National Fish and Wildlife Foundation

Business Plan for Lower Mississippi Alluvial Valley

November 2019

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Purpose of a Business Plan

The purpose of a NFWF business plan is to provide a concise blueprint of the strategies and resources required to achieve desired conservation outcomes. The strategies discussed in this plan do not represent solely the foundation's view of the actions necessary to achieve the identified conservation goals, but instead reflect the majority view of the many federal, state, academic, and organizational experts that consulted during plan development. This plan is not meant to duplicate ongoing efforts, but rather to invest in areas where gaps might exist so as to support the efforts of the larger conservation community.

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About NFWF

Chartered by Congress in 1984, the National Fish and Wildlife Foundation (NFWF) protects and restores the nation's fish, wildlife, plants and habitats. Working with federal, corporate and individual partners, NFWF has funded more than 4,500 organizations and generated a conservation impact of more than $4.8 billion. Learn more at www.nfwf.org.

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Conservation Need

The Mississippi River drainage basin encompasses 41 percent of the conterminous United States. The river can be divided into three sections: the Upper Mississippi — the river from its headwaters to the confluence with the Missouri River; the Middle Mississippi — which is downriver from the Missouri to the Ohio River; and the Lower Mississippi — which flows from the confluence with the Ohio River to the Gulf of Mexico. This business plan addresses the bottomland hardwood forests, wetlands and freshwater habitats, and associated species within the Lower Mississippi, which for the purposes of this business plan will be referred to as the Lower Mississippi Alluvial Valley (LMAV).

The LMAV is the nation's largest floodplain, covering more than 24 million acres across portions of seven states: Arkansas, Illinois, Kentucky, Louisiana, Mississippi, Missouri, and Tennessee. The floodplain consists of an intricate network of sloughs, oxbows, side channels and backwater areas that support a diverse forested wetland ecosystem. The region's topography is subtle, and small changes in elevation dramatically shape the hydrology, influencing plant and wildlife diversity and structure (Killgore et al. 2014). These complex terrestrial and aquatic habitats support numerous fish and wildlife species, though many populations are believed to be stressed or in decline (Killgore et al. 2014). Bottomland hardwood forests also provide a number of ecosystem services, including water quality protection, carbon sequestration, and economic benefits, through additional game habitat. For instance, the extensive wetland habitats of the valley can provide a tremendous filtering capacity to help improve water quality by absorbing both nutrients, such as nitrogen and phosphorus, and sediment. Adding to the intricacy of this landscape, more than 80 percent of the region's forests are privately owned meaning restoration will be done within a complexity of management goals (Oswalt 2013).

Largely underappreciated in the broader wildlife context, the LMAV is considered the heart of the Mississippi Flyway, where more than 40 percent of North America's waterfowl and 60 percent of all U.S. bird species migrate or winter. More than 100 land birds, such as Swainson's warbler, prothonotary warbler and swallow-tailed kite also breed here (LMVJV 2015). The iconic and likely extinct, ivory-billed woodpecker was once abundant in this region, relying on extensive, mature bottomland forests, which have been replaced by agricultural fields and younger forests (USFWS 2010). The Mississippi River and its side channels, tributaries, oxbows and backwaters support at least 90 fish species, including several charismatic, long-lived species like alligator gar and pallid sturgeon, as well as approximately 50 freshwater mussel species (USACE 2015). The region's black bear helped create the larger than life persona of President Theodore Roosevelt (the Teddy Bear was born in this geography), and the

floodplain is the wintering home to the majority of the nation's waterfowl, loved by hunters and bird watchers alike.

The region's abundant natural resources contribute significantly to local economies. The LMAV's rich, alluvial soils support one of the most productive agricultural areas in the world. Cropland is the dominant agricultural use, with cotton, soybeans, corn and rice generating approximately 80 percent of all crop revenues. The region's forests produce over 375 million cubic feet of timber, valued at $290 million in annual revenues. And impressively, outdoor recreation, including hunting, fishing and wildlife viewing is estimated to generate more than $1.3 billion annually. And to the nation's commerce, the Mississippi River, as well as several major tributaries, support commercial navigation and transport of vast quantities of goods, with more than 60 percent of all U.S. agricultural exports passing through lower Mississippi River ports (IEI 2014).

Particularly over the last thirty years, large-scale land use changes and human modifications to land and water resources have contributed to habitat loss and degradation, collectively impairing forest health, water quality, and wildlife populations. Extreme shifts in weather patterns, including larger, more frequent flooding events, followed by extended periods of drought complicate restoration efforts (Gardiner 2014). This business plan addresses threats to bottomland hardwood forests and wetlands and aquatic habitats and outlines strategies to restore and enhance these habitat types, and benefit the species that rely upon them.

Bottomland Hardwood Wetlands

Once the largest forested wetland ecosystem in North America, more than 18 million acres, or nearly 80 percent of the forest cover within the 24 million acre floodplain were lost, primarily due to conversion to farmland. Conversion of bottomland hardwood forests to farmland began with European settlers and accelerated in the 19th and dramatically in the 20th century as improvements in flood control, drainage and farming technology made it possible to access previously saturated soils. Forested wetland conversion eventually slowed in the 1980s with the passage of "swampbuster" provisions in the Farm Bill.

Although forest restoration efforts have increased the amount of forested habitat in the LMAV, additional reforestation is needed to further expand the size of existing core forest patches and increase connectivity between forest blocks to facilitate species movement. Further, forests planted within the past 20+ years are in need of management to improve structure and diversity, and create suitable habitat for wildlife (LMVJV 2016). Topographic and hydrologic restoration will continue to be necessary on old-field sites where natural ridges and swales have been leveled and ditches and tiles installed to lower water levels (Allen et al. 2004). Invasive species, such as feral hogs, Chinese tallow tree, privet and purple loosestrife damage or compete with native vegetation and will require management.

Restoration and management of bottomland hardwood wetlands will benefit many forest and wetland dependent wildlife species. The following species are indicators of a healthy bottomland hardwood wetland ecosystem and represent the habitat needs of a broad suite of species that inhabit the region.

Louisiana black bear. Louisiana black bear is one species that will benefit from the establishment of additional forest habitat and increased connectivity, as it requires large forested areas to meet their biological needs. One of 16 subspecies of the American black bear, the Louisiana black bear was listed as

threatened in 1992 under the U.S. Endangered Species Act citing habitat loss and fragmentation as primary threats to their populations. Significant improvements in population size and habitat achieved through habitat protections, concerted reforestation efforts, and translocations resulted in the Louisiana black bear's removal from the Endangered Species List in 2016.

While Louisiana black bears have recovered substantially since their initial listing, they exist in small, isolated populations with little to no gene flow amongst distinct populations. This is largely due to the vast agricultural matrix that fragments tracts of forest and hinders movement of individuals between areas. Reforestation investments will be targeted to increase forest habitat and connectivity, and improve genetic health of existing Louisiana black bear populations. These investments will also benefit forest birds and other wildlife species requiring large blocks of forest habitat.

Swamp rabbit and game species. The swamp rabbit, also known as a swamper or cane-cutter, is a bottomland hardwood specialist and the largest member of the cottontail family. Due to their dependence on large forest blocks, swamp rabbit populations declined in the LMAV coinciding with the loss of forest acres to agriculture. Significant reforestation and afforestation efforts implemented in the last 30 years have allowed swamp rabbit populations to rebound, and they are a popular game species throughout the LMAV. Unlike the eastern cottontail who shares some of the same habitat and is a habitat generalist, swamp rabbits remain restricted to narrow bands of bottomland forest in order to be in close proximity to wetlands. Swamp rabbits rely on a range of forest conditions to meet their biological and physiological needs. Relative population abundance of swamp rabbits is correlated with larger, contiguous forest patches with evidence that habitat patches greater than 250 acres are necessary to support viable populations (Allen 1985).

Coarse woody debris, which is an important component of mature forest stands, provides horizontal and vertical structure for swamp rabbits and many other forest birds, bats and herpetofauna. Swamp rabbits also benefit from random disturbance events in these mature stands that create canopy gaps to promote herbaceous vegetation and shrub growth. Natural disturbances, as well as active forest management that mimics these effects, provide critical horizontal cover for thermal refuge and predator avoidance. Other important game species like white-tailed deer and wild turkey also benefit from increased understory vegetation by managing monoculture plantations for suitable fawning and nesting habitat.

Waterfowl. Approximately 40 percent of the nation's migratory waterfowl use the LMAV, including species such as mallard, wood duck, and green-winged teal that winter in the region. Loss of bottomland hardwood forests, as well as flood control projects have decreased waterfowl habitat. While some flooded agricultural fields are an important food source, improvements to bottomland hardwood wetlands provide habitat diversity and multiple benefits to waterfowl. Forested wetlands provide roosting and loafing sites, cover from predators, and food sources from mast producing trees such as oaks, pecan and persimmon (ESMSU 2009).

Increasing available food energy sources is a key strategy for maintaining and improving wintering waterfowl populations in the LMAV. The forest management strategies outlined in this business plan will seek to maintain and enhance mast production, and provide sufficient energy for waterfowl during the non-breeding period by increasing the carrying capacity of restored bottomland hardwood forests.

In addition to Louisiana black bear and swamp rabbit for which this business plan sets species goals, many other species will benefit from reforestation and improved bottomland hardwood management, including waterfowl, white-tailed deer, wild turkey. High priority forest birds, such as Swainson's warbler, prothonotary warbler, and swallow tailed-kite as well as other non-game species like reptiles and amphibians will also benefit from forest management, reforestation and hydrologic improvements (Rosenberg et al. 2016).

Additional Aquatic Habitats

Historically, the Mississippi River was a dynamic river system that moved across the alluvial floodplain creating secondary channels and winding loops, which formed oxbow lakes. These structurally complex habitats support a number of aquatic communities. However, throughout the 20th century, massive flood control and navigation efforts were implemented by the U.S. Army Corps of Engineers (USACE) through the Mississippi River and Tributaries project, installing levees and dikes and improving channelization, which separated rivers from their natural floodplains and impaired natural wetland function. More than 2,700 miles of levees were installed along the mainstem, limiting the reach of Mississippi River floodwaters to approximately 2.4 million acres, or 10 percent of the historical 24 million acre floodplain. These alterations have impaired aquatic habitats, restricted fish passage and limited natural flooding regimes, including access to forested wetlands, which support spawning and nursery habitat for several aquatic species (LMVJV 2007).

The Lower Mississippi River Conservation Committee (comprised of state and federal agencies), USACE and partners have implemented a number of projects within the "batture", or portion of the floodplain between the Mississippi River and levees, to notch dikes in secondary channels, which improves and restores flow between these secondary channels and the main channel. Partners are also working within the batture to improve flows and water levels between the main channel and floodplain, which improves water quality and increases fish access (LMRCC 2015).

A number of fish species will benefit from improved connectivity between habitats in the LMAV. Oxbow lakes, and connectivity to them, are of particular interest because oxbow lakes are thought to be important habitats for some fish species as spawning and/or nursing habitat, yet they are declining. With extensive river control structures, new oxbow lakes are prevented from forming and existing oxbows gradually fill in over time and become marshes. Oxbow lakes within the batture are often connected to the main channel seasonally during floods, but at varying frequency (some connect most years, others only occasionally). The degree of connectivity affects the types of fish assemblages these water bodies contain.

Oxbows benefit charismatic species such as alligator gar and paddlefish. Other fish that are commonly found in oxbow lakes with high connectivity include rheophilic species, such as river carpsucker, white bass, and forage fish such as skipjack herring (Miranda 2005). NFWF can play a role in connecting (and restoring) oxbow lake habitats.

Pallid sturgeon, an endangered species under the Endangered Species Act, will also benefit from connectivity as the species rely on a diverse suite of environments including floodplains, backwaters, side channels, and the main channel (USFWS 2014). Dike notching — a process of creating small aquatic openings in previously closed levees that allows continuing functioning of the levees — will increase flows within side channels. This activity will lead to a shift in fish assemblages to include species such as

blue catfish and shovelnose sturgeon (Boysen et al. 2012). These and other aquatic species will benefit from activities to improve water quality and aquatic habitat in the LMAV.

Current Conservation Context

The conservation picture of the LMAV is moderated by the low socio-economic opportunities of this region. Conservation capacity is sparse and dominated by a few non-governmental organizations, notably Ducks Unlimited, The Nature Conservancy, and Mississippi Wildlife. Opportunities may exist to expand the partner base by bringing forward others in the NFWF network such as the National Wild Turkey Federation, Trust for Tomorrow, The Conservation Fund, and conservation districts at large.

This Business Plan builds upon the work of these established partners and several long-standing partnerships working to restore bottomland hardwood forests and wetlands, and aquatic habitats in the LMAV, including the Lower Mississippi Valley Joint Venture (LMVJV), Tri-C Partnership[1], and Lower Mississippi River Conservation Committee (LMRCC). Bottomland hardwood and wetland restoration projects are implemented through two Conservation Delivery Networks[2] (on-the-ground partner networks), which work closely with the LMVJV and Tri-C Partnership to step down broad science-based conservation priorities into strategic on-the-ground outcomes. Partners working collaboratively through the LMRCC, including the USACE, U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, U.S. Geologic Service, state natural resource agencies, and conservation non-profits, implement aquatic habitat restoration projects.

Largely due to the above mentioned efforts, over the past three decades more than 1 million acres of marginal, frequently flooded cropland has been planted in bottomland hardwoods. A majority of these acres have been established on private lands and largely through the support of the U.S. Department of Agriculture Natural Resources Conservation Service's (NRCS) Wetland Reserve Program (now Agricultural Conservation Easement Program-Wetland Reserve Easements) (LMVJV 2007). As is common in the LMAV community, for the purposes of this business plan, Wetlands Reserve Easements (WRE) will be used to reference both the Wetlands Reserve Program and Agricultural Conservation Easement Program-Wetland Reserve Easements.

NRCS and partners recognize a growing need to manage forests established through WRE that are reaching the 20+ year age class to optimize and ensure that these reforested easements provide quality habitat for wildlife and align with the ecosystem level goals of the program. Addressing the need for forest management is a high priority for International Paper, Walton Family Foundation and other NFWF funding partners and will be a key focus of this business plan and future investments in the region. At the time of business plan development, projects are underway to inventory and assess existing WRE forest stands in Arkansas, Louisiana and Mississippi, which will help to inform management recommendations, including thinning and possibly other tree removal methods, such as group tree removal and patch cuts. Partners are also assessing the capacity of local forest products mills to determine potential demand for harvested trees and opportunities to improve access to forests in need of management, providing landowners with an economic incentive to implement conservation

[1] The Tri-C Partnership formed at the request of NRCS State Conservationists in Arkansas, Louisiana and Mississippi to improve collaboration among the NRCS and conservation partners in the Lower Mississippi River Valley.
[2] The two conservation delivery networks (CDNs) include the Arkansas MAV CDN and the Louisiana-Mississippi MAV CDN.

treatments. Technical assistance capacity to work with private landowners to plan and implement forest management practices has also been identified as a need, though the organizations and agencies currently working in the LMAV have limited capacity to significantly increase staffing.

Many existing WRE restoration sites and future sites targeted for restoration are adjacent to, or in proximity to large public landholdings, including National Forests, National Wildlife Refuges, and state lands. Many of these public lands are also in need of forest management to improve wildlife habitat and can provide locations for developing demonstration sites to enhance education and outreach efforts to private landowners, consulting forests, and land managers.

The geographic focus of this business plan overlaps with several priority areas identified in the NRCS' Mississippi River Basin Healthy Watersheds Initiative. Although the business plan focuses primarily on strategies to improve water quality and wildlife habitat through restoration of bottomland hardwood wetlands, NFWF will continue to explore future opportunities to incorporate additional sediment and nutrient reduction, and wildlife habitat improvement strategies on working agricultural lands.

The LMRCC published the "Restoring America's Greatest River: A Habitat Restoration Plan for the Lower Mississippi River" in 2015, which identifies more than 200 aquatic habitat restoration and river-access improvement projects. The Lower Mississippi River Conservation Committee, USACE and partners have implemented a number of projects to notch dikes and to improve flows and water levels within oxbow lakes (LMRCC 2015). To date, 29 river restoration projects have been completed restoring flows to over 101 miles of river side channels. LMRCC funding is limited for additional aquatic restoration projects, and NFWF's involvement in this region will enable local partners to leverage scarce financial resources and improve aquatic habitat.

NFWF is looking to expand investment in this region to enable partners to accelerate bottomland hardwood wetland restoration and address a growing need to implement management treatments on existing forest stands to improve wildlife habitat. Further, significant opportunities exist to support strategic aquatic connectivity and habitat restoration projects, including the potential to leverage USACE resources on projects of mutual interest. NFWF's ability to bring additional resources to this region will also allow local partners to leverage federal and state resources that otherwise would not be accessible.

The LMAV has been heavily shaped, and will continue to be in the future, by agricultural land use. NFWF investments addressing threats to water quality impacts stemming from agricultural runoff and sedimentation will largely focus on reforesting marginally productive, frequently flooded cropland. If funding and partners can be cultivated, NFWF will consider investments in additional conservation practices, including those on agricultural lands, such as cover crops and vegetated buffers, to reduce agricultural runoff and sedimentation on agricultural lands that are likely to remain in production.

Conservation Outcomes

The vision for the Lower Mississippi Alluvial Valley Business Plan is to **improve the capacity of the bottomland hardwood ecosystem to maintain robust and resilient populations of native species, while safeguarding clean water that flow through the Lower Mississippi Basin's watersheds**. To realize this vision the plan identifies both species and habitat outcomes it will achieve over the next 10 years (Tables 1 and 2). For forest habitat, target species include Louisiana black bear and swamp rabbit which, when taken together, require healthy forests. For aquatic habitats, additional information is needed in order to develop measurable goals for both waterfowl and freshwater fish species. This business plan also focuses on prospective species that benefits from increased food resources and freshwater fish species that require connected channels and floodplains for spawning and for certain life stages. Below is further description of some of the major species this business plan.

Louisiana black bear
Louisiana black bears in the LMAV contend with a variety of threats that are largely a product of their limited and patchy distribution when compared with other contiguous populations of black bears throughout the eastern U.S. While black bears in this region have recovered substantially since their initial listing, they exist in small, isolated populations with little to no gene flow amongst distinct populations.

The business plan goal is to improve the viability of black bear populations in the LMAV by increasing gene flow from low to moderate between the Tensas River Basin and White River Basin. In other words, we want to improve the genetic health of isolated populations of bears by connecting them. This will also help us build intact, more contiguous forests. This will be accomplished through targeted reforestation efforts over 10 years. To achieve this goal, we will support the establishment of 25,000 acres of bottomland hardwood forest. The result will be a more resilient and stable black bear population helping to ensure it will not backslide toward listed status.

Swamp rabbit
Without active management, bottomland hardwood habitat throughout the LMAV becomes increasingly less optimal for swamp rabbit and other bottomland hardwood species. As a prey species for many terrestrial and avian predators, strategies that increase ground cover are necessary to maintain robust swamp rabbit populations. Additionally, upland forest habitat is critical when escaping floods during inundation events.

The business plan goal is to manage bottomland hardwood forest blocks to increase swamp rabbit populations by 15 percent over baseline. Improved forest management will have a positive effect on survival and reproduction in swamp rabbits by increasing forage, cover and refuge opportunity. To achieve this goal, we will support the management of 25,000 acres of existing bottomland hardwood forest to improve heterogeneity of forest structure and increase availability of understory vegetation. This will result in more robust swamp rabbit populations that are indicative of improved bottomland hardwood forest condition. This will have the co-benefit of aiding other game species as well such as white-tailed deer and wild turkey.

Waterfowl

The North American Waterfowl Management Plan (NAWMP) establishes continental waterfowl population objectives, which have been stepped down to the LMAV in a regional plan. The regional plan is centered on a suite of dabbling ducks that winter in the LMAV in significant numbers including mallard, wood duck, green-winged teal, gadwall, and northern shoveler. The NAWMP goals for the LMAV are derived from historical bird distribution data, from mid-winter surveys and county-level harvest statistics. Waterfowl goals for the LMAV are based on the assumption that non-breeding waterfowl are food-limited and so the NAWMP thus uses a habitat bioenergetics model which establishes Duck Energy Days (DEDs) goals for each state in the LMAV to meet the region's population goal (Petrie et al. 2011; LMVJV 2015).

Approximately 65 percent of the forests established through WRE were planted in mast producing trees including oaks, pecan and persimmon. However, the stepped down NAWMP assumes a conservative 20 percent mast producing trees on WRE easements which are estimated to provide 61 DED/acre in energy content (LMVJV 2015). Meaning that many of these forests are in need of assessment and management to maintain and improve conditions for long-term mast production.

NFWF looks to support a bottomland hardwood forest restoration strategy targeting 25,000 acres of existing bottomland hardwood forest to improve survivability and production of mast-producing tree species, and will support hydrologic restoration of moist soils and their management on the same WRE easements to increase the energy available for waterfowl from this important habitat. Specific species goals and outcomes are not included in the business plan at this time because current monitoring systems and techniques do not allow for detailed population counts. Waterfowl will be included as a prospective species, where we will look to establish specific species goals and outcomes over the course of this business plan. Other species are also slated to be evaluated, as outlined in the Table 2 (see below)

Table 1: Target Bottomland Hardwood Wetland Species and Goals.

Species Outcomes	
10-Year Business Plan Goals	
Louisiana black bear	Increase gene flow from low to moderate between Tensas Basin and White River Basin populations
Swamp rabbit	Increase abundance of swamp rabbits by 15% over baseline within monitored project sites >250 acres

Prospective Species

The following prospective focal species require additional information and/or investment before NFWF can include them as focal species with measurable conservation goals in the business plan.

Table 2: Prospective Aquatic Species and Planned Actions.

Prospective Species: Planned Actions	
Freshwater Fish	Invest in identifying focal species, determine baselines and develop a business plan goal that can be monitored at an appropriate scale. Investigate species response to hydrologic connectivity in the Mississippi River system, including the reconnection of oxbow lakes (assess by 2021).
Forest birds	Invest in a monitoring effort to evaluate forest bird occupancy (measured in number of territories) on WRE easements. Data should evaluate linkage between forest condition, patch size and the # of breeding birds. Prothonotary warbler is potentially a good indicator species for bottomland hardwood forest condition.
Waterfowl	Evaluate state aerial survey data as a potential indicator of waterfowl response to habitat restoration actions. Mallard[3] is likely an appropriate indicator species for bottomland hardwood forest habitat restoration efforts that increase available energy resulting in improved carrying capacity for waterfowl. Invest in projects to validate bioenergetics habitat models supporting waterfowl goals in the LMAV region.

[3] Mallard and wood duck are the two waterfowl species most likely to benefit from management that improves mast production in bottomland hardwood forests. The LMAVJV bioenergetics model is used to forecast improvements in available energy of targeted habitats and resulting in improved carrying capacity for waterfowl, expressed as duck energy days (DED's). It is important to recognize that survey data will be challenging to use for linking management interventions and response due to weather (freezing events), disturbance and detection issues.

Geographic Focus

The geographic footprint of the Lower Mississippi Alluvial Valley Business Plan encompasses the Mississippi Delta and alluvial floodplain and follows the boundary adopted by the LMVJV partnership. States that fall within this region include parts of Arkansas, Illinois, Kentucky, Louisiana, Mississippi, Missouri, and Tennessee. Conservation investments will be targeted within five focal areas that were selected based on bottomland hardwood restoration and management priorities identified by the Conservation Delivery Networks and priority aquatic restoration reaches outlined by the LMRCC and USACE in the Lower Mississippi River Resource Assessment (Figure 1). Additional criteria that informed focal area selection included: opportunities to expand upon existing forest blocks to increase habitat for Louisiana black bear and connect existing populations; concentrations of existing forest where management treatments will be needed during the business plan timeframe to sustain and increase food production for waterfowl; and low-cost, high priority aquatic restoration sites that will likely benefit freshwater fish focal species, once identified. Table 3 describes the five focal areas, and the focal species and activities we anticipate funding within them. Note: While these focus areas will be a main focus of dollars, it does not mean that all projects will fall in these territories.

Table 3: Focal Areas by Habitat and Species.

Focal Area	Anticipated Conservation Action	Species
N. Mississippi River	Aquatic and floodplain habitat restoration	freshwater fish species
White River	Bottomland hardwood wetland restoration and enhancement and aquatic habitat restoration	waterfowl, swamp rabbit, forest birds, and freshwater fish species
Tallahatchie	Bottomland hardwood wetland restoration and enhancement	waterfowl, forest birds, and swamp rabbit
Boeuf-Tensas	Bottomland hardwood wetland restoration and enhancement and aquatic habitat restoration	Louisiana black bear, waterfowl, swamp rabbit, forest birds, and freshwater fish species
Lower Red/Atchafalaya	Bottomland hardwood wetland restoration and enhancement and aquatic habitat restoration	waterfowl, swamp rabbit, forest birds, and freshwater fish species

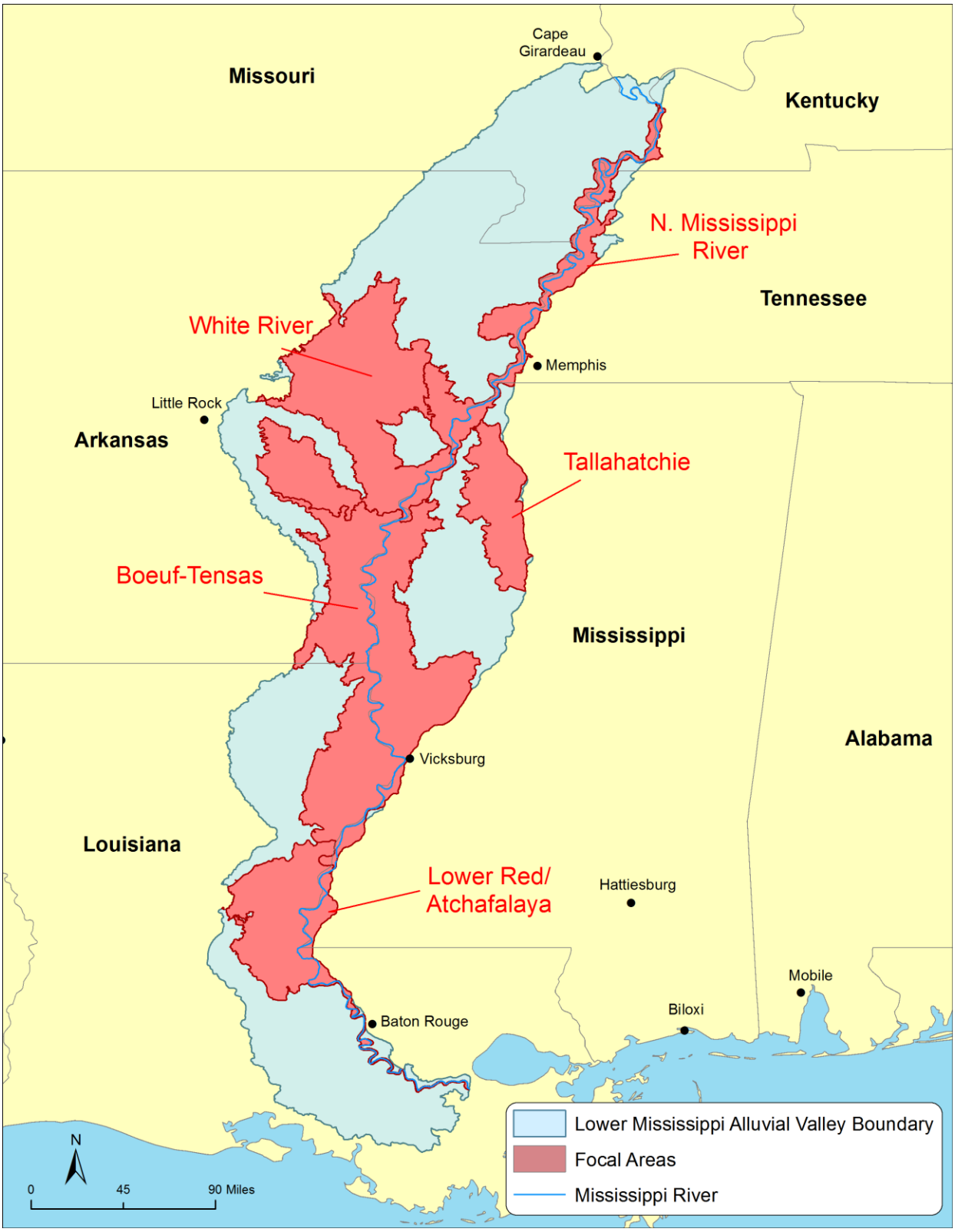

Figure 1. Lower Mississippi Alluvial Valley Focal Areas

Implementation Plan

The following strategies are proven to benefit bottomland hardwood wetland ecosystems and in-stream habitats with the overarching goal to maximize wildlife and water quality benefits. NFWF will fund projects implementing these strategies to support the goals and outcomes described in this plan. The results chain in Figure 2 provides a model for how the collective strategies are predicted to contribute to the identified conservation outcomes.

Strategy 1: Improved management and restoration of bottomland hardwood wetland habitats to benefit associated species

1.1 Bottomland Hardwood Forest Enhancement and Maintenance – Enhance and maintain existing bottomland hardwood forests to improve forest habitat structure and understory condition on public and private lands.

1.1.1 Mechanical/Herbicide/Thinning: Strategies may include pre-commercial thinning, invasive species control, crop tree release and residual stocking to improve forest stand structure, and tree and understory species composition to benefit wildlife. Preference will be given to projects that enhance and maintain forest habitat on protected lands, including but not limited to, lands enrolled in the NRCS' WRE or Conservation Reserve Program, as well as properties adjacent to, or within close proximity to large blocks of existing bottomland forest habitat.

1.1.2 WRE Forest Inventory and Assessment: Complete inventories and assessments of existing WRE forests to document stand stocking and species composition. This information will guide decisions on how to design forest management treatments to improve wildlife habitat.

1.2 Bottomland Hardwood Forest Restoration – Restore bottomland hardwood forests in targeted areas that expand upon core blocks of existing bottomland hardwood forest and create corridors between existing blocks of bottomland hardwood forest to promote wildlife dispersal and expansion. For the purposes of this business plan, restoration refers to the establishment of new bottomland hardwood forests, including reforestation of harvested sites and afforestation of cropland.

1.2.1 Bottomland Hardwood Plantings: Strategies that may be employed to establish new bottomland hardwood stands on public and private lands include site preparation (e.g., herbicide, mechanical site prep.) and planting of bottomland hardwood seedlings.

1.2.2 Natural Regeneration: Practices that promote natural regeneration of bottomland hardwood forests may also be supported.

1.3 Target Outreach, Education and Assistance to Private Landowners, Forest Practitioners, and Other Key Constituencies – Throughout the focal geographies and the larger LMAV landscape, NFWF will invest in strategies to continue to grow the universe of willing landowners and knowledgeable practitioners, increase landowner adoption of conservation practices, and address barriers to

restoring forested wetland and aquatic habitats and improving associated fish and wildlife populations.

1.3.1 Demonstration sites: NFWF will support demonstration projects that are designed to engage public and private landowners, foresters and land managers and other key partners to increase bottomland hardwood restoration and implementation of enhancement treatments to improve wildlife habitat value of existing bottomland hardwood forests. Preference will be given to projects that address enhancement and management of existing bottomland hardwood forests established through WRE.

1.3.2 Outreach and Education: Support capacity for outreach, education, training, technical assistance and implementation of practices to increase bottomland hardwood wetland restoration and enhancement on private and public lands. Where appropriate, opportunities to leverage capacity to increase participation in Farm Bill and other financial assistance programs to restore and enhance bottomland hardwood wetlands on private lands and/or engage private industry to advance habitat restoration and enhancement will be given priority.

- Engagement with the public to increase awareness of and support for bottomland hardwood wetland restoration may be considered. In addition to demonstration sites (1.31), investments to improve forest practitioners' technical knowledge of management treatments that will achieve desired forest conditions for wildlife through peer-to-peer learning, workshops, and field days will be considered.
- Black Bear – Activities might include potential for capacity for outreach, education, training, technical assistance and implementation of practices to promote human-bear coexistence and improve perceptions towards Louisiana black bears in the LMAV. Engagement with the public to increase awareness of and support for Louisiana black bear recovery, such as workshops and outreach events that reduce opposition to Louisiana black bear recolonization, will be considered.

1.3.3 Advance Market-Based Solutions or Incentives: Pilot market-based solutions or incentives that stimulate landowner participation in bottomland hardwood wetland restoration, enhancement, and protection practices. Projects should effectively align with other existing private landowner initiatives or programs, such as U.S. Fish and Wildlife's Partners for Fish and Wildlife Program and USDA's Working Lands for Wildlife, as appropriate.

1.4 Bottomland Hardwood Forest Habitat Conservation – Conserve high quality bottomland hardwood habitat or key sites targeted for strategic bottomland hardwood restoration and/or enhancement.

1.4.1 Conservation Easements: Support high leverage, targeted conservation easements that protect the highest quality intact existing habitat, or strategic sites that are identified for bottomland hardwood habitat restoration. Support may include covering transactional costs or direct investment in the purchase. Conservation projects, those looking to enhance or restore habitat can be included as a part of a broader easement project to also restore and/or enhance bottomland hardwood wetland habitat.

1.5 Restore Wetland and Floodplain Hydrology – Improve hydrological connectivity of wetland and floodplain habitats to improve water quality and wildlife habitat. Strategies include connecting

water features between adjacent tracts on public and private lands, as well as lands enrolled in WRE. Improve wetland habitat and function through vegetation management, managing for moist soil plants, and installation of low-maintenance water control structures, such as flashboard risers, for water management capability.

Strategy 2: Additional aquatic habitat restoration and enhancement

2.1 Improve Aquatic Connectivity and Water Quality – Remove or retrofit aquatic barriers, such as dikes and levees, to improve flows between rivers and side channels to increase habitat connectivity for fish and other aquatic species. Reroute agricultural runoff to constructed or restored wetlands, rehabilitate or stabilize ditches and/or gullies, and/or establish buffer strips to benefit water quality. Implement proof-of-concept approaches to increase the frequency and duration of oxbow connection to the river main stem.

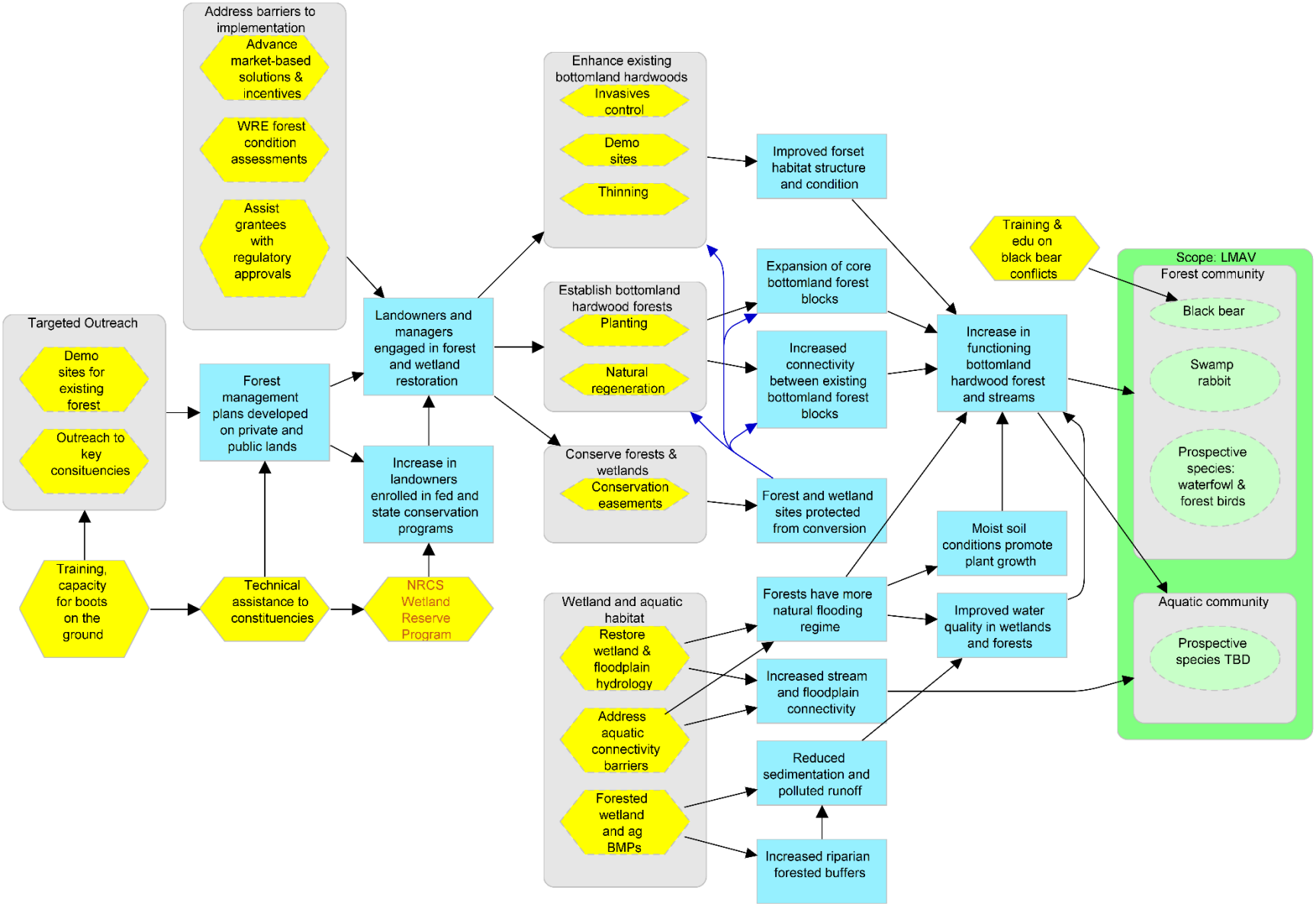

Figure 2. Results chain depicting the relationship of various strategies (yellow hexagons) within the business plan to each other, to the intermediate results (blue boxes) and ultimately to an increase in LMAV species (green ovals).

Risk Assessment

Risk is an uncertain event or condition, which, if it occurs, could have a negative effect on a program's desired outcome. We assessed seven risk event categories to determine the extent to which they could impede progress towards our stated business plan strategies and goals during the next 10 years. Below, we identify the greatest potential risks to success and describe strategies that we will implement to minimize or avoid those risks, where applicable.

Table 3: Risk Assessment.

RISK CATEGORY	RATING	RISK DESCRIPTION	MITIGATING STRATEGIES
Economic Risks	**Moderate**	Insufficient funds to pay landowners to implement bottomland hardwood management treatments. In addition, lack of market incentives for timber harvest from thinning creates an issue for the long-term sustainability of forest management after the initial grant. Increases in crop prices (rice, corn, soybeans, cotton) could create disincentive to take land out of production.	NFWF will look to connect landowners with markets for timber to address long-term sustainability issues. To encourage landowners to take cropland out of production, the business plan will look to target marginal lands that would not produce high crop yields.
Environmental Risks	**Moderate**	More frequent and sustained flooding and drought events could delay restoration project implementation. Invasive animal (feral hogs) and plant species can affect tree plantings and outcompete native vegetation.	NFWF will structure project period of performance to incorporate multiple restoration seasons. Work with NRCS on hog eradication funds, and fund invasive plant removal at high priority restoration sites.
Financial Risks	**Moderate**	Current funding available for aquatics work is limited.	Budget plan includes fundraising strategies to target additional public and private funding sources for bottomland hardwood wetland implementation and aquatic strategies.
Institutional Risks	**Moderate**	Current lack of technical and organizational capacity for project partners to guide landowners in managing bottomland hardwoods. Forest landowners required to obtain a Compatible Use Agreement (CUA) from NRCS before they can undertake forest management on lands enrolled in WRE. Currently unclear whether NRCS has the capacity to address the volume of CUAs that will arise under this plan.	NFWF business plan will fund outreach and technical capacity that can address this risk, but some organizations are hesitant to take on more grant-funded staff positions. NFWF could award longer-term grants to provide more long-term financial security.
Regulatory Risks	**Low**	Aquatic restoration projects will require USACE permits which could delay implementation.	Coordinate closely with USACE and project partners to focus on permitted projects or ones with high probability of obtaining permits within a reasonable. NFWF will continue to build relationship with USACE, and connect grantees with them to facilitate project permitting and

			other approvals that might be required.
Scientific Risks	**Low**	Limited data on bottomland hardwood forest structure and condition could limit ability of project partners to move forward with management at scale. Limited data has also hindered development of appropriate goals for freshwater fish species.	Projects are underway in AR, LA, MS to assess current condition of WRE-planted bottomland hardwood forests, but will take 2-3 years to complete. NFWF staff time will be dedicated to ensure that freshwater fish goals are developed with experts based on rigorous science.
Social Risks	**Moderate**	Risk that landowners are not willing to participate in restoration and management activities associated with government programs or allow assessment and monitoring of species impact on their lands. Current black bear harvest in southeastern Arkansas and possible future expansion of harvest could slow progress towards the goal of improving genetic diversity in the northern portion of the LMAV.	The plan's outreach, demonstration sites, and technical assistance strategies encourage landowners to participate. NFWF will explore transfer of landowner marketing best practices from other regions to engage landowners in this region. Work with project partners to incorporate education about human-bear conflict as part of their outreach strategies.

Monitoring & Evaluating Performance

Performance of delivering the Lower Mississippi Alluvial Valley business plan will be assessed at project and program scales. At the project scale, individual grants will be required to track relevant metrics from the table below for demonstrating progress on project activities and outcomes and to report out on them in their interim and final programmatic reports. At the program scale, broader habitat and species outcomes will be monitored through targeted grants, existing external data sources, and/or aggregated data from relevant grant projects, as appropriate. In addition, NFWF may conduct an internal assessment or commission a third-party evaluation at a future stage of the program to determine program outcomes and adaptively manage. In some cases, these course corrections may warrant increased investment; however, it is also possible that NFWF would reduce or eliminate support if periodic evaluation indicates that further investments are unlikely to achieve intended outcomes.

Table 4: Metrics for Tracking Business Plan Strategies and Outcomes.

Category	Strategy/ Outcome	Metric	Baseline	Goal	Data Source
Bottomland Hardwood Wetlands	Enhance and maintain existing bottomland hardwood forests[4]	Improved management practices - # of acres under improved management	0	25,000	Grantee
	Establish new acres of bottomland hardwood forest	Bottomland hardwoods - Land restoration - # of acres restored	0	25,000	Grantee
	Restore and enhance bottomland hardwood wetland hydrology	Restored hydrology - # of acres with restored hydrology	0	15,000	Grantee
	Conserve high priority existing bottomland hardwood tracts or sites identified for bottomland hardwood restoration	Conservation easements - # of acres protected under long-term easement	0	30,000	Grantee
	Engage private landowners through outreach and technical assistance to implement conservation practices on their lands	Outreach/education/ technical assistance - # of landowners reached	0	5,000	Grantee
		Outreach/education/ technical assistance - # of landowners demonstrating behavior change	0	500	Grantee

[4] Forest inventory and assessments are underway in Arkansas, Louisiana, and Mississippi to evaluate the condition of existing bottomland hardwood forests established through NRCS' Wetland Reserve Easement (WRE) program. NFWF expects completion of these assessments by 2021.

Louisiana black bear	Increase gene flow among populations by increasing the amount and connectivity of bottomland hardwood forests[6]	Level of genetic differentiation	Low flow (0.20 differentiation)	Moderate gene flow (0.15 differentiation)	Targeted grantee/ contractor
	Monitor species movement between populations	# of populations monitored	0	2	State agency, contractor
Swamp Rabbit	Increase abundance of individuals by 15% over baseline within monitored project sites >250 acres	Abundance increase over baseline	Variable	15% over baseline	Grantee/contractor
Aquatic Habitats	Improve connectivity and in-stream habitat	Fish passage improvements – Acres of lake habitat (oxbows) opened	0	500	Grantee
		Fish passage barriers - # of stream miles opened	0	35	Grantee
	Improve water quality through improved management of agricultural lands	BMP implementation for nutrient or sediment reduction - # of acres with BMPs to reduce nutrient or sediment loads	0	10,000	Grantee
Aquatic species	Improve habitat connectivity and restore access to spawning habitat	Metric that measures freshwater fish species response to connectivity and inundation of the Mississippi River system	Under development	Under development	To be determined

Budget

The following budget shows the estimated costs to implement the business plan activities. NFWF will have to raise funds to meet these costs; therefore, this budget reflects NFWF's anticipated engagement over the business plan period of performance and it is *not* an annual or even cumulative commitment by NFWF to invest. This budget assumes that current activities funded by others will, at a minimum, continue.

BUDGET CATEGORY	Yrs 1-5	Yrs 6-10	Total
Strategy 1. Improved management and restoration of bottomland hardwood forest and wetland habitat to benefit forest-associated species			
1.1 Bottomland Hardwood Forest Enhancement and Maintenance	$4,250,000	$4,250,000	$8,500,000
1.2 Bottomland Hardwood Forest Restoration	$2,500,000	$2,500,000	$5,000,000
1.3 Target Outreach and Assistance to Private Landowners and Forest Practitioners (Incorporated in other line items)	-	-	-
1.4 Bottomland Hardwood Forest Habitat Conservation	$250,000	$250,000	$500,000
1.5 Restore Wetland and Floodplain Hydrology	$2,500,000	$2,500,000	$5,000,000
1.6 Planning, Research and Monitoring	$593,750	$468,750	$1,062,500
Strategy 2. Additional aquatic habitat restoration and enhancement			
2.1 Improve Aquatic Connectivity and Water Quality	$2,250,000	$2,250,000	$4,500,000
2.2 Planning, Research and Monitoring	$281,250	$156,250	$437,500
Other			
Program Assessment and Evaluation	$0	$250,000	$250,000
TOTAL BUDGET	**$12,625,000**	**$12,625,000**	**$25,250,000**

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