



National Fish and Wildlife Foundation Western Pennsylvania Business Plan for Restoration of Healthy Forests and Freshwater Habitat

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Richard
King
Mellon
Foundation

The National Fish and Wildlife Foundation extends its sincere gratitude to the Richard King Mellon Foundation for its generous financial support to develop the Western Pennsylvania Healthy Forests and Freshwater Habitat Business Plan. This science-based plan will serve as a blueprint for investments made as well as a valuable tool for attracting public and private sector partners and other funders to support and accelerate the achievement of its conservation goals.

Cover photo credits:

Shingletown Gap: Luke Brady

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Allegheny River: S. West

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Executive Summary

The Western Pennsylvania Restoration Plan is a comprehensive strategy to guide investment that will improve and protect critical aquatic and forest habitat in Pennsylvania's western counties. The region is a biologically and geographically rich and diverse landscape defined by extensive stream and river networks, prolific forests, and consequently, extensive human disturbances on the landscape that threaten the sustainability and capacity to expand the habitat range of avian and aquatic species of interest. The plan identifies a clear set of measurable outcomes for species responses to habitat improvement and to which investments can be directed. ***By identifying a clear set of measurable outcomes, investments can be strategically directed, and will provide a framework to facilitate leveraging of public and private resources.*** The plan has been developed in consultation with key federal and state agencies and is informed by non-governmental organizations that are committed to the conservation and stewardship of Western Pennsylvania's outstanding habitat, species, and watersheds.

Conservation Need

Legacy and ongoing stressors stemming from urban development, energy exploration, extractive industries, and agriculture have extensively fragmented forest and aquatic habitat. Water quality degradation due to runoff from these same stressors and point sources has impaired the capacity of streams and rivers to sustain aquatic life. By mapping the known habitat for a suite of species representative of Western Pennsylvania's healthy forest mosaic and healthy freshwater systems, the need for restoration that offsets past threats and informs future land-based decisions is clear. Representative species of interest for forest and riparian zones include Cerulean Warbler, Golden-winged warbler, American Woodcock, Black-throated Blue Warbler, and Louisiana Waterthrush and for freshwater systems, Eastern Brook Trout, Eastern Hellbender, and threatened and endangered mussel communities.

Selection of Focal Geographies

Eleven focal geographies were identified based upon 1) their potential to provide high quality habitat for these eight species, 2) proximity to known populations of the species, and 3) the ability to simultaneously address multiple threats from human disturbances on the landscape including: incompatible agricultural practices, coal production and abandoned mine lands, incompatible forest management practices including forest fragmentation, energy development, residential and commercial development, dams and other stream barriers, and point source pollution. The focal geographies are central to fostering a coordinated grant making strategy that will align species responses to habitat restoration addressing known threats.

Conservation Outcomes

With a focus on restoration that improves the quality and connectivity of streams, riparian habitat, and mixed-age forests, an increase of the distribution and abundance of habitat for the

suite of indicator species is expected. Reduction of pollution outputs and habitat disturbances from current and future human activities on the landscape are also expected as attention to local capacity and the development of audience-specific incentives is carried out under the plan. Specific outcomes identified in the plan include the improvement of targeted watersheds for Eastern Brook Trout, the re-connection of stream miles for fish passage, and the enhancement of riparian complexes. Forest habitat acreage will be restored and expanded, improving the overall forest complexity and opportunities for increased Cerulean Warbler, Golden Warbler, and American Woodcock populations.

Implementation Plan

The plan specifies a suite of strategies: 1) Improving and restoring **stream and riparian habitat** resulting in responses by populations of Eastern Brook Trout, Eastern Hellbender, and threatened and endangered mussel species. 2) Increasing and improving **forest habitat** to develop and sustain the mosaic of old- and new growth forests necessary for avian communities comprised of Cerulean Warbler, Golden-winged Warbler, American Woodcock, Black-throated Blue Warbler, and Louisiana Waterthrush. 3) Improving **water quality** by reducing polluted runoff from agricultural lands, urban landscapes, and sediment runoff from roads and infrastructure and 4) Building **local capacity and advancing innovations** to accelerate restoration.

Risks to Success

The plan describes the principle risks to successful implementation of the plan's strategies and identifies actions to mitigate or avoid those risks where possible. Environmental risks, like flooding or shifts in species and habitat ranges from climate change, present both immediate and long-term potential for impacting this plan. Risk associated with regulatory and financial considerations requires diligence by the funders and the practitioners to track and influence where possible. Institutional risk as it affects the human capacity and coordination essential for carrying out the plan, is addressed in the implementation strategies.

Monitoring and Evaluating Performance

Conservation outcomes will be measured through a combination of environmental monitoring and modeling and in partnership with ongoing programs. To the extent possible, alignment of monitoring with existing programs will support improved evaluation through the availability of historic and baseline conditions in the areas where restoration takes place. A project-by-project evaluation of outputs and outcomes will be tracked and considered in aggregate to gauge progress toward increases in the area and quality of habitat and for improvements in water quality.

Funding Needs

The Western Pennsylvania Restoration Business Plan was developed based on a \$20 million investment over five years, 2015-2020. Nearly 10% of the restoration needs identified within the focal geographies could be addressed at this level of investment.

Conservation Need

Background

The Western Pennsylvania Restoration Business Plan provides a comprehensive strategy to guide investments for improving and protecting critical aquatic and forest habitat in the western counties of Pennsylvania including: Allegheny, Armstrong, Beaver, Bedford, Blair, Butler, Cambria, Cameron, Centre, Clarion, Clearfield, Clinton, Crawford, Elk, Erie, Fayette, Forest, Fulton, Greene, Huntingdon, Indiana, Jefferson, Lawrence, McKean, Mercer, Potter, Somerset, Venango, Warren, Washington, and Westmoreland.

The natural resources emblematic of the western portion of Pennsylvania have literally built the Commonwealth and the Nation by providing, through extractive energy industries and agriculture, the fuel, fiber and food that has undergirded the economic well-being of the region. The region's forests, streams, rivers, wetlands, and floodplains, host a diversity of nationally and globally significant ecosystems and habitats (Figure 1).

Habitat loss and degradation from a range of threats, such as residential and commercial development, energy development, historic and ongoing extractive industries, and agriculture, collectively have impaired water quality, forest health, wildlife populations, and the communities that rely on these

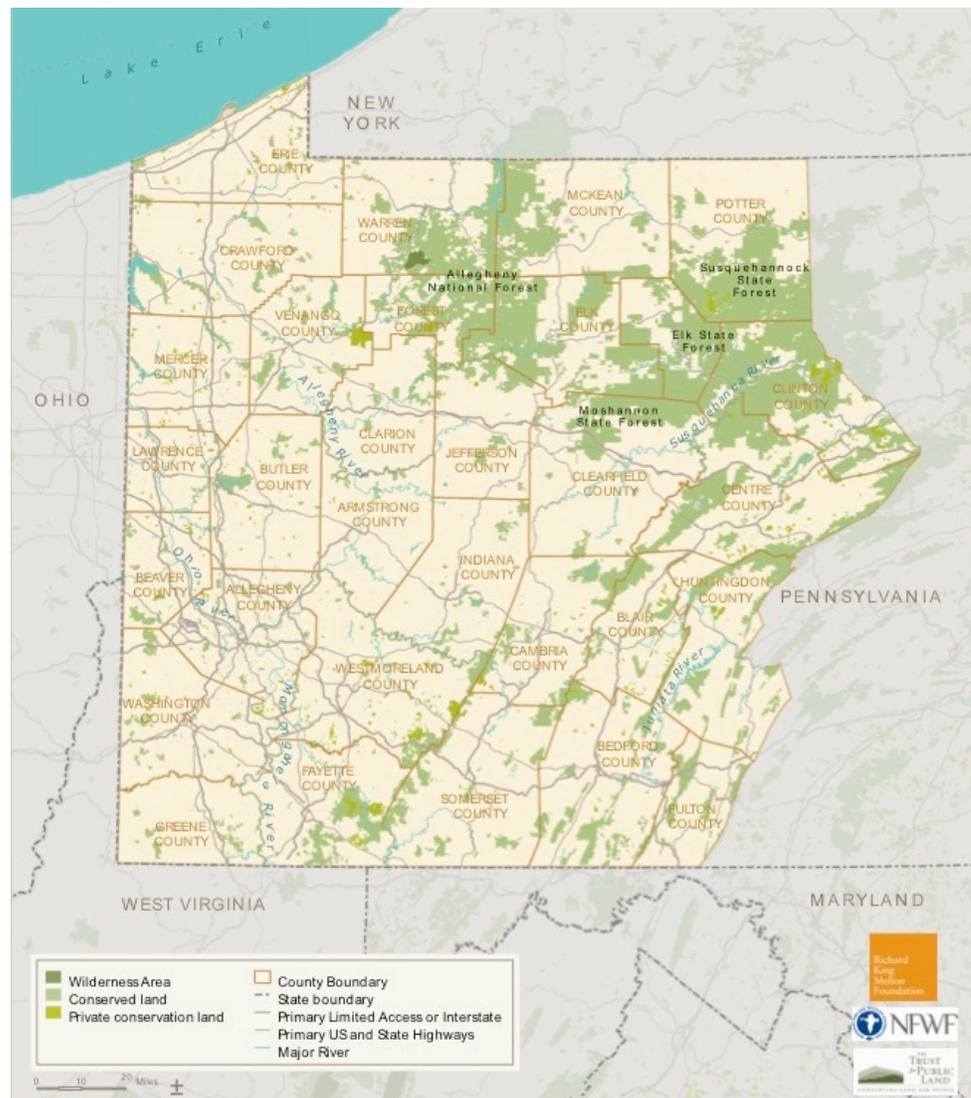


Figure 1 Area Map for Western Pennsylvania Restoration Analysis

resources.

Avian and aquatic communities directly impacted by the cumulative threats now are limited to the patches of forests and streams where habitat needs can still be met that have been carved out and isolated by these human disturbances. Prior to the landscape disturbances, the continuity of forests and unimpaired stream miles enabled these communities to migrate and successfully reproduce across vast, contiguous habitat. The fragmentation and barriers imposed upon forest and aquatic habitat has significantly diminished the natural capacity for bird and aquatic species to occupy areas that were previously available.

The conceptual model below illustrates the relationship of habitat and community response to threats and contributing factors, providing a framework for building a strategy for restoration.

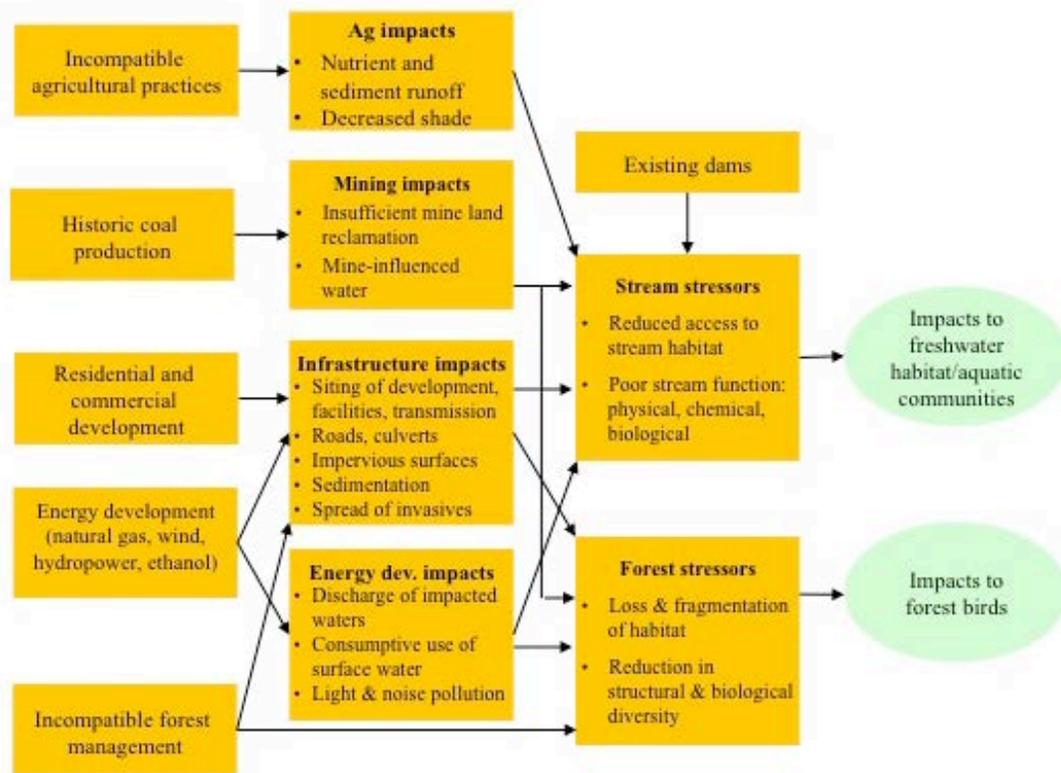


Figure 2 Conceptual Model of Threats to Western Pennsylvania's Forest and Freshwater Habitats

Threats

Fragmentation and Degradation of Stream and Riparian Habitat Caused by Deforestation and Development

The Western Pennsylvania region encompasses over 40,000 miles of streams and rivers providing extensive ecosystem services supporting diverse, indigenous aquatic life. As conduits that connect the landscape, streams facilitate the dispersal of aquatic organisms, and they are critical to the transport of energy and nutrients throughout aquatic systems. They support a vast assemblage of fish, amphibians, mollusks, insects, and other wildlife. A majority of the

resident fish species across the region, including Eastern Brook Trout (*Salvelinus fontinalis*) and Eastern Hellbender (*Cryptobranchus alleganiensis alleganiensis*), rely on high quality, cold water streams at all stages of their life cycles.

Past and present land uses have degraded many of the streams in the region by altering hydrology through deforestation and the disconnection of the channel with its floodplain. The resulting impact on habitat includes raising water temperatures, increasing sediment and other pollutant loading, disrupting the downstream transport of large woody debris, and obstructing animal movements. In addition to threatening many native fish species, these changes have adversely affected human communities by degrading water quality, reducing recreational opportunities, threatening drinking water supplies, and increasing the risk of property damage due to flooding. The increased frequency and intensity of rain events associated with climate change have exacerbated many of these impacts.

Fragmentation and Degradation of Forest Habitats Due to Development

Nearly 70 species of trees across the Western Pennsylvania region sustain habitat for over a hundred bird species. The area has extensive forest tracts of which nearly 70% are under private ownership. These lands in particular are under high pressure of subdivision and development, which leads to further fragmentation and the consequent loss of forests composed of mixed age, mixed species and increasingly homogenous stands, threatening the habitat opportunities and sustainability of these habitats for bird species of interest. Statewide, urban sprawl and development, which contribute to deforestation at a rate of 150 acres of forest land a day, with devastating effects on both water quality and the availability of habitat. Within the Western Pennsylvania landscape, there also are areas where agricultural conversion to forestland is actually increasing forest cover, but the structure and diversity of the forest often is not managed to support the range of habitat needs required by the species of interest.

With an overall trend towards forest lands becoming fragmented and resulting in smaller tracts, the number of private forest owners that need technical assistance and support for managing and building sustainable forests increases daily.

Degraded Water Quality from Polluted Runoff

The largest overall threat to water quality and aquatic habitat across the Western Pennsylvania region is polluted runoff stemming from the range of human activities on the landscape including agriculture, urban, forest management, coal production, energy development, and the extensive infrastructure systems supporting these activities. Runoff from these sources impairs water quality and aquatic habitats by delivering excess nutrients, sediments and other contaminants to surface water. The consequent impacts of this pollution include reduced dissolved oxygen concentrations, increased turbidity, and a smothering of stream substrates that are critical to fish populations.

Insufficient Local Capacity to Address Identified Threats

The capacity of local and regional organizations, including local governments, to collectively respond to the range of conservation issues, both threats and opportunities, is varied across the Western Pennsylvania landscape. From county to county and region to region, there is wide variability in the focus and priorities of institutionalized entities – such as the municipalities and conservation districts, as well as the non-governmental organizations that have emerged over the last few decades to respond to specific planning, environmental, social, and other issues. The by-county performance in leveraging farm bill conservation funding opportunities and other programs that are distributed regionally, like Growing Greener, varies widely (Appendix A, Methodology, Table 4, Farm Bill Conservation Program by County). Western Pennsylvania counties and municipalities have much room for improvement especially in supporting private landowners across all sectors -- urban, forest, and farm -- in land and water protection. Without a focus on building capacity for improved conservation delivery and sustainable financial and incentive programs, the implementation strategies in this plan cannot be sustained beyond the life of the initiative.

Species of Interest

The goal of the plan is to improve the quality and connectivity of Western Pennsylvania’s forest and freshwater ecosystems by targeting investments in places with the greatest potential to improve habitat for a suite of avian and aquatic species that are representative of ecosystem health. The plan prioritizes habitat for eight species that when taken together are indicators of a healthy forest mosaic and healthy freshwater systems. The eight species include: for forests and riparian zones, Cerulean Warbler, Golden-winged Warbler, American Woodcock, Black-throated Blue Warbler, and Louisiana Waterthrush; and for freshwater, Eastern Hellbender, Eastern Brook Trout, and threatened and endangered mussels.

These species were selected to represent the range of habitat that is typified by diverse and healthy forest and aquatic systems. Table 1 summarizes the habitat conditions that each species or group of species relies upon.

Table 1 Species of Interest and Habitat Preferences, Western Pennsylvania Restoration Strategy Geospatial Prioritization

Healthy Forests	
Cerulean Warbler	Species prefers old large deciduous forests and avoids edges impacted by fragmentation of forests. Requires a structurally complex forest to support its life cycle. Prefers ridgelines and upper steep slopes or the forests along larger stream rivers where there are breaks in the forest.
Golden-winged Warbler	Breeding pairs require a complex structure of habitat components: shrubby, young forest with limited canopy cover that is frequently interspersed with herbaceous areas of grasses and forbs, including widely spaced over-story trees for perches. Habitat typically borders more mature forest and is usually set within a landscape of deciduous forest.
American Woodcock	Found in young, shrubby deciduous forest, old fields, and mixed forest agriculture, this species utilizes forest openings and clearings for display and roosting and habitat requires mesic soils for earthworms. Wetlands are also very important.
Black-throated Blue Warbler	Found in large, relatively continuous tracts of deciduous or mixed deciduous-coniferous forests with a thick understory of shrubs and saplings and a large closed canopy.
Louisiana Waterthrush	Requires mature riparian forests, typically with steep sided valleys with swiftly flowing streams.
Healthy Freshwater Habitat	
Eastern Hellbender	Found in clean, fast flowing streams with abundant rocks large enough to hide under.
Eastern Brook Trout	Species prefers clean, cold, rocky streams with plenty of shade, and well-oxygenated water.
Threatened and Endangered Mussels	Highly susceptible to any type of pollution, both point and nonpoint-source, these mussel communities are sustained by high quality, clean water.

Selection of Focal Geographies

Focal geographies were selected based upon 1) their potential to provide high quality habitat for these eight Species of Interest, 2) proximity to known populations of the species, and 3) the ability to simultaneously address multiple threats through a coordinated grant making strategy.

As the location and range of the identified threats were integrated into a map, a compelling visual blueprint emerged, delineating specific geographies where one or more threats are clearly adjacent to successful and flourishing communities of the Species of Interest. The co-location of outstanding and priority habitat with threats to the landscape for which strategies and actions can be taken for restoration, provides the highest and best opportunity for expansion of existing and intact populations. These areas are hypothesized to be the zones where investment of restoration and conservation dollars will result in species-level responses to the improvement and expansion of available habitat. By addressing legacy, current, and future threats, priority habitat can be protected, expanded, and improved to support increased numbers and range of the representative avian and aquatic species. The resulting focal geographies (Figure 3) include:

- | | |
|------------------------------|---|
| 1 – Shenango River and Lake | 7 – Conemaugh and Clearfield Headwaters |
| 2 – French Creek | 8 – Upper Juniata River |
| 3 – Upper Allegheny | 9 – Bald Eagle to Penns Valley |
| 4 – Mid- and Lower Allegheny | 10 – Moshannon |
| 5 – Laurel Highlands | 11 – Triple Divide |
| 6 – Dunkard Creek | |

WESTERN PA RESTORATION STRATEGIES

Regional Focal Geographies

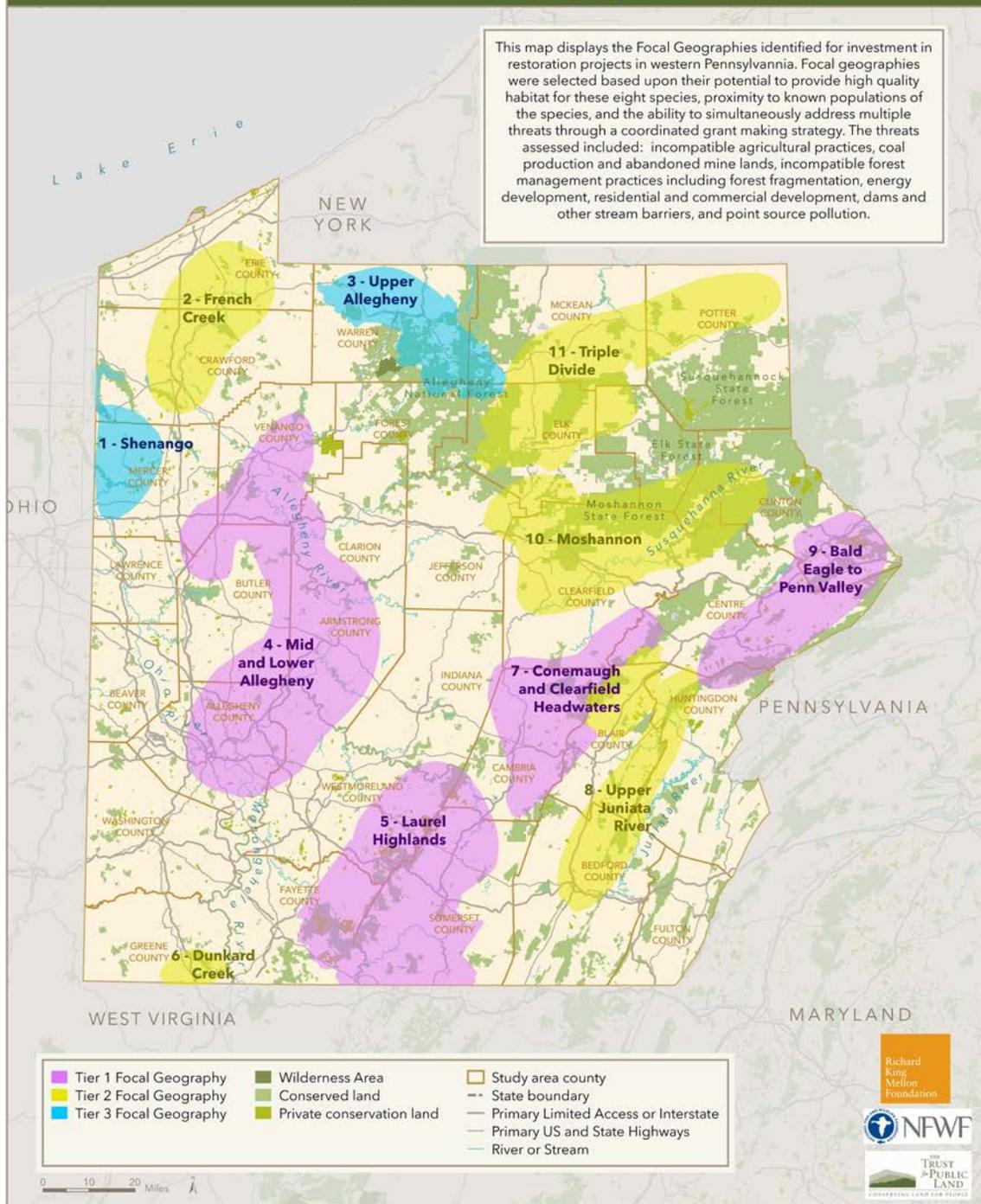


Figure 3 Map of Focal Areas

Within these eleven focal geographies, there is variation in the relative influence of multiple threats and the extent of each threat. Based on the extent of threats and the intersection of multiple threats, the focal geographies were further categorized into tiers. Tier 1 geographies (shown in pink) represent the presence of the largest number or concentration of threats, and represent the greatest urgency for restoration and protection actions, and also represent places where there may be opportunities to address multiple threats with a comprehensive, place-based conservation strategy. Tier 3 geographies are under pressure from few numbers of threats and therefore may represent shorter term opportunities to get “quick wins” or to invest in a singular conservation strategy. It is important to note that all eleven focal geographies represent significant opportunities, but the tiered approach allows for a strategy of phased implementation that may include a combination of geographies from different tiers. (See **Appendix A** for a more detailed explanation of the methodology used to identify focal geographies.)

Conservation Outcomes

The purpose of this Western Pennsylvania investment strategy is to improve the quality and connectivity of streams, riparian habitat, and forests to increase the distribution and abundance of fish, birds and other wildlife, as evidenced by eight species identified as indicators of habitat condition. In addition, by reducing polluted runoff from agricultural fields, urban areas, roadways, and emerging energy infrastructure, many ecological, social and economic values that are dependent on clean water will be restored and sustained. Attention to local capacity and the development of appropriate, audience-specific incentives will sustain the outcomes that are sought across all priorities.

Stream and Riparian Habitat Outcomes

- Increase the average habitat patch size for allopatric populations of Eastern Brook Trout within 10 targeted subwatersheds.
- Open up 170 stream miles to provide access to upstream habitat. This goal represents 10% of potential fish passage projects in the focal geographies.
- Restore habitat in 155 stream miles through riparian complex enhancements to improve overall water quality that will increase the security of mussel communities and Eastern Hellbender. Some of this restoration work will be targeted to ensure quality habitat upstream of barrier removal projects.

Forest Habitat Outcomes

- The plan establishes species population targets for three avian species of interest: Cerulean Warbler – restoration of 5000 acres meeting riparian and mature forest habitat requirements and supporting up to 5 territories per 25 acres (1000 breeding pairs); Golden-winged Warbler – restoration of 2500 acres of early successional forest, supporting two individuals per 10 (250); and American Woodcock – restoration of 2500 acres of early successional forest supporting an increase of 1 singing male per 29 acres (90). Because of lag times associated with occupancy can be 3-4 years post-restoration, these targets will be achieved after the five-year timeframe of the plan. We can anticipate, however, that acreage restored in years one and two of the plan will be occupied by the appropriate species of interest within the five-year timeframe. Comparable targets will be established for Black-throated Blue Warbler and Louisiana Waterthrush. However, predicting population changes is challenging given that existing tools, like the Breeding Bird Survey, provide information about species at a broad level. Improved monitoring protocol that can be used to generate reliable population estimates at smaller scales is being piloted and will be incorporated to establish the other targets as it becomes available.

- Protect or restore 110,000 acres representing the diversity of forest habitat by restoring and enhancing forestlands. Private forestland owners will support a diverse network of old-growth and new-growth managed forests, resulting in 10,000 acres of restored forestlands and 100,000 acres permanently protected from development.

Water Quality Outcomes

Reduce annual nitrogen and phosphorus inputs to surface waters by 6000 and 1800 pounds respectively; reduce sediment inputs by 4 million pounds annually; and increase urban stormwater storage capacity by 70 million gallons per year.

Local Capacity Outcomes

Reach approximately 100,000 landowners as needed to increase landowner participation in Federal Farm Bill conservation programs by 10% in counties targeted for restoration. By increasing the available technical assistance providers on the landscape, landowners and local governments will build improved networks and approaches that will result in sharing of limited resources, improved costs efficiencies, transfer of information and technology, and leveraging of experience.

Implementation Plan

This business plan focuses on four overarching strategies to address the major conservation threats to aquatic and forest systems of Western Pennsylvania. They include: 1) Restoring stream and riparian habitat, 2) restoring and managing forest habitat, 3) improving water quality, and 4) building local capacity. The plan will implement activities in geographies where this suite of strategies can address multiple threats simultaneously. Each strategy is described in more detail below, including a simplified results chain. More detailed results chains are provided in Appendix B.

1 Restore Stream and Riparian Habitat



1.1 Improve Riparian Habitat (See also section 2.4 – Improve and Extend Riparian Corridor.)

- 1.1.1 Restore stream banks, floodplains, and adjacent wetlands to enhance riparian conditions across 3700 acres along 155 miles of stream
- 1.1.2 Install livestock exclusion fencing, forested buffers and other riparian restoration in order to protect surface waters from human-disturbances on the landscape.
- 1.1.3 Stabilize streambanks through reforestation, native plantings, and other methods especially in highly erodible areas on working landscapes, slopes, abandoned and/or un-reclaimed mine lands, and other vulnerable areas.
- 1.1.4 Provide technical assistance and outreach to landowners to implement easements, agreements, and acquisitions to permanently protect land within and adjacent to restored riparian habitat.

1.2 Improve Instream Habitat

- 1.2.1 Improve in-stream structure and complexity along 10 to 20 stream miles to increase habitat opportunities for native fish and other aquatic organisms across all portions of their life cycles.
- 1.2.2 Improve wood recruitment to streams through upland and riparian forest management.
- 1.2.3 Implement practices that will manage and reduce sediment within the stream channel, improved temperature regulation through establishment of shade trees, and increase habitat opportunities through installation of in-stream habitat structures.

1.3 Restore Stream Geomorphology

- 1.3.1 Naturalize stream channels to restore hydrologic function, meander, floodplain and wetland connections, and other geomorphological processes along an estimated 5 to 10 miles of stream.
- 1.3.2 Improve diversity of flow regimes that will benefit the species of interest, including targeted channel reconfiguration and impoundment removal.

1.4 Restore Connectivity

- Stream barriers including dams and poorly designed culverts and bridges inhibit fish movement. These barriers quickly fragment the stream into sections, isolating brook trout populations and limiting their ability to find the best substrate for reproduction or access to cooler water in the summer. Within the focal geographies, there are 297 dams, 3375 culverts, and extensive networks of roads including over 15,400 miles of roads that are in proximity to streams with impaired water quality.
- 1.4.1 Assess and prioritize dams and other stream barriers for highest habitat and stream mile access provided through removal activities based on consideration of the connectivity improvement rank and potential to significantly increase the functional network length for aquatic populations.
 - 1.4.2 Provide outreach and technical assistance to landowners to improve willingness to allow aquatic connectivity restoration on their land. Assistance will be needed in securing funding from multiple sector sources especially for larger projects.
 - 1.4.3 Eliminate 10 fish passage barriers to restore aquatic connectivity along 170 stream miles. Barrier removal will focus on high priority dams, small dams, and road-stream

crossings that will achieve the highest functional network connecting and increasing patch size of allopatric populations of Eastern Brook Trout.

- 1.4.4 Replace road-stream crossings such as culverts that inhibit fish passage and connection between intact, aquatic patch habitat within aquatic habitat priority areas.
- 1.4.5 For energy and other development areas, assist land owners, industry, and government to ensure that alignment of all new infrastructure (extraction and delivery systems) imposes no new barriers within habitat priority areas and to the extent possible, utilize development activities to remove existing barriers.

2 Restore and Manage Forest Habitat



For the species of interest, the creation and sustenance of a healthy forest complex requires management of a variety of age classes that will support resilience against disease and invasive plants and animals while providing diverse habitat options for multiple species. The focal geographies contain over 1.9 million acres of forestlands that have forest management opportunities. These areas present specific restoration opportunities for the evaluation of how timber management practices can support the regeneration of forests at multiple class levels over short and long-term periods.

2.1 Improve Connectivity of Mature Forests

Within the focal geographies there are 3.8 million acres separating forest patches.

These areas represent significant opportunity for reforestation and improved management strategies that will connect forest patches to create contiguous forest, forest corridors, and improved riparian forest habitat that can increase the resilience of the existing habitat priority areas and expand their size.

- 2.1.1 Provide permanent protection to 100,000 acres of private forestlands through conservation easements by leveraging relatively small private investments to steer public funds to the highest priority habitat protection areas, with a particular focus on increasing the acreage of large tracts of mature forest.
- 2.1.2 Provide assistance to landowners for forest stewardship planning and estate successional planning to reduce parcelization and subdivision of intact private forest lands especially in the energy development areas.

2.2 Restore Young and Transitional Forest Habitat

- 2.2.1 Create and enhance 5000 acres of early successional and transitional forest habitat targeting public and private lands in close proximity to known populations of Golden-winged Warbler and American Woodcock that may re-populate the new habitat.
- 2.2.2 Provide assistance to landowners and managers for development of prescriptive management plans for forest stands that are un-managed or under-utilized (e.g., abandoned mine lands and energy development areas) and/or improvement of fallow or un-managed habitat through planting and selective treatment to facilitate appropriate habitat conditions for Golden-winged Warbler and American Woodcock.

2.3 Restore Oak-dominated Upland Habitat

- 2.3.1 Create and enhance 5000 acres of oak-dominated habitat to expand range and occupancy of Cerulean Warbler.
- 2.3.2 Provide assistance to landowners and managers for selection and implementation of silviculture practices including single-tree selection harvests, group selection for uneven-aged systems, shelterwood harvests, thinnings, modified even-age regenerations, and crop tree release.

2.4 Improve and Extend Forested Riparian Corridors

The focal geographies include over 75,000 acres of non-forested streambank (within 100 feet of the stream), resulting in 3,101 non-forested stream miles. Forest restoration that increases connectivity for terrestrial habitat that can also improve aquatic habitat through increased shading, reduced erosion, and other riparian-based benefits is a nexus for stacked ecosystem benefits. (See also section 1.1 – Improve Riparian Habitat.)

- 2.4.1 With the long-range goal of 100% riparian forest buffers within focal geographies, establish continuous forest buffers along 155 miles of streams.
- 2.4.2 Establish 657 riparian buffer acres supporting widths of 35' and greater and maximizing options for landowner participation in the Conservation Reserve Enhancement Program (CREP) and other cost share programs.
- 2.4.3 Implement turf to tree conversions, tree plantings adjacent to stream-side roads, and tree plantings within built environments, increasing riparian forested buffers by an additional 1000 acres in urban/suburban corridors within priority habitat areas.
- 2.4.4 Provide permanent protection to restored forested riparian corridors.

3 Improve Water Quality



3.1 Reduce Polluted Runoff from Agricultural Lands

Within the focal geographies, over 261,000 acres have the potential for improved agricultural practices, including adoption of conservation plans (including nutrient- and manure management), implementation of livestock exclusion, improved riparian forested buffer, barnyard improvements, adoption of conservation tillage, cover crops, and pasture-based management. Within the focal geographies, there are 354 stream miles that are impaired and attributed to agriculture, including sediment, nitrogen, and phosphorus as the sources.

- 3.1.1 Offer programs that will assist in the development of farm conservation plans (including nutrient management) and increase enrollment in Farm Bill programs impacting 13,000 acres of agricultural lands (approximately 80 farms) by focusing on whole farm environmental performance for reducing nutrient and sediment losses and increasing ecological function of forest-, wetlands-, floodplain-, and streams on agricultural lands.
- 3.1.2 Improve access of high-performing conservation farms to funds for farmland preservation and increase conservation performance on farmlands that are already enrolled in farmland preservation.
- 3.1.3 Improve and promote incentives related to conservation certification and market-based approaches to enhance agricultural environmental performance including bridge loans and trading.

3.2 Reduce Urban Stormwater Runoff

The built environment and the infrastructure supporting it has defined and limited the areas within which restoration is feasible. Existing acres of residential and commercial development within the focal geographies areas exceeds 1.1 million. An increase of 30%, or an additional 315,000 acres are predicted to be developed over the next 45 years, providing local municipalities an extensive opportunity for directing conservation-based and environmentally sensitive development that integrates green infrastructure, protection of natural, existing infrastructure (floodplains and forest corridors) and overall principles of low impact development.

- 3.2.1 Install 6.5 million square feet of green infrastructure to increase urban stormwater storage capacity and reduce inputs of nonpoint source pollution associated with large storm events including rain gardens, green roofs, pervious surfaces, and rain barrels.
- 3.2.2 Implement easements and acquisitions for critical lands supporting green or existing natural infrastructure to protect from future subdivision.
- 3.2.3 Install demonstration sites of green infrastructure in high priority and visible locations and support training for land managers and local governments.

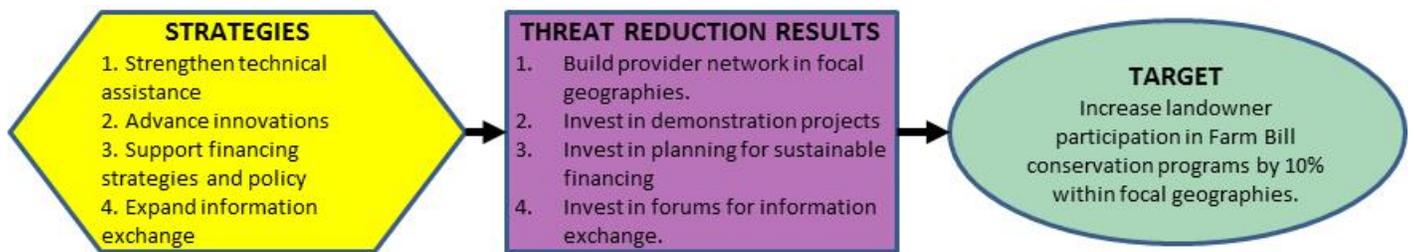
3.3 Reduce Sediment from Roads and Infrastructure for Energy Development and Extractive Industries

Within the focal geographies, 1,042,981 acres are within the predicted zones for future shale gas energy development. These areas present the opportunity for pre-energy development conservation activities that target landowners and gas industry

stakeholders to implement BMPs that minimize the impacts to rivers and streams associated with drilling and its associated infrastructure (i.e., roads, pipelines, etc.).

- 3.3.1 Improve 10% of stream-road-pipeline crossings utilizing Pennsylvania’s environmental sensitive maintenance guidance developed by the Pennsylvania Dirt and Gravel Roads Program for logging, natural gas, and other landscape disturbances that build and maintain unpaved road surfaces.
- 3.3.2 Implement BMPs across the entire life cycle of natural gas extraction for minimizing the loss of sediments or other pollutants to waterways from road crossings, pre-production, wells-to-pad development, actual extraction, and post-construction reclamation.

4 Build Local Capacity to Accelerate Restoration



4.1 Strengthen Landowner Technical Assistance

- 4.1.1 With a focus on the multi-issue targeted areas, an increase in the presence and intensity of technical assistance providers to work with private landowners will strengthen the capacity of organizations, businesses and local governments to scale-up recovery efforts in these targeted geographies, especially in the energy development areas.
- 4.1.2 Improved networking and other approaches to share limited resources and leverage expertise and equipment will also be a focus of these efforts.

4.2 Advance Innovations and New Technologies to Lower the Cost and Accelerate the Pace of Restoration

While targeted on-the-ground restoration work is underway, invest in demonstrations of innovative methods and new technologies that hold promise to drive down the costs and accelerate the pace of restoration, especially within the energy development areas.

4.3 Support Financing Strategies and Policy Development

Sustainable funding sources will be needed to manage, monitor and maintain restoration projects beyond the scope of this plan. Support local efforts to develop and adopt financing tools and strategies to support long term conservation investments.

4.4 Expand the Exchange and Transfer of Information and Technology

- 4.4.1 Invest in forums, conferences, symposiums and other related activities to promote knowledge, information and technology sharing among key constituent groups, and with the general public. As new technologies, new regulations and new opportunities rapidly emerge, the need to make investments in this area grows.

- 4.4.2 Fund information exchanges with a particular focus on stormwater, agricultural management, best practices in energy development, and habitat restoration, and with key audiences including local governments, practitioners and academia.

Risks to Success

Risks are uncertain events or conditions that can have a negative effect on the implementation of the implementation of the plan and/or achievement of outcomes should they occur. The principal risks to the Western Pennsylvania Business Plan are outlined below and, where applicable, strategies to avoid or mitigate these risks have been identified and incorporated into the plan.

Regulatory Risks

Risks associated with Pennsylvania's regulatory environment are largely related to the reduced capacity for enforcement in areas related to land use changes within urban and energy development landscapes. This risk is particularly true as it relates to stormwater management and agricultural compliance, where historically, the regulations have been in place but low (or non-existent) enforcement has taken place, creating an overall sense that the industry is exempt from compliance. The focus of stormwater and agricultural regulations has been piloted within the major cities and the Chesapeake Basin, but is less enforced in the Ohio and Great Lake basins within the Western Pennsylvania geography. As regulatory enforcement increases, the risk factors diminish given that heightened compliance will generally correspond to favorable conservation outcomes.

- **Stormwater Regulations:** For communities that do not have regulated Municipal Separate Storm Sewer Systems (MS4), there continues to be widespread misunderstandings about local government obligations to address/reduce stormwater and who has responsibility for addressing it within planning/zoning, etc. Within the MS4-regulated communities, minimal control measures (MCM) may be paper-based exercises and not adequately staffed or enforced. Future enforcement by Pennsylvania Department of Environmental Protection (PA DEP) and USEPA may cause financial/regulatory challenges for those already regulated and communities that are phased into the MS4 program in the future.
- **Riparian Buffer Protections:** In the fall of 2014, the Pennsylvania state legislature removed the requirement to protect 150' wide buffers between new developments and HQ and EV streams in areas requiring stormwater permits. The new requirement allows builders and other developers to offset disturbances elsewhere and potentially include in the offset protective measures that are "substantially equivalent" practices for protecting water quality and preventing erosion and sedimentation. This change presents both PA DEP and restoration practitioners with the added liability of protecting

HQ and EV streams from new development and changing land uses. By prioritizing work in places with the greatest need and greatest potential, this plan will strive to ensure any offsets to development within the focal geographies deliver benefits within the focal geographies rather than in places with less potentially high quality habitat.

- **Non-Conventional Drilling:** The evolving landscape in how non-conventional natural gas extraction is treated by regulators and taxing authorities has the potential to dramatically impact the extent to which many of the threats outlined in this plan materialize on the landscape. The plan mitigates these impacts in part by assuming that natural gas extraction from the Marcellus shale will continue at its existing pace, and identifies strategies to buffer the highest potential habitat from its effects.
- **Agriculture:** Statewide agricultural compliance with existing regulations is being sought, but enforcement requires willingness by conservation districts to serve the dual role of technical assistance provider AND regulator (where district has authority/agreement with PADEP). For agricultural operations with ANY animals (manure) - manure management plans are required. Statewide, less than half of operations are believed to have the required plan in place. Erosion & sedimentation plan requirements (Chapter 102), as well as nutrient management plans are believed to have less than 60% compliance for those required to have them. PA DEP has instigated small watershed assessments statewide that will concentrate regulatory evaluation at a HUC 14 (and smaller) level to essentially create "clouds of compliance" that may improve broader agricultural interest in compliance. However, in some areas, it has also increased skepticism and trust in inviting/receiving governmental or perceived governmental support for conservation funds and technical assistance. The plan focuses on working with and building the capacity of local conservation partners, who are more likely to retain landowner trust, to deliver technical and financial assistance

Financial Risks

Many of the implementation strategies will require ongoing management and monitoring, especially those related to management of forests to maximize habitat benefits across successional stages. A sustainable funding or financing strategy will be critical to sustaining the benefits and achieving the long-term outcomes. The program's focus on leveraging public cost share funding to implement Best Management Practices will help to alleviate this risk.

Environmental Risks

Western Pennsylvania is at high risk of flash flooding given the topography and land use changes underway in vulnerable areas, including unconventional gas drilling. Historically, urban centers within steeply sloped river valleys (e.g. Johnstown), have experienced extreme flooding that threatened life, property, and caused significant environmental degradation through erosion and sedimentation and transport of chemicals and contaminants from the landscape. Climate change over the long-term is expected to present significant shifts in the forest and

aquatic community composition. The area has historically experienced introduction of nuisance as well as highly detrimental invasives in both aquatic and forest habitats.

- **Flooding:** The diverse topography of Western Pennsylvania, especially steep slopes and valleys, lend themselves to higher potential for flooding, especially within the developed areas where impervious surfaces are present at the threshold of 15% and higher. The region has been flood-prone historically.
- **Climate Change:** Climate change presents high potential for habitat shift. However, the timeframe is likely 10 to 20 YRS, so is a lower risk within the <10YR threshold. Risk of new invasive species is highly linked to climate change scenarios in addition to human introduction from other areas.
- **Emerging Contaminants:** Environmental contaminants stemming from non-conventional drilling, endocrine disruptors passing through wastewater treatment systems, and endocrine disruptors and other contaminants stemming from pesticide use on agricultural systems are present and pose a threat to aquatic health.

Institutional Risks

There is a strong alignment of existing partners, especially those who have collaborated on the new/upcoming State Wildlife Action Plan. However, the extent to which traditional, county-level partners have been included in evaluating plans and integrating them into local-level initiatives presents both a risk and an opportunity.

- **Local Capacity and Coordination:** There is insufficient coordination of the existing capacity and no common understanding of the gaps in capacity to deliver conservation. NGOs and county-level quasi-government entities (like the conservation districts) are working largely in parallel and not in collaboration.
- **Coordinating Funding:** There are a limited number of organizations poised to coordinate delivery of the public and private funding opportunities across the breadth of this plan (i.e., forest-, wildlife-, farm-, and stream/river sources). In order to maximize the impact of various funding streams and to minimize redundancy, new partnerships will need to be developed, and organizations will need to demonstrate a willingness to identify and accept new roles and responsibilities in order to deliver conservation more effectively.

Efforts to build local capacity to coordinate and deliver conservation are a significant focus of this plan. Implementation Strategy 4 strives to address these institutional risks.

Monitoring and Evaluating Performance

Outcomes will be measured through a combination of direct monitoring and modeling. In some cases, progress toward achieving plan outputs and outcomes will be calculated by tallying the results of individual projects. In others, outcome assessments will require information from other sources. Where possible, these outcomes will be assessed using data provided by existing regional and local monitoring efforts.

Where data are unavailable, the investment program may direct funds to support specific targeted assessments.

Stream and Riparian Habitat

Improvements in the stream and riparian habitat will be assessed utilizing stream habitat and fish population data provided by the grantees and in collaboration with state and national monitoring efforts including the Pennsylvania Department of Environmental Protection's Surface Water Quality Monitoring Network (WQN). The WQN includes chemical, flow, and biological sampling and is a collaborative effort between USGS, the Pennsylvania Water Science Center, the Susquehanna River Basin Commission and PA DEP. Presently, there are 83 active WQN sites monitored including IBIs for macroinvertebrate and fish. The IBI data would provide a baseline for evaluation of pre- and post-restoration for the areas that are aligned with the WQN sites.

For aquatic species, the Pennsylvania Fish and Boat Commission and educational institution partners conduct the unassessed waters initiative supported by R.K. Mellon, NFWF, and the State, documenting the presence of trout populations. This monitoring initiative could be easily adapted to include assessment of other aquatic species including Eastern Hellbender and possibly mussel communities. Heightened coordination with state agencies and local colleges and universities as well as with established science-based conservation organizations like Western Pennsylvania Conservancy to ensure that data collection and monitoring is aligned with measurements that will assess the conservation goals may be required.

Forest Habitat

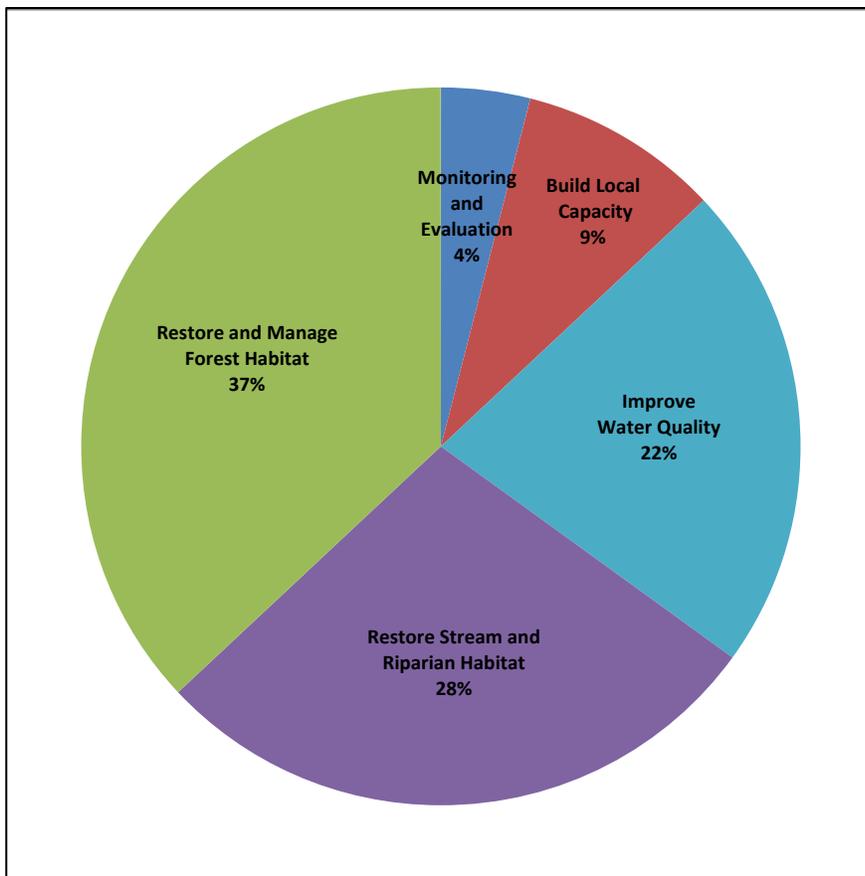
Improvements in forest habitat require a combination of direct monitoring and modeling based on landscape changes achieved through improved and expanded forest structure and continuity. Outcomes for avian species will be estimated using models that define relationships between habitat availability and carrying capacity for individual priority bird species. The Natural Heritage Program and revised State Wildlife Action Plan are expected to provide additional guidance in directing and coordinating monitoring efforts and the Pennsylvania Game Commission and Pennsylvania Fish and Boat Commission along with the Department of Conservation and Natural Resources, the U.S. Fish and Wildlife Service, and the U.S. Forest

Service, area colleges and universities, and grantees will need to be coordinated in supporting collection of data that will assess the stated conservation goals.

Water Quality

Pennsylvania Department of Environmental Protection’s Integrated Water Quality Monitoring and Assessment program, and the WQN, coordinated with USGS gauging stations, will provide water quality and storm trend data that, where aligned with restoration locations, will support baseline and post implementation measures for evaluating nonpoint source pollution improvements. Additionally, the capacity of local organizations including watershed associations, Trout Unlimited and other citizen science monitoring initiatives, are critical partners for data collection and evaluation of pre- and post-implementation responses. Direct measurements of nutrient and sediment inputs at project level sites are expensive and often dependent on lag times associated with local hydrology and precipitation. Modeling to estimate the cumulative reductions achieved by program investments combined with watershed health assessment should be integrated into grant projects to improve assessment.

Funding Needs



The conservation outcomes and supporting implementation plan were developed based on a \$20 million investment over five years. Aspects of the plan are scalable dependent upon initial investment and opportunities for additional leverage from a variety of state-, federal-, and other sources.

Figure 4 Budget Allocations by Implementation Strategy (Percent of Total Budget)

Definition of Terms

Focal Geography: Areas identified through the plan development process, a subset of the **Regional Focus Areas** and based upon 1) their potential to provide high quality habitat for these eight Species of Interest, 2) proximity to known populations of the species, and 3) the ability to simultaneously address multiple threats through a coordinated grant making strategy.

Habitat Priority Areas: Defined geographic areas in which habitat for one or more species of interest is present.

Regional Focus Areas: Defined geographic areas in which conservation issues (threats and opportunities) overlay the priority habitat focus areas defined by the presence of species of interest and their preferred habitat.

Species of Interest: Bird and aquatic species identified as representative of the diversity of mixed forests, high quality, cold-water streams, and warm water rivers systems found in Western Pennsylvania. For this plan, the species of interest include: Cerulean Warbler, Golden-winged Warbler, American Woodcock, Black-Throated Blue Warbler, Louisiana Waterthrush, Eastern Hellbender, Eastern Brook Trout, and threatened and endangered mussels.

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A number of existing resources developed by conservation partners provided guidance for setting priorities and outcomes including the Western Pennsylvania Conservancy's Conservation Blueprint, the Golden Winged Warbler Status Review and Conservation Plan, Management Plan for American Woodcock in Pennsylvania (Palmer 2008), the Pennsylvania Aquatic Community Classification, the Pennsylvania Natural Heritage Program (Walsh et al. 2007), Trout Unlimited Conservation Success Index (Fesenmyer 2014), The Nature Conservancy's Northeast Aquatic Habitat Classification System (Olivero et al. 2008). A full list of publications and literature utilized in the development of this plan are included under the References section and in Appendix A Methodology. These resources were significantly augmented by the extensive expert input from conservation partners especially, but not limited to those listed in the adjacent box.

Advisory and Data Team Participating Organizations

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FracTracker Alliance
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Pennsylvania Biological Survey
Pennsylvania Department of Conservation and Natural Resources
Pennsylvania Department of Environmental Protection
Pennsylvania Environmental Council
Pennsylvania Fish and Boat Commission
Pennsylvania Game Commission
Pennsylvania State University
Pennsylvania Young Forest Council
Richard King Mellon Foundation
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