies and Indian Tribes, DGIF also worked to involve the many private nongovernmental organizations that own conservation lands and easements in Virginia or implement conservation projects consistent with the Wildlife Action Plan. Collectively, these groups are called conservation partners. Element 8 indicates that, "…broad public participation is an essential element of developing and implementing…" Wildlife Action Plans. Throughout the development of the Virginia's 2015 Wildlife Action Plan, the authors have made a significant effort to engage and address the needs/ interests of both the conservation partners and the general public.

Conservation partners were contacted in phases. The first group included partners that have been actively involved in implementing Virginia's 2005 Wildlife Action Plan. These meetings began in October of 2013 and continued through December 2014. These meetings were designed to inform partners that the Action Plan was being updated, describe the problems encountered while implementing the original Action Plan, discuss changes that would be made to address those problems, and to solicit feedback and cooperation. Table 2.1 lists the various agencies and groups that were contacted during this timeframe to set up a meeting via conference call or in-person (**bolded** are entities with which the co-authors met in-person or on the phone). The majority of these meetings lasted two hours. The Action Plan authors also met multiple times over the course of the Action Plan's development with many of these partners, including the Virginia Department of Conservation and Recreation's Natural Heritage Program, the Virginia Department of Forestry, and the Eastern Virginia Rivers National Wildlife Refuge Complex.

Table 2.1. First Phase Conservation Partners.

Federal	State	Regional/NGO
USFWS, Great Dismal Swamp National Wildlife Refuge	**Virginia Department of Conservation and Recreation, Planning and Recreation Resources**	**North Atlantic Landscape Conservation Cooperative**
NPS, Shenandoah National Park	**Virginia Department of Conservation and Recreation, Natural Heritage Program**	**Southeast Atlantic Slope Mollusk Group**
USFWS, Eastern Virginia Rivers National Wildlife Refuge Complex	**Virginia Department of Forestry**	Appalachian Landscape Conservation Cooperative
USFWS, Potomac River National Wildlife Refuge Complex	**Virginia Department of Environmental Quality, Coastal Zone Management Program**	**South Atlantic Landscape Conservation Cooperative**
USFWS, Ecological Services Staff		**Appalachian Mountain Joint Venture**
USFWS, Blackwater National Wildlife Refuge		**TNC, Allegheny Highlands Program Coordinator**
USFS, George Washington/Thomas Jefferson National Forests		**TNC, Southern Rivers Program Director**
USFWS, Back Bay National Wildlife Refuge		**TNC, Clinch River Program Coordinator**
USFWS, Chincoteague National Wildlife Refuge		**TNC, Chesapeake Rivers Coordinator**
USFWS, Wildlife and Sportfish Restoration Program, Region 5		**TNC, Associate State Director for External Affairs and Senior Conservation Scientist**
USFWS, Eastern Shore National Wildlife Refuge		
DoD, Marine Corps Base Quantico		
DoD, Natural Resources Program		
DoD, Naval Air Station Oceania		
DoD, Readiness and Environmental Protection Integration Program		
NRCS, Virginia State Office		

The second group of conservation partners contacted included three types of agencies or organizations. The first type included NGOs that expressed interest in being involved with the planning process. The second group included state natural resource agencies that had not chosen to participate in past efforts related to the Action Plan. The final group included local land use planning agencies. DGIF would like to partner more directly with the local land use planning agencies. Unfortunately, with over 100 cities and counties in Virginia, it was not feasible to meet with every member of this community. Instead, the authors contacted a subset of Virginia's Planning District Commissions representing urban and rural jurisdictions. Each of the following organizations was contacted and offered an opportunity to meet and discuss this planning effort. Specifically, these meetings were designed to help participants understand the goals of the Action Plan and the information the plan would provide. The authors took these

opportunities to better understand the other organizations' needs and how those could be accommodated within the updated Action Plan (Table 2.2). **Bolded** entities indicate a meeting was held, either in person or via phone call. The first of these meetings occurred in July 2014 and the last in December of 2014. The majority of these meetings lasted two hours.

Table 2.2. Second Phase of Conservation Partners.

State Agency	Organizations	Planning District Commissions
Virginia Marine Resources Commission	**Xerces Society**	**Richmond Regional Planning District Commission**
	Chesapeake Bay Conservancy	**Hampton Roads Planning District Commission**
	Virginia Institute of Marine Science	**Northern Virginia Regional Commission**
		Accomack/ Northampton Planning District Commission
		Northern Neck Planning District Commission
		George Washington Planning District Commission
		Middle Peninsula Planning District Commission
		Crater Planning District Commission

In October of 2014, the authors distributed a list of proposed species to be included as Species of Greatest Conservation Need within the update Action Plan. In addition to a wide range of DGIF staff, this list was distributed to conservation partners known to work directly with species and habitat conservation efforts. Recipients were provided with a set of guidelines explaining the draft prioritizations and instructions regarding how to recommend any changes to this list. Recipients were invited and encouraged to distribute this list to any other individuals or organizations they thought might be interested in participating in this effort. Table 2.3 lists all conservation partners that received the proposed SGCN list from the authors for review.

Table 2.3. Conservation Partners that Reviewed Proposed SGCN List.

Federal	State	NGO/ Other
USFWS, Eastern Virginia Rivers National Wildlife Refuge Complex	Virginia Department of Conservation and Recreation, Natural Heritage Program	Appalachian Mountain Joint Venture
USFWS, Potomac River National Wildlife Refuge Complex	Virginia Department of Forestry	Atlantic Coast Joint Venture
USFWS, Ecological Services Staff	Virginia Marine Resources Commissions	Virginia Audubon Society
USFS, George Washington/ Thomas Jefferson National Forests	Virginia Institute of Marine Sciences	TNC, Chesapeake Rivers Program
USFWS, Eastern Shore National Wildlife Refuge		TNC Senior Conservation Scientist
USFWS, Chincoteague National Wildlife Refuge		TNC, Clinch River Program
USFWS, Back Bay National Wildlife Refuge		TNC, Allegheny Highlands Program
NRCS, Virginia State Office		TNC, Southern Rivers Program
NPS, Shenandoah National Park		Eastern Brook Trout Joint Venture
USFWS, Blackwater National Wildlife Refuge		Virginia Society of Ornithology
USFWS, Great Dismal Swamp National Wildlife Refuge		Xerces Society

On May 1, 2015, DGIF made the draft 2015 Wildlife Action Plan available to conservation partners and the public via the DGIF website at: and http://www.bewildvirginia.org/wildlife-action-plan/draft/ and http://www.dgif.virginia.gov/. To announce that these materials were available, the authors sent email notifications to the following agencies, conservation partners, and tribes (Table 2.4).

Table 2.4. Conservation Partners that Received the Draft 2015 Virginia Wildlife Action Plan for Review.

DCR, Natural Heritage Program	DCR, Planning and Recreational Resources	DOF, Virginia Department of Forestry
DEQ, Coastal Zone Management Program	DEQ, Division of Environmental Enhancement	Virginia Marine Resources Commission
Virginia Institute of Marine Science	Virginia Department of Transportation	Virginia Department of Agriculture and Consumer Services
USFWS, Virginia Field Office	USFWS, Southwest Virginia Field Office	USFWS, Chesapeake Bay Field Office
USFWS, Eastern Virginia Rivers National Wildlife Refuge Complex	USFWS, Back Bay National Wildlife Refuge	USFWS, Potomac River National Wildlife Refuge Complex
USFWS, Blackwater National Wildlife Refuge	USFWS, Great Dismal Swamp National Wildlife Refuge	USFWS, Chincoteague National Wildlife Refuge
USFWS, Eastern Shore National Wildlife Refuge	NRCS, Virginia State Office	DoD, Marine Corps Base Quantico
DoD, Naval Air Station Oceania	DoD, Readiness and Environmental Protection Integration Program	DoD, Natural Resources Program
US Geological Survey	Appalachian Mountain Joint Venture	USFS, George Washington and Thomas Jefferson National Forests
NPS, Shenandoah National Park	NPS, Appalachian National Scenic Trail	NPS, Appomattox Court House National Historic Park
NPS, Booker T. Washington National Monument	NPS, Colonial National Historical Park	NPS, Fort Monroe National Monument
NPS, Fredericksburg and Spotsylvania National Military Park	NPS, George Washington Birthplace National Historic Park	NPS, New River Gorge National River
NPS, Maggie L. Walker National Historic Site	NPS, Petersburg National Battlefield	NPS, Richmond National Battlefield Park
North Atlantic Landscape Conservation Cooperative	South Atlantic Landscape Conservation Cooperative	Appalachian Landscape Conservation Cooperative
Atlantic Coast Joint Venture	American Fisheries Society, Virginia Chapter	B.A.S.S. Federation Nation of Virginia, Inc.
Chesapeake Bay Foundation	Chesapeake Data LLC	Coastal Conservation Association
Ducks Unlimited	Eastern Brook Trout Joint Venture	Friends of Dyke Marsh
Virginia Society of Ornithology	Friends of the Rappahannock	Friends of the Rivers of Virginia
Garden Club of Virginia	Izaak Walton League	James River Association
National Wild Turkey Federation, Virginia	New River Land Trust	Northern Virginia Conservation Trust
Piedmont Environmental Council	Sierra Club - Virginia Chapter	The Wildlife Foundation of Virginia
TNC	Virginia Native Plant Society	Virginia Association of Counties
Virginia Audubon Council	Virginia Conservation Network	Virginia Council of Trout Unlimited
Virginia Deer Hunters Association, Inc.	Virginia Farm Bureau	Virginia Herpetological Society
Virginia Municipal League	Virginia Outdoors Foundation	Wetlands Watch
Wild Virginia	Wildlife Center of Virginia	XERCES Society
Virginia Master Naturalists	Accomack-Northampton Planning District Commission	Central Shenandoah Planning District Commission
Commonwealth Regional Council	Crater Planning District Commission	Cumberland Plateau Planning District Commission
George Washington Regional Commission	Hampton Roads Planning District Commission	Lenowisco Planning District Commission
Middle Peninsula Planning District Commission	Mount Rogers Planning District Commission	New River Valley Planning District Commission
Northern Neck Planning District Commission	Northern Shenandoah Valley Regional Commission	Northern Virginia Regional Commission
Rappahannock-Rapidan Regional Commission	Region 2000 Local Government Council	Richmond Regional Planning District Commission
Roanoke Valley-Alleghany Regional Commission	Southside Planning District Commission	Thomas Jefferson Planning District Commission
West Piedmont Planning District Commission	Chesapeake Conservancy	The Wildlife Society, Virginia Chapter
Virginia Outdoor Writers Association	Absentee Shawnee Tribe of Oklahoma	Catawba Nation
Cherokee Nation of Oklahoma	Delaware Nation of Oklahoma	Delaware Tribe of Indians
Eastern Band of the Cherokee Indians	Eastern Shawnee Tribe of Oklahoma	Shawnee Tribe
Tuscarora Nation	United Keetoowah Band of Cherokee Indians in Oklahoma	

Following the release of the draft 2015 Action Plan for review, and the distribution of the announcement emails, recipients suggested that DGIF notify other potentially interested parties. These included Virginia's Environmental Educators, the Virginia Union of Land Trusts (VaULT), and the state recognized tribes. An announcement email was sent to the Environmental Educators on May 7. A comprehensive contact list for VaULT members could not be found until May 11. The authors spent several days trying to find appropriate contact information for the state recognized tribes, but were unsuccessful. On July 16, the authors were notified that the Pamunkey Tribe had become federally recognized and the USFWS was able to provide contact information for the tribal leadership. A letter was sent to the Pamunkey Tribe advising them of the Action Plan. This letter included an offer to meet to discuss the plan with tribal representatives.

In an attempt to distribute the Action Plan to a larger public audience, the authors worked with DGIF's outreach staff to post an announcement on DGIF's Facebook page. The Facebook posting resulted in 2466 Views, 116 Likes, and 25 Shares. DGIF considered issuing a press release to announce the Action Plan's availability. The DGIF's Media Manager indicated that Virginia's media outlets monitor Facebook, which has become a common method of distributing information to the media. However, to ensure media distribution, an announcement was sent directly to the membership of the Virginia Outdoor Writers Association. These efforts resulted in one interview with a reporter from the Winchester Star newspaper. During a discussion with DGIF's Media Manager, the authors expressed disappointment with the limited response. The authors were informed this level of response was consistent with the level of response received on posts regarding similar topics.

In another attempt to distribute the Action Plan to a larger public audience, the authors worked to give presentations to a variety of groups regarding the purpose of the Action Plan. The authors requested DGIF staff and other partners help identify opportunities to give presentations to conservation partners and public audiences. Between October 2013 and August 2015, the authors were invited to give presentations to the Garden Club of Virginia, the Roanoke Valley Bird Club, the Roanoke Izaak Walton League, the Adult Forum Program for St. George's Episcopal Church in Fredericksburg, Virginia, and the Chesapeake Bay Foundation's Richmond Supper Club. These presentations all involved discussions of the Wildlife Action Plan which included describing how climate change would be addressed, how the updated Action Plan would be formatted, types of threats to wildlife and habitats that would be included, and types of actions that can be taken to address these issues. Each of these meetings was open to the public and audiences ranged in size from 20 individuals to 120 individuals. During each presentation, the presenter offered to meet with other groups at other events as needed.

Additional presentations were given to the joint annual meeting of the Virginia/West Virginia Chapters of the American Fisheries Society (approximately 150 participants), the Crater Planning District Commission's Quarterly Planning Director's Meeting (8 participants), the joint meeting of the Northern Neck Planning District Commission, the Northern Neck-Chesapeake Bay Region Partnership, and the Northern Neck Tourism Commission (40 participants), and the Commonwealth Planning Region's Chief Administrative Officers Committee meeting (9 participants).

The Action Plan's authors submitted an article for the Virginia Master Naturalists newsletter, *The Pollinator*. The article was distributed in July 2015, and the newsletter has an estimated total circulation of 1800 households. The article focused on the history of the Action Plan, its updated format, threats, conservation actions, and opportunities for Master Naturalist chapters to become involved with Action Plan implementation. The Action Plan authors were also contacted by the Green Infrastructure Center to

collaborate on a training curriculum to help local land use planners incorporate the updated Action Plan with local land use plans and green infrastructure plans.

The updated Wildlife Action Plan was presented to the Virginia Board of Game and Inland Fisheries on August 20, 2015. This meeting was open to the public, and the public was provided an opportunity to comment on the draft Action Plan during this event. One member of the public elected to provide a formal comment praising the action plan and encouraging DGIF to continue efforts to improve habitats in southeastern Virginia using fire. The Board of Game and Inland Fisheries voted to endorse the updated Wildlife Action Plan.

DGIF Involvement

When Virginia's original Action Plan was written, the planning effort was directed by the Wildlife Diversity Division. The Wildlife Diversity Division consisted of programs related to threatened and endangered species, nongame species conservation, environmental commenting, watchable wildlife, geospatial analysis, and data management. During 2010, DGIF executed a significant restructuring of its wildlife resource programs. Per this restructure, the former Wildlife Diversity Division was merged with the former Fisheries Division, which managed sportfish resources, and the former Wildlife Division, which managed terrestrial game species and habitat resources. These three divisions, Wildlife Diversity, Fisheries, and Terrestrial Wildlife, became the Bureau of Wildlife Resources. Functions and procedures within the Bureau are distinctly different from those used during the previous agency structure. These changes are significant in terms of how DGIF prioritizes projects and allocates State Wildlife Grant dollars.

In updating the Action Plan, to develop an effective and comprehensive document, it was imperative to ensure that the diversity of Bureau programs and personnel had the opportunity to participate in this planning effort. DGIF staff members are an important conservation partner and, as such, were treated as a target for outreach efforts consistent with the guidance of Element 7.

Between October 2013 and March 2014, the Action Plan authors met with the Bureau's Administrative Team, the Bureau's Threatened and Endangered Species Committee, the terrestrial biologists and administrators from each of DGIF's four management regions, the aquatic biologists and administrators from each of DGIF's four management regions, and DGIF's Media Manager. These meetings were scheduled to announce the update of the Action Plan, describe issues encountered with the original Action Plan, the process that would be used to create the updated plan, and to notify staff of the opportunities they would have to participate in the update process.

Between April 2014 and June 2014, the Action Plan authors coordinated meetings with DGIF staff to discuss habitat concerns. Specifically, meetings were held to discuss how habitats should be identified and classified within the updated Action Plan, what issues threatened the viability of those habitats, and what actions could be taken to address those threats. Meetings were held to discuss coastal/marine habitats, wetland habitats, forest habitats in eastern Virginia, forest habitats in western Virginia, karst habitats, open habitats (including grassland, shrub land, post-agricultural, glade, and savanna habitats), and aquatic habitats in DGIF's four management regions. Each of these meetings required two to five hours. At several times during this process, the Action Plan authors met with the Bureau's senior administrators to update them on the planning process and issues that needed to be addressed. Meetings with DGIF staff and administrators were extraordinarily helpful in that they helped the authors

develop the first draft of narratives and materials that facilitated discussions with Conservation Partners and the writing of the final Action Plan.

On April 14, 2015, two weeks before the draft Action Plan was made available to the general public, the draft Action Plan was made available to Bureau staff for review and comment. This provided an additional opportunity to find typographical errors, identify issues with species distributions, and clarify narratives regarding habitats, conservation threats, and actions.

Summary of Comments and Action Plan Adaptations

Thirteen members of DGIF staff and fourteen outside individuals and organizations provided comments on the draft Action Plan. Generally, comments were positive and complimentary of the new format. For example:

> "On the whole this is an excellent plan that shows a lot of thoughtful "big picture" consideration of ecosystem conservation. I applaud the shift from a focus on single species to a concern for habitat conservation. I especially applaud the recognition of climate change and its implications for wildlife. In today's political climate, this is a courageous step."
>
> "It's very well researched, comprehensive, and informative."
>
> "The plan overall looks great I think. You have digested what you and others saw as challenges (to implementation) in the last WAP, and worked very hard to materialize those into improvements in this plan. "

Other categories of comments Included:

- The most common comments involved typographical mistakes, which were corrected.
- Some reviewers notified DGIF of changes made to either the common name or scientific name for some species. These comments were reviewed and corrected as directed. Such changes were forwarded to the biologists that maintain the Virginia Fish and Wildlife Information System.
- Several reviewers identified species distribution errors within the Local Summaries. Each of these comments was reviewed and Local Summaries were corrected as needed.
- Some reviewers expressed concerns regarding the prioritization of specific species. If sufficient information was provided (see section on updating the SGCN list) changes were made. If insufficient data was provided, reviewers were contacted to request additional information.
- Several reviewers provided additional details about conservation properties identified within the Local Action Plan Summaries. Properties were added or removed from these lists as directed.

- Several DGIF staff requested language be added to identify white-tailed deer as a threat impacting forest habitats in specific planning regions. Working with the appropriate district biologist and one of DGIF's Deer Program Managers, text was drafted and included as needed to indicate the impacts deer have on forest habitats and the conservation actions that can be taken to address these issues.

- Several reviewers correctly identified that the draft Action Plan failed to discuss the issue of habitat connectivity for either aquatic or terrestrial habitats. This was an unfortunate oversight which the authors are working to correct. Information on aquatic connectivity has been added to the Statewide Section and the appropriate planning region chapters. At this time, no prioritization tool exists for Virginia's rivers that flow into the Mississippi River drainage. These data will be incorporated into the online version of the Action Plan as they become available. Regarding the connectivity of terrestrial habitats, at the time of this writing, DGIF is collaborating with the North Atlantic Landscape Conservation Cooperative to identify Regional Conservation Opportunity Areas for the 13 northeastern states. Connectivity is a key factor being considered in this effort and these data will be incorporated into the online version of the Action Plan as they become available.

- One reviewer correctly identified a flaw in the process used to identify priority watersheds within each of the local planning regions. The draft Action Plan only identified watersheds as priorities for restoration. No information was provided to identify healthy watersheds that would be conservation priorities in their current state. To address this issue, the authors met with representatives from the Virginia Natural Heritage program to discuss the Virginia Healthy Waters Initiative. Following this meeting, the Statewide Section and each of the planning region chapters were updated to include narrative and maps from the Virginia Healthy Waters Initiative. New materials will be added to the online version of the Action Plan as the Virginia Healthy Waters Initiative is updated in 2015 and 2016.

- Planners from the Central Shenandoah Planning Region contacted DGIF to discuss a particularly troublesome habitat threat near the town of Elkton, Virginia. After discussing and conferring with the town planner, this project was added to the Local Summary as a priority project.

- The updated Action Plan prioritizes species both by their level of imperilment and conservation opportunity. Each SGCN is assigned to one of three conservation opportunity scores: A, B, or C. Category B identifies species that either have specific research needs or "on the ground" conservation actions have been identified that cannot currently be implemented due to a lack of funding, personnel, or other resources. One reviewer suggested that category B was too broad and could be misleading to readers. They suggested adapting the conservation opportunity rankings so that category B would be broken into more descriptive subcategories. The authors understand this concern and also recognize that the conservation opportunity ranks will need to change over time as this Action Plan is implemented. Rather than complicate an untested system, the list of SGCN provided within this Action Plan (see Appendix A) has been expanded to include a notes section to indicate why each conservation opportunity ranking was assigned to each SGCN. Modifications to the conservation opportunity categories will be considered when the Action Plan is updated.

In summary, those individuals that commented on the draft Action Plan provided significant feedback and insights that have helped improve the quality and utility of the document. As the updated Action Plan is implemented, DGIF staff and others will continue collaborating with Conservation Partners and working to inform the general public about the wildlife conservation efforts implemented on their behalf.

Update of Virginia's Wildlife Action Plan

Congress requires that each state describe the procedures that will be used to review and update their Action Plan at intervals not to exceed ten years (Public Law 106-291). Virginia will complete a comprehensive and formal revision of Virginia's Wildlife Action Plan by October 2025. The exact process for updating this Plan will be determined closer to that deadline. The process will, however, be developed in close consultation with DGIF administrators, DGIF staff, the USFWS, other agencies, and partners. As indicated previously, DGIF will continue its annual reporting of projects and accomplishments. When reporting on projects funded via State Wildlife Grants, DGIF will provide data on project outputs and effectiveness measures per the standardized metrics developed by AFWA and the Wildlife TRACS system. If indicated by the effectiveness and project output data, projects and programs may be altered to better address changing conditions. Efforts may also be adjusted as new technologies, data, or conservation strategies become available. If circumstances require the Action Plan be revised prior to the 10-year deadline, DGIF staff will coordinate efforts with the appropriate representatives of the USFWS' WSFR Program.