National Fish and Wildlife Foundation

Business Plan for Forestland Stewards Initiative

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INTERNATIONAL (A) **PAPER**

The National Fish and Wildlife Foundation would like to extend its sincere gratitude to International Paper for its generous financial contribution to the Forestland Stewards Initiative, which supported the development of this business plan. This science-based plan will serve as a blueprint for investments made through the Forestland Stewards Initiative 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.

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Executive Summary

The National Fish and Wildlife Foundation (NFWF) developed this Business Plan (Plan) to identify the strategies necessary to meet the conservation goals of the Forestland Stewards Initiative (Initiative), a pioneering partnership between International Paper (IP) and NFWF developed in 2013 to enhance forest ecosystems for the benefit of wildlife species and freshwater systems, while promoting and supporting working forests in eight states across the Southeastern United States. International Paper has provided a generous 5-year contribution of $7.5 million to the Foundation to underwrite the Initiative.

The Business Plan outlines the type and magnitude of benefits that will be realized through the Initiative and the potential obstacles (risks) to achieving those gains. Importantly, the Plan also provides a roadmap for investing available and anticipated resources to achieve the Initiative's goals over the next 5 years. The strategies and activities discussed in this plan do not represent solely NFWF's view of the actions necessary to achieve the identified conservation goals. Rather, it reflects the consensus or majority view of the many federal, state, academic and organization experts consulted during plan development.

The Forestland Stewards Initiative is of particular importance to the Southeast, which contains some of the most biologically diverse and economically important systems in the entire world. The Southeast supports 68 percent of the animal species[1] found in the United States (Wear and Greis, 2002), while supplying 55 percent[2] of the nation's timber harvest, 16 percent of global industrial wood supply (PINEMAP, 2011) and supporting more than 1 million people working in the forest-based wood products industry (Wear and Greis, 2013). Although threats to species of conservation concern are widespread across the Southeast, threats are especially concentrated within the Coastal Plain and the Appalachian-Cumberland subregions (Wear and Greis, 2012). Both the economic value of working forests and the biological uniqueness of the region underscore the importance of this Initiative and its goals.

Targeted Landscapes and Strategies

The Forestland Stewards Initiative focuses on three landscapes in the Southeast: The Coastal Carolinas, the Piney Woods of Texas and Louisiana and the Cumberland Plateau region -- stretching from northwestern Alabama to the Kentucky/West Virginia border (Figure 1). For the purposes of the Business Plan, the Coastal Carolinas and Piney Woods are combined because the conservation strategies for both are primarily focused on recovering and improving a shared native southern pine ecosystem - the longleaf pine. This forest ecosystem once covered 90 million acres from Virginia to Texas and is one of the globe's most biologically diverse ecosystems (America's Longleaf Restoration Initiative [ALRI], 2009). Bottomland hardwood habitat restoration is also a priority in the Coastal Carolinas and Piney Woods, as is connecting large forest tracts or hubs to enhance wildlife corridors and to strengthen working forest aggregations in these regions.

In the Cumberland Plateau, the Business Plan defines strategies for restoring and enhancing the upland shortleaf pine/oak savanna ecosystem as well as riparian and freshwater habitat across this landscape. Similar to longleaf, shortleaf pine once dominated vast stretches of the Southeast and other portions of the U.S., and provides important habitat for numerous woodland and savannah dependent species. The Cumberland Plateau also supports some of the richest freshwater diversity in the U.S. (The Nature Conservancy [TNC], 2003), and the Plan addresses strategies and goals to improve the health of

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[1] For the purposes of this calculation animal species include mammals, birds, reptiles and amphibians.
[2] Percentage of total volume.

Figure 2. Map showing Forestland Stewards Landscapes and Longleaf Pine Historic Range across the southeastern United States.

freshwater systems through restoration of native upland and riparian forests and strategic in-stream habitat improvements.

Within all three landscapes, smaller focal areas were selected to further guide where investments could be targeted in order to achieve maximum conservation impact relative to the Initiative's goals.

A key strategy across all of these landscapes and one that is critical to achieving the goals of the Initiative is providing support to landowners to keep working forests working. In the South, more than 86 percent of forests are on private lands (Wear and Greis, 2013), and the Initiative will seek to provide incentives, technical assistance and other tools to support landowner efforts to re-establish and maintain healthy native forest systems on working lands.

Conservation Outcomes

Through the investments made in support of this plan over the next 5 years, we anticipate that more than **16,000 acres of forestlands will be restored**, **187,000 acres of private and public forests will be enhanced** through improved management, and **1,000 miles of stream** habitat will be improved for native fish and other aquatic species (Figure 3).

Based on scientific literature and expert opinion, the business plan hypothesis is that these habitat restoration achievements will lead to species outcomes, specifically increased populations of indicator species (Figure 3). For the purposes of the business plan, indicator species signify the presence of a set of
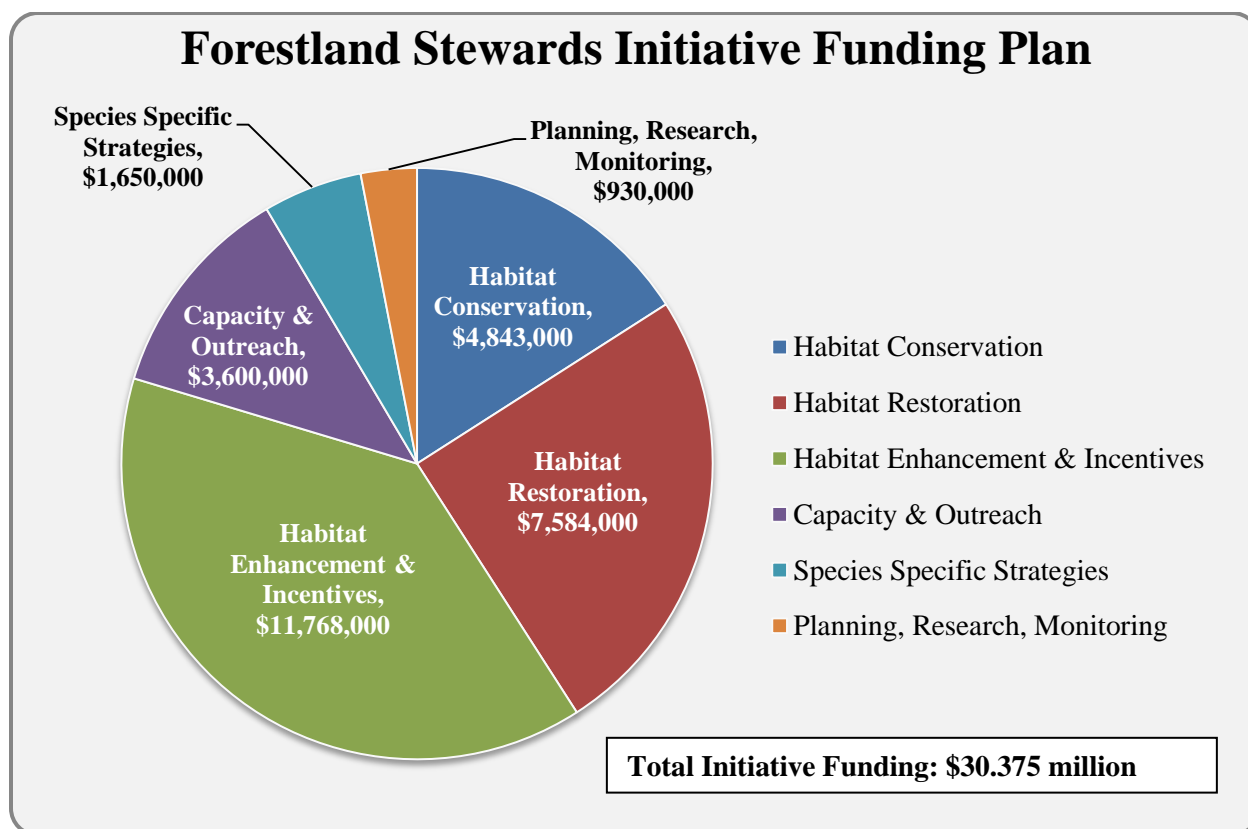
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other species with similar habitat needs and therefore serve as a proxy for ecological health and resilience. Based on the best available science, the business plan sets "targeted species outcome ranges" for four (4) indicator species. It is anticipated that by implementing the strategies defined in the business plan, the population of these indicator species will increase. Given the dynamic nature of these ecosystems, the plan does not set strict population goals for each species but rather sets "species targets" to track over time. Setting species targets is important because it helps NFWF and its partners to focus on those implementation strategies that seek to achieve multiple ecological benefits, including benefits to fish and wildlife.

An Initiative scorecard has been created to illustrate and track the progress toward achievement of the Initiative's conservation goals and outcomes. The scorecard includes both near-term (5-year) and long-term (15-year) goals and outcomes (Figure 3). Estimated outputs and outcomes have been "rolled-up" for all three landscapes to represent the cumulative impact of the Initiative.

Funding Plan

For each landscape, implementation strategies have been organized into six categories. Each of those strategies will be invested in to accomplish the overall goals of the program. The sources of funding that will be used to implement the plan include the donation made by International Paper, funds from NFWF's federal partners including the Department of Defense, USDA Forest Service and Natural Resources Conservation Service, and U.S. Fish and Wildlife Service and other corporate and philanthropic donations. The final source of funding will come from grantees that match IP and NFWF funding. In total, the Plan's budget is estimated at roughly $30.3M over 5 years (Figure 2).

Figure 2. Forestland Stewards Funding Plan Chart

Forestland Stewards Initiative Funding Plan

- Species Specific Strategies, $1,650,000
- Planning, Research, Monitoring, $930,000
- Habitat Conservation, $4,843,000
- Capacity & Outreach, $3,600,000
- Habitat Restoration, $7,584,000
- Habitat Enhancement & Incentives, $11,768,000

Legend:
- Habitat Conservation
- Habitat Restoration
- Habitat Enhancement & Incentives
- Capacity & Outreach
- Species Specific Strategies
- Planning, Research, Monitoring

Total Initiative Funding: $30.375 million

The funding plan will be evaluated on a year-to-year basis as the program is implemented and progress is evaluated. Adjustments will be made in order to best meet the goals of the Plan in the most cost efficient manner. Herein are the needed strategies and activities that support the outlined goals for the Forestland Stewards Initiative.

Scorecard: Forestland Stewards Initiative

Figure 3. Forestland Stewards Scorecard

Initiative Duration:
2013-2017 (yr 2 of 5)

Forestland Stewards
NFWF   INTERNATIONAL PAPER

Initiative Investment:
Partner Funding - $10.125 Million

| $3.69 million |

Match Funding - $20.250 Million

| $7.09 million |

Total: $30.375 Million

Program Coverage:

Initiative Strategies:

Habitat Restoration:

| 9,200 acres | 16,000 | Acres of longleaf, shortleaf, & riparian forest restored

Habitat Enhancement & Incentives:

| 98,370 acres | 187,000 | Acres of longleaf, shortleaf and bottomland hardwood forest enhanced

| 16 miles | 1,000 | Miles of stream under improved management

Habitat Conservation:

| 0 acres | 14,500 | Acres of longleaf, shortleaf, & riparian forest under long-term easement.

Capacity & Outreach:

| 2,610 landowners | 3,000 | Private landowners reached through technical assistance

Species-Specific Strategies:

| 0 groups | 35 | Groups of red-cockaded woodpeckers translocated

Planning, Research & Monitoring:

| 0 surveys | TBD | Fund stream barrier surveys in order to determine priorities for future connectivity restoration

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Targeted Outcomes for Species (Long-Term 15 years):

Northern Bobwhite (*Colinus virginianus*)
Target: Increase population by 1,200 – 1,500 coveys
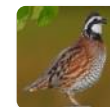
Bachman's Sparrow (*Aimophila aestivalis*)
Target: Increase regional populations by 3,100-3,800 pairs

Red-cockaded Woodpecker (*Picoides borealis*)
Target: Increase regional populations by 65-80 groups

Prairie Warbler (*Dendroica discolor*)
Target: Increase population by 8,000-10,000 pairs

Other Conservation Outcomes:

Index of biological integrity (IBI)
Target: Improved or maintained score in 75% of stream segments where strategies are implemented

Mature Longleaf Pine Habitat
Target: Increase mature longleaf pine by 48,000-58,000 acres

Definition of Key Terms

Below is a list of common terms and acronyms that are used throughout the Business Plan.

America's Longleaf Restoration Initiative (ALRI): A collaborative effort of multiple public and private sector partners that actively supports range-wide efforts to restore and conserve longleaf pine ecosystems. The vision of the partners involved in the ALRI is to have functional, viable longleaf pine ecosystems with the full spectrum of ecological, economic and social values inspired through the voluntary involvement of motivated organizations and individuals.

Burn Crew: Teams of individuals trained and certified in the application of prescribed fire. Burn crews may be made up of individuals from multiple agencies or organizations or may be housed under one entity. Burn crews are often developed to pool limited expertise and resources to maximize ecological return. In some cases, crews may be responsible for a broader array of forest management activities, such as mechanical or herbicide control and may be referred to as Ecosystem Restoration Teams or Ecosystem Support Teams.

Flagship Species: Popular, charismatic species that serve as symbols and rallying points to stimulate conservation awareness and action.

Focal Areas: For the purposes of this Business Plan, Focal Areas are approximately defined boundaries within the Coastal Carolinas, Piney Woods and Cumberland Plateau landscapes, developed to guide potential investments made through this Initiative. Data, methods and rationale used to select and define the Focal Areas are described in the Materials and Methodology section of this plan.

Fragmentation: The process by which a large expanse of habitat is transformed into a number of smaller patches of smaller total area, isolated from one another by a matrix of habitats unlike the original.

Indicator Species: A species whose presence indicates the presence of a set of other species and whose absence indicates the lack of that entire set of species.

Keystone Species: A species that has a disproportionately large effect on its environment relative to its abundance.

Local Implementation Teams: Local Implementation Teams are comprised of representatives from state and federal agencies, non-profits and private landowners that help organize, plan and deliver conservation actions to restore and enhance the longleaf pine ecosystem across the historic longleaf range. Local Implementation Teams typically are centered on Significant Geographic Areas and Sites (defined below and within the America's Longleaf Restoration Initiative Range-Wide Conservation Plan for Longleaf).

Maintenance Class Longleaf: A mature condition of longleaf pine habitat that supports key indicator species and typically requires a management regime that is primarily limited to regular prescribed burning and does not require other extensive maintenance treatments to maintain habitat conditions. Specific longleaf stand conditions have been defined through extensive literature review and stakeholder input compiled by the Jones Center for Ecological Research and is generalized for use across the full longleaf range (Figure 4). This term's definition is still being refined by the America's Longleaf Restoration

Initiative. There is an ongoing effort to develop a tiered system for understanding the relative 'classes' or development stages for longleaf. The table below lists the parameters:

Figure 4. Specific Parameters Defining Maintenance Class Longleaf Pine Habitat for Business Plan

Metric	Parameters
Basal Area	40 – 70 square feet per acre
Canopy Cover	40 – 60 percent
Midstory Cover	Less than 20 percent
Understory Cover	Greater than 65% contiguous herbaceous; at least 20% grasses

Source: McIntyre, R. Kevin. 2012. Longleaf Pine Restoration Assessment: Conservation Outcomes and Performance Metrics, Final Report. Joseph W. Jones Ecological Research Center. 92 p.

Seral (Sere): An intermediate stage found in ecological succession in an ecosystem advancing towards its climax community. In many cases more than one seral stage evolves until climax conditions are attained.

Significant Geographic Area (SGA): The America's Longleaf Restoration Initiative developed the Range-Wide Conservation Plan for Longleaf Pine that identifies core areas, typically anchored by significant public lands, such as national forests, state forests, or military installations, where longleaf pine currently exists and around which coordinated efforts are being developed to further restore, enhance, protect, and connect longleaf pine on an ecosystem level. SGAs have been identified and apply only to the Coastal Carolinas and Piney Woods landscapes.

Translocation: The deliberate, human-mediated movement of living organisms from one area to another. As a conservation tool, translocation can be used to increase the range of a species through reintroduction to an area from which it has been extirpated, or to increase numbers in a critical population by adding individuals from a wild or captive population. It is one of the main management options for restoration and conservation of threatened animal species.

Umbrella species: Are species selected for making conservation related decisions, typically because protecting these species indirectly protects the many other species that make up the ecological community of its habitat. Species conservation can be subjective because it is hard to determine the status of many species. Umbrella species can be used to help select the locations of potential reserves, find the minimum size of these conservation areas or reserves, and to determine the composition, structure and processes of ecosystems.

Conservation Strategies for the Forestland Stewards Landscapes

The Coastal Carolinas and Piney Woods landscapes form the approximate eastern and western boundaries of the historical range for longleaf pine. In addition, both landscapes include significant occurrences of bottomland hardwoods, often intersecting with longleaf pine stands and providing important habitat and migration corridors for a number of species of conservation need, as well as water quality benefits. Linked by these common ecosystems and similar conservation needs, the strategies and resulting outcomes proposed for the Coastal Carolinas and Piney Woods landscapes are being addressed together for purposes of this business plan.

The Cumberland Plateau landscape, as defined by the Initiative (Figure 1), is addressed separately from the Coastal Carolinas and Piney Woods. Featuring complex landforms and diverse ecosystems, including some of the most biologically rich freshwater habitats in the United States, the conservation needs and intricate link between forest health and health of aquatic systems within this region necessitate a broader suite of strategies to address these challenges than those identified for the longleaf dominant landscapes.

The following sections outline the conservation needs, implementation plan for key strategies and risks, and anticipated outcomes for these Forestland Stewards landscapes.

Coastal Carolinas and Piney Woods

Conservation Need

Longleaf pine once extended throughout large portions of the Coastal Carolinas and Piney Woods landscapes. Similar to other areas within its historical range, longleaf pine has experienced a significant decline within these two landscapes (Figure 5). Fire suppression is one of the most significant risks to the longleaf system along with fragmentation from development (Wear and Greis, 2012). Longleaf ecosystems support a host of unique wildlife species, which rely on both the forest canopy as well as associated understory. Range-wide, twenty nine species of plants and animals are listed as federally threatened or endangered due to the decline of the longleaf forest (ALRI, 2009).

Within the Coastal Carolinas and Piney Woods landscapes, the

Figure 5. Range-wide trends in longleaf dominant and longleaf forest type from 1970 to 2010.
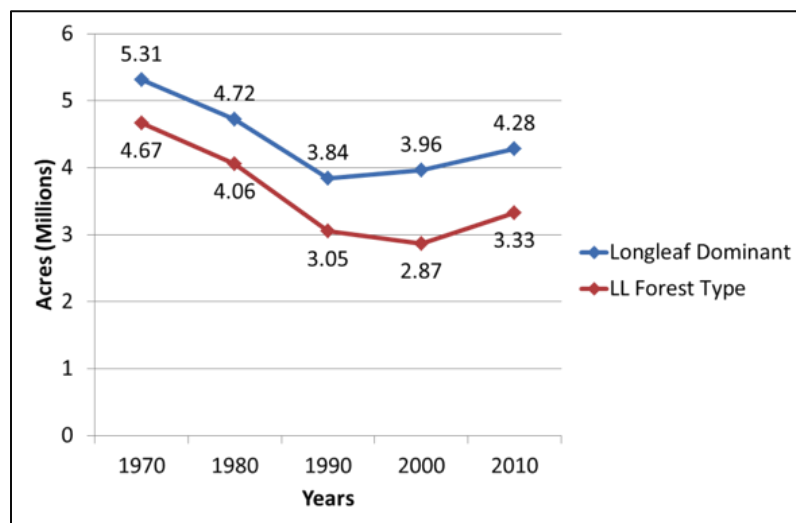
(Source: USDA Forest Service, Forest Inventory and Analysis, Forest Inventory Online State Reports, August 2013.) Note: Longleaf Dominant includes both longleaf forest type and longleaf/oak forest type.

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Initiative will re-establish longleaf pine with the aim of increasing the amount of favorable habitat conditions supporting increased populations of three species whose presence offers strong indication of a healthy longleaf system: Red-cockaded Woodpecker, Bachman's Sparrow, and Bobwhite Quail (McIntyre, 2012). All three species prefer an open understory of grasses maintained by regular, prescribed burning.

Selection of indicator species for the longleaf pine geographies represent three of the four species recommended as a result of a stakeholder and literature review process conducted by the Jones Ecological Research Center (Appendix A: Materials and Methodology). Populations of all three of these species have been severely reduced due to the loss of longleaf pine habitat. Red-cockaded woodpecker (RCW) is dependent upon a mature canopy cover that can provide cavity trees, creating a priority for what has been termed "maintenance class" longleaf stands (McIntyre, 2012) and the loss of this habitat form has resulted in its listing as Endangered by the US Fish and Wildlife Service. Red-cockaded woodpecker serves as an ideal indicator species. It has a broad range across the entire longleaf pine historical landscape and its presence is an extremely strong indication that broad species assemblages will also be able to thrive (U.S. Fish and Wildlife Service [USFWS], 2003).

While RCW is a strong indicator for mature, maintenance class longleaf, the presence of bobwhite quail and Bachman's sparrow are helpful indicators for successful restoration of early successional habitat. These bird species require open understory maintained by fire and will respond quickly to regular fire treatments. Their populations will often be reduced as the longleaf ecosystem ages and then populations will increase again as the stand reaches maturity if there is continued management for an open understory (U.S. Geological Service [USGS], 2014).

Prescribed burn | Credit: The Nature Conservancy, NC Chapter

Although a majority of the existing mature, low density forests indicative of maintenance class are currently located on public lands, significant opportunities exist to partner with private landowners to restore longleaf and implement management practices that support mature, woodland-savanna forest conditions. Informing private landowners of the multiple benefits of longleaf, such as its wind-resistance and drought tolerance, as well as opportunities for multiple income streams such as timber harvesting and sustainable pine straw raking, will be an important component of this Initiative.

Many of the geographies targeted for longleaf restoration also contain opportunities for restoration of adjacent bottomland hardwood habitat and has been identified as a priority for local implementation teams[3]. This ecosystem faces many of the same threats and pressures from land use conversion to agriculture, fragmentation from development and the spread of invasive species. Threats unique to this system include altered hydrology and water quality impacts from upstream municipal and agricultural sources. Restoration of these forest types will result in conservation of habitat for a wide variety of species including Louisiana black bear, American woodcock, wood stork and swallow-tailed kite (Appendix A: Materials and Methodology).

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[3] Information derived from stakeholder feedback during October 8 & 9, 2013 stakeholder calls.

Figure 6 below provides a brief overview of relevant baseline conditions documented within both landscapes. Although situational differences exist between the landscapes, the core strategies identified within the Implementation Plan are transferrable across both landscapes, unless specifically referenced. This information can be used to inform how resources are allocated to specific strategies to ensure the greatest conservation return on investment.

Figure 6. Differences relevant to baseline conditions within the Piney Woods and Coastal Carolinas landscapes

	Coastal Carolinas	Piney Woods
Private lands within the landscape	91%	85%
Private forestlands within SGAs	42%	74%
Private lands with longleaf within the landscape	58%	43%
Private landowner type	Mix of large forestland investors, hunting plantations and small (<500 acres) owners	Largely large forest investors and small (<500 acres) owners
Longleaf age class	Mix of age classes on public and private lands	Private lands tend to have younger longleaf (<10 years), with ecological outcomes 15 to 25 years away
Longleaf seedling stock	Relatively stable supply of longleaf seedlings to meet planting needs	Supply can be unstable, causing reduced planting due to low seedling availability
Source populations	Source populations relatively prevalent, reducing needs for translocation	Source populations are concentrated in limited locations, making translocation a priority for successful species outcomes

Strategies for restoring longleaf pine and bottomland hardwood habitat in the Coastal Carolinas and Piney Woods landscapes will largely be targeted within several focal areas, which are described in Appendix A: Materials and Methodology and illustrated in Figure 7 and Figure 8 respectively. These focal areas encompass considerable hubs of existing longleaf pine, defined as Significant Geographic Areas (SGAs) in the America's Longleaf Restoration Initiative Range-Wide Conservation Plan for Longleaf, and in most locations include coordinated efforts already underway to restore and connect longleaf habitat, improve associated wildlife populations, and support working forests.

Figure 7. Map of Coastal Carolinas Focal Areas
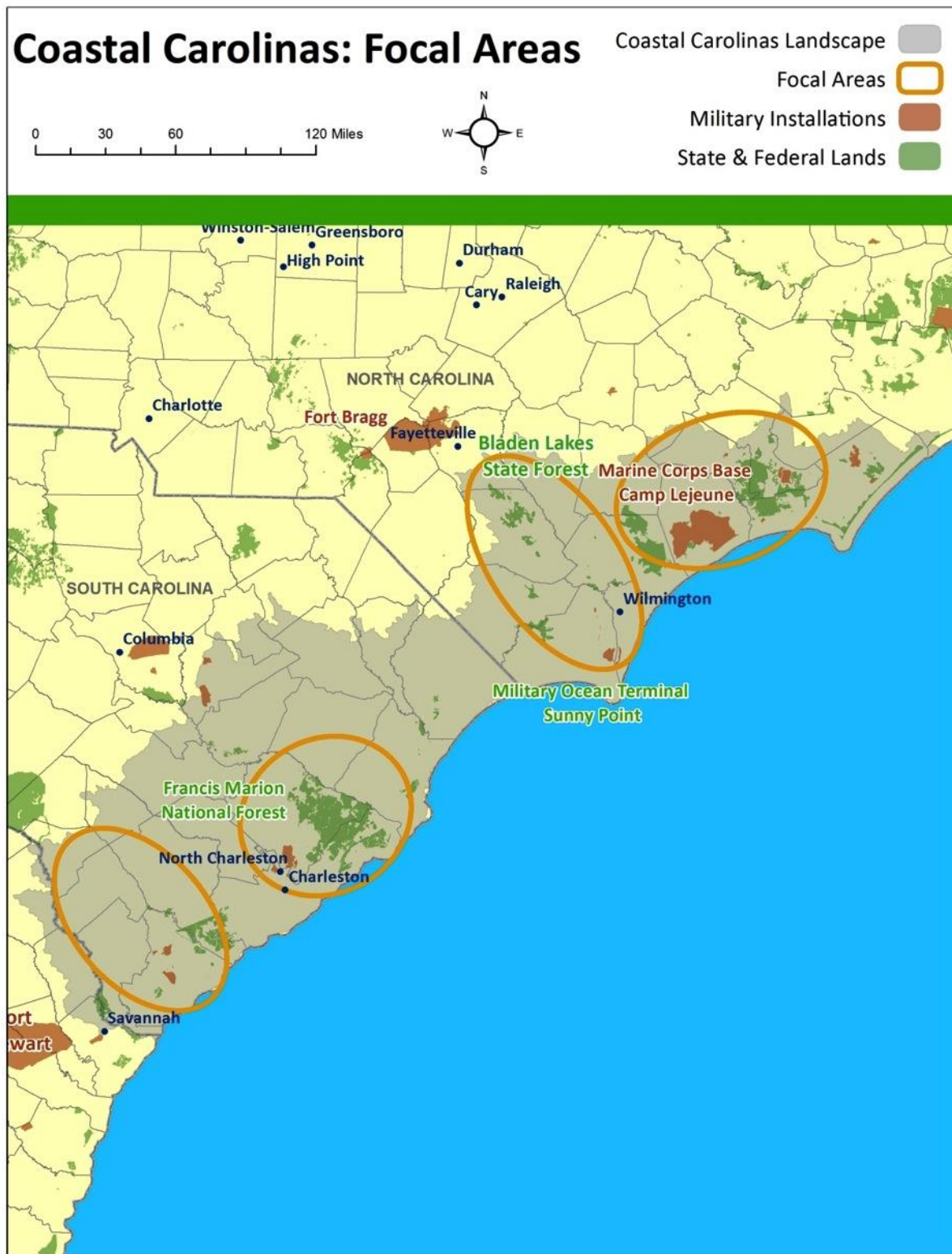
Figure 8. Map of Piney Woods Focal Areas
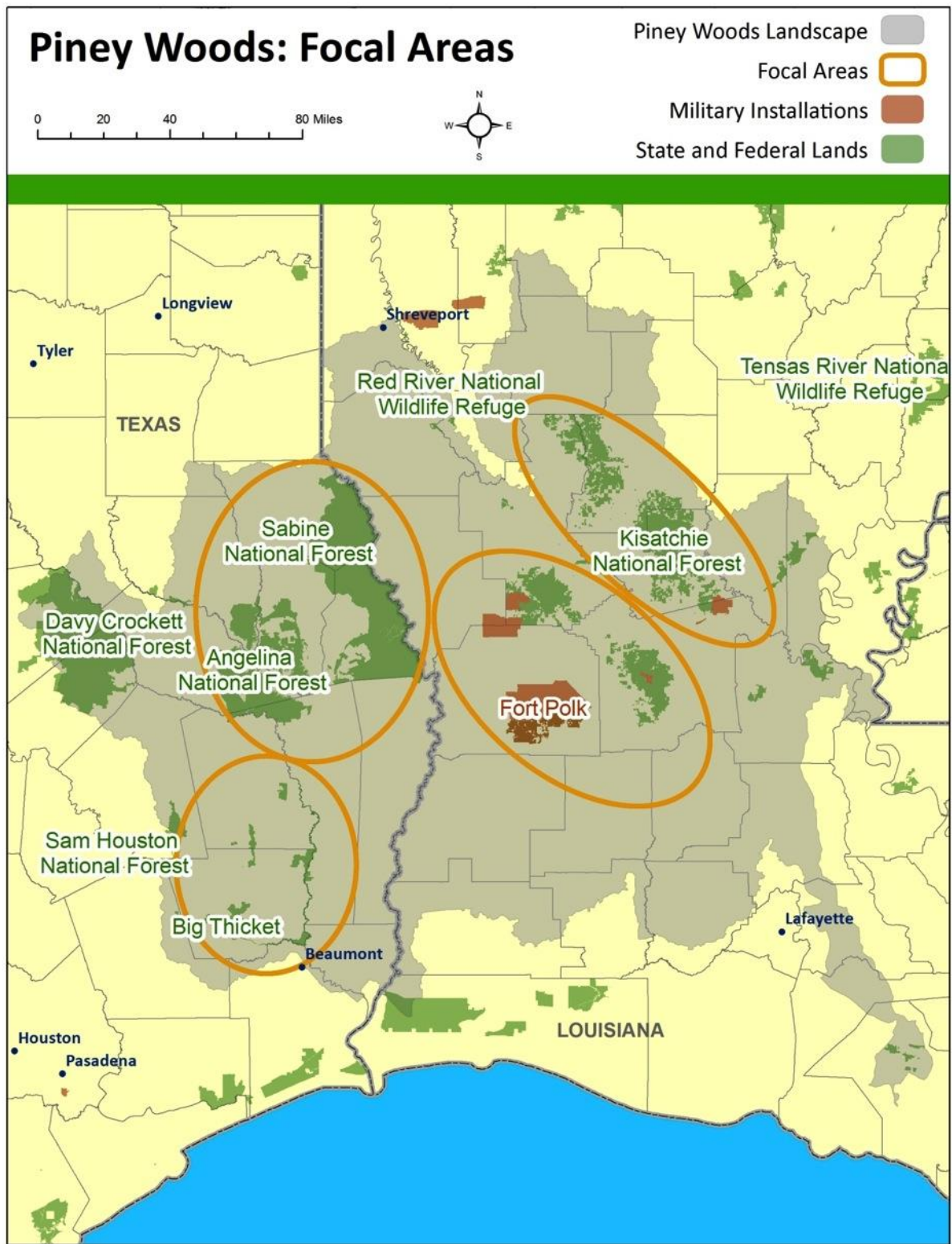
The conceptual model below (Figure 9) is a visual depiction of the conservation situation for longleaf pine ecosystems in the Coastal Carolinas and Piney Woods. Threats to these ecosystems (pink) are categorized as two broad stresses: Habitat Degradation and Habitat Fragmentation. The model depicts multiple Contributing Factors (orange) to these Threats that relate to the use and management of fire, general vegetation management practices, land use conversion from forests in which ecological processes can thrive, and the presence of invasive plants. Yellow diamonds contain descriptors denoting one or more Strategies grouped in accordance with NFWF's standard strategy categorization, and link to the most relevant Contributing Factors. (NFWF's strategy categorization includes (1) habitat restoration, (2) habitat enhancement and incentives, (3) habitat conservation (land protection), (4) capacity and outreach, (5) species-specific strategies, and (6) planning, research, and monitoring.)

Figure 9. Conceptual Model for the Coastal Carolinas and Piney Woods Landscapes
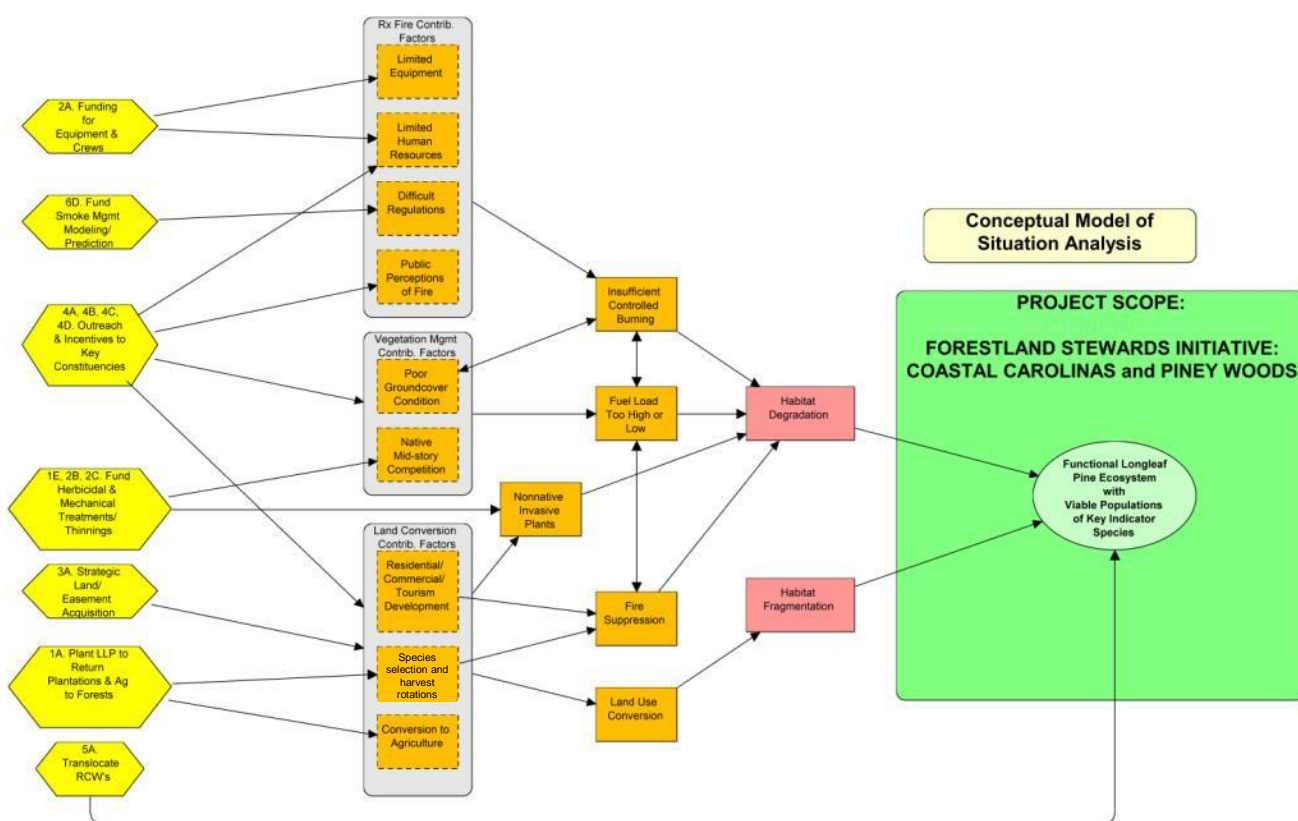
Conceptual Model Legend
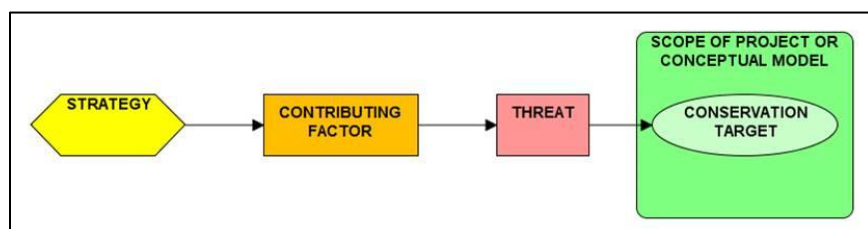
Implementation Plan

The strategies below represent the actions needed to achieve the target outcomes (Figure 9) within the Coastal Carolinas and Piney Woods landscapes as assessed through interviews, literature review and stakeholder meetings (Appendix A: Materials and Methodology). The strategies are grouped into six

categories. *Habitat Restoration*, or creation of new habitat where it currently does not exist, and *Habitat Enhancement and Incentives* (including management), which involves the necessary treatments to maintain or improve existing habitat, are the core strategies for achieving goals in all three initiative landscapes. The other four categories: *Habitat Conservation; Capacity and Outreach*; *Species-Specific Strategies*; and *Planning, Research and Monitoring* are supporting strategies to ensure the success and, where possible, the permanence of investments in restoration and enhancement.

Following each strategy is an assessment of *risks* that might reduce the ultimate outcomes (Appendix B: Risk Analysis). Although the intent of this Plan is to identify the known risks, it is beyond the capacity and scope of the Forestland Stewards Initiative to address all identified risks through implementation of strategies. Specific actions that may mitigate certain risks are identified where such actions are known or considered feasible under this Initiative. Diagrams, or "results chains", (Appendix C: Results Chains) were developed to assess the efficacy of strategies and visually represent how strategies influence results, reduce threats, and meet conservation targets.

Longleaf pine seedling| Credit: Mark Godfrey, The Nature Conservancy

Habitat Restoration Strategies

Restoration is a critical part of the strategy for expanding hubs of longleaf pine and building corridors for wildlife growth and movement. Regular planting of new longleaf stands also ensures a mix of age classes as the forests mature. However, because restoration is expensive and longleaf can be costly to manage, planting is recommended only in the most strategic locations as a result of planning, research and monitoring (Figure 24).

Within the Coastal Carolinas landscape, there are significant large tracts of private lands, many with some existing form of conservation easement or protection (particularly in South Carolina) that may offer unique opportunities to focus restoration activities on acreage that can provide some assurance of permanence.

For bottomland hardwoods, there is a need to re-establish native forests. Strategies should be focused on opportunities that are adjacent to existing seed sources for possible natural regeneration.

The business plan recommends focusing investments on the following target restoration actions in order to achieve the identified objectives.

<u>Actions</u>

- Restore longleaf pine in targeted areas prioritized based on research and monitoring
- Prepare site and plant desired hardwood species in bottomlands, particularly along riparian corridors
- Maintain and enhance planted acreage through invasive control, intermediate thinning (longleaf pine) and additional under planting as necessary

<u>Risks and mitigating actions</u>

Possible risks to habitat restoration efforts include the high cost of restoration, potential for conversion of planted acres (longleaf or bottomland) to other land uses, as well as delayed or discontinued longleaf pine management treatments that could potentially compromise desired habitat conditions. To mitigate these risks, the following additional actions are recommended:

- o Limit planting to areas with permanent conservation (easement or fee) and to designated focus areas and corridors
- o Target funds and planting to protected lands where there is an established commitment to wildlife management
- o Target restoration activities to areas adjacent to longleaf that is already receiving appropriate management treatments
- o Support efforts to provide landowners with management expertise to minimize costs and expand knowledge base

Habitat Enhancement and Incentives Strategies

The longleaf pine ecosystem is fire dependent and burning every two to three years is needed in order to maintain understory characteristics for representative species and regulate competition from other species. To achieve these outcomes, support for burn crews and direct silvicultural treatments for forest structure and composition is needed (Figure 23).

An estimated 58% and 43% of all longleaf is located on private lands in the Coastal Carolinas and Piney Woods regions respectively[4]. In order to ensure appropriate management of this longleaf and increase acres on private lands, coordination with cost-share programs for establishment and maintenance of longleaf through Natural Resources Conservation Service (NRCS), US Fish and Wildlife Service (USFWS) and state sources will be most effective. Two high-leverage opportunities include supplementing existing cost-share programs to promote more frequent burning on those lands that are approaching maintenance class and working with large private hunting plantations with existing conservation easements in southeastern South Carolina to establish longleaf.

Timber Investment Management Organizations (TIMO) and Real Estate Investment Trusts (REIT) partners own an estimated 5.5 million acres within the Piney Woods landscape and 2.5 million acres

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[4] These percentages were developed using USGS GAP land cover data for longleaf pine and overlaying draft GIS SGA boundaries available through the ALRI or from the local implementation teams. Note that boundaries of SGA's are being refined by local implementation teams. The amount of private and public land within each landscape was also evaluated using the USGS Protected Areas Database.

within the Coastal Carolinas landscape[5]. These landowners could be valuable partners in large-scale conservation. However, TIMOs and REITs do not have access to NRCS cost-share funding and because of their fiscal responsibility to investors often need to harvest forests at the end of a rotation. Support for projects that test new innovative incentives to these landowners that could allow for long-term ecological outcomes will be an important strategy.

Currently, greater technical capacity exists within the Coastal Carolinas to support habitat enhancement. Additional planning and organization is needed within the Piney Woods landscape to ensure that adequate technical support and resources are available and targeted to the highest priority areas.

For bottomlands, this strategy involves focusing resources on improving the condition of existing bottomland hardwoods degraded by over harvest or invasive species.

The business plan recommends focusing investments on the following target enhancement and incentive actions in order to achieve the identified objectives.

Actions

- Fund the use of prescribed fire, including firefighter training, seasonal crews, equipment, and burn unit planning
- Leverage cost-share incentives from NRCS and assist with targeting resources to high priority sites and/or practices
- Support innovative partnerships with large timber investment managers
- Fund capacity for outreach and assistance to landowners, including management planning and facilitating enrollment in available cost-share assistance programs
- Fund pre-commercial thinning on sites 10-20 years old that are adjacent to existing longleaf
- Fund herbicide treatments to prevent re-sprouting of competing species and mechanical treatments if necessary, focusing on acreage most likely to require minimal re-treatment
- Thin undesirable competing species to promote release of hardwood understory or allow for natural regeneration in bottomlands

Risks and mitigating actions

Possible risks to habitat enhancement and incentives efforts include potential for longleaf pine management treatments, such as prescribed fire, to be discontinued or delayed including as a result of landowner concerns over liability, compromising habitat conditions; a relatively small number of burn window days; smoke management conditions and public resistance to controlled burns make it difficult to implement burn plans; and funding at federal and state level for conservation cost-share programs may be reduced or redirected away from longleaf. In addition, the economic imperative faced by many industrial landowners to harvest at the end of rotation may present challenges to achieving long-term ecological outcomes. For bottomland hardwoods, upstream impacts, such as pollution or rechanneling of streams could negatively impact habitat conditions. To mitigate these risks, the following additional actions are recommended:

  o Augment capacity and train landowners to burn their own lands as well as certified burn managers to enable burning during windows of optimal conditions

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[5] Core Working Forest Areas Mapping, prepared by the Open Space Institute in collaboration with the Partnership for Southern Forestland Conservation (unpublished data). Available at: http://www.osiny.org/site/PageServer?pagename=Research_TIMO_North_Carolina

- o Consider developing a cost-share program that supplies funding for long-term burning (*e.g.* a burning endowment)
- o Consider the history of burning to evaluate the potential for long-term, sustained burning rotations on specific sites before providing funding
- ○ Create effective public communications plans for specific events, and about fire generally as an ecological management and wildfire prevention tool
- o Focus bottomland strategies in watersheds where conditions upstream are supportive of and unlikely to negatively influence improvements to bottomland habitat

Habitat Conservation Strategies

Permanent, voluntary land conservation is one of the best ways to ensure that investments in restoration and enhancement result in ecological outcomes and ensure the availability of land for working forests. It is also critical to conserve existing stands of mature longleaf that are already providing ecological values and habitat for key indicator species.

Land conservation is a high cost strategy and the Initiative may be best able to leverage other conservation dollars through funding transaction costs, planning and implementation of targeted acquisitions and easements. Often, a project's timely execution can hinge on deal aspects such as survey and appraisal work, an environmental report or the capacity of an organization to seek and find multiple funding sources. Pairing protection and restoration efforts is a potentially high-leverage opportunity.

The Coastal Carolinas currently has a greater amount of mature longleaf than the Piney Woods landscape. However, additional mapping is needed to better identify locations of mature longleaf stands within the Coastal Carolinas to guide future conservation efforts. Such mapping is addressed within the Planning, Research, and Monitoring Strategies category below.

For bottomlands, "strip" easements along streams provide dependable, permanent protection for this ecosystem and are relatively cost effective.

The business plan recommends focusing investments on the following target conservation actions in order to achieve the identified objectives.

Actions

- Support high leverage, targeted conservation transactions that protect the highest quality intact existing habitat. Support may include covering transactional costs, targeting management dollars to conservation projects or direct investment in the purchase
- Incentivize conservation projects by committing restoration or enhancement funds contingent on the completion of the transaction

Risks and mitigating actions

Sustained, limited funding levels for land conservation are a potential risk to habitat conservation efforts. To mitigate this risk, the following additional actions are recommended:

- o Coordinate with The Nature Conservancy and other organizations focused on developing a range-wide longleaf pine land conservation strategy to ensure high priority targets are supported as funding is available

Capacity and Outreach Strategies

Strategic coordination and effective communication between longleaf pine practitioners and landowners is important for insuring that information is reaching appropriate audiences, duplicate outreach and restoration efforts are minimized and limited resources are directed to the highest priority areas and restoration needs. Across the historical longleaf range, local implementation teams are facilitating coordination at the state and local levels. To date, 16 local implementation teams have been established with several more planned for development during the Initiative timeframe. However, there is still a need for additional capacity to support outreach and restoration objectives identified in the Plan.

Currently, the Coastal Carolinas landscape has greater capacity than the Piney Woods including a more established network of local implementation teams.

The business plan recommends focusing investments on the following targeted capacity and outreach actions in order to achieve the identified objectives.

Actions

- Focus outreach to private landowners adjacent to or in close proximity to established longleaf that is receiving appropriate management treatments at regular intervals
- Target and train landowners in prescribed burning management who are interested in long-term forest/wildlife management to reduce demands on burn crews
- Support for coordination, information sharing and administration of local implementation teams within SGAs to facilitate the development and refinement of geospatial targeting of restoration and enhancement activities and track and measure progress

Risks and mitigating actions

Possible risks to capacity and outreach efforts include a potential for decreased institutional support for longleaf and increased turnover of property ownership, which may lead to a change in land management priorities as land is sold or passed down to heirs. To mitigate these risks, the following additional actions are recommended:

- o Encourage federal and state agencies and non-profits to continue support and prioritization of longleaf restoration
- o Support outreach and education efforts to private landowners that include information on estate planning and resources available for transition of property to the next generation

Species-Specific Strategies

Translocation is recommended in forests where species populations are isolated and habitat has been restored but species are not present. This strategy is particularly relevant to the translocation of Red-Cockaded Woodpecker (RCW). The Coastal Carolinas landscape has significantly more and larger RCW populations than the Piney Woods landscape, which may require a greater amount of translocation to establish new populations or augment existing small populations. USFWS and state resource agencies are crucial partners in these efforts through programs such as Partners for Wildlife, Southern Range Translocation Cooperative and the Safe Harbor program.

The business plan recommends focusing investments on the following species-specific actions in order to achieve the identified objectives.

<u>Actions</u>

- Support translocation of individuals and groups of red cockaded woodpecker, as dictated by the southern range translocation cooperative

<u>Risks and mitigating actions</u>

Possible risks to species-specific efforts include the potential that translocation of individuals and groups will not be successful in creating viable populations, as well as resistance by private landowners who are concerned with restrictions as a result of managing for a threatened or endangered species. To mitigate these risks, the following additional actions are recommended:

- o Ongoing research and experience with translocation is increasing success of these efforts and should be applied to appropriate situations
- o Safe harbor agreements can be used to ease landowner concerns

Planning, Research and Monitoring Strategies

Because at least 25 to 35 years are needed for newly planted longleaf to host[6] the full range of species (McIntyre, 2012), restoration and enhancement activities should be focused, wherever possible, on those landscapes that are most likely to receive necessary management over the long term in order to reach maintenance class. The following considerations may be helpful in assessing projects most likely to reach ecological maturity:

1) Acres are in proximity to existing longleaf (to allow for burning efficiencies and assurance that the acreage will be part of a larger habitat block)
2) Acres are under permanent conservation (to prevent conversion)
3) Acres that will be burned beyond the term of the grant (to ensure maintenance of habitat)
4) Acres are in maintenance class or approaching maintenance class (providing much greater assurance the acres will provide species outcomes in the near future)
5) Acres are adjacent to source populations (to allow for some assurance of long term species outcomes)

Furthermore, to be able to estimate and track species outcomes, it would be beneficial to begin to collect better information on longleaf conditions and treatment within an electronic mapping platform. To facilitate this planning, there is a need for a common range-wide map of the location of longleaf forests that can serve as a base for local implementation teams to identify priority areas and corridors within which they would target outreach, restoration and management.

Bottomland hardwood restoration and enhancement will largely occur adjacent to longleaf priorities. However, it is valuable for practitioners to identify bottomland priorities and track their progress towards restoration of this system. As part of this business planning process, OSI developed a map illustrating the location of existing bottomland hardwood forests using USGS GAP land cover data and an estimate of

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[6] Stands between 25 – 35 years may provide sufficient foraging habitat for red-cockaded woodpecker, but are typically not mature enough to support nesting habitat (McIntyre, 2012).

restoration priorities using NRCS SSURGO flooding probability[7]. The map can be used to identify where extensive flooding is occurring (i.e. natural floodplains), but lands have been converted out of bottomland hardwood forest.

The business plan recommends focusing investments on the following targeted planning, research and monitoring actions in order to achieve the identified objectives.

Actions

- Support development of a range-wide map of longleaf locations and incentivize implementation teams to identify priority areas and corridors and track the location of plantings, burning and other management activities
- Support completion of technical work such as establishment of desired forest conditions[8] and modeling of species responses to restoration activities
- Incentivize use of bottomland hardwood mapping tools through reference in grant applications
- Funding for additional modeling and prediction around smoke management

Risks and mitigating actions

Possible risks to planning, research and monitoring efforts include the potential for lack of consensus by stakeholders on development of range-wide longleaf maps, insufficient funding to provide continuity and coordination on technical work, and public perception of prescribed burning and smoke becomes increasingly unfavorable and political support further diminishes. To mitigate these risks, the following additional actions are recommended:

- Improve tools for smoke prediction aimed at reducing possible conflicts

Conservation Outcomes

Often habitat conditions take many decades to mature and develop to a point where they can self-sustain native diversity. In order to address this, we differentiate between outputs stemming directly from grant activity, which will be measured in the five-year Initiative timeframe (Figure 10), and longer term targeted species outcomes, which will begin to be registered during the life of the Initiative and then continue to be measured over an additional 10-15 years after the Initiative (Figure 11).

As with any initiative, there is the risk that immediate outcomes might not be achieved due to political, economic or other external factors. To the extent possible, this business plan seeks to identify potential risks and assess the ability of the Initiative to mitigate these risks through direct strategies (see implementation plan and Appendix B: Risk Analysis for more details). Because of the long timeframe and complex habitat conditions associated with some of the targeted outcomes for this Initiative, risks are particularly relevant. The three major risks for targeted outcomes include:

1) Delayed or discontinued longleaf pine management and burning treatments that compromise habitat conditions. Further delaying burning by even one or two years can create a significant setback in outcomes and this by far is the most significant risk to these outcomes. Selecting

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[7] This tool is a regional adaptation of a method developed by the Institute for Renewable and Natural Resources at Texas A&M University for the Trinity River Information Management System (http://trims.tamu.edu/).
[8] Descriptions of forest landscape condition goals - http://www.fs.fed.us/restoration/CFLRP/glossary.shtml

strategic sites where burning is already occurring nearby or where landowners are committed to wildlife management may reduce the likelihood of this risk.

2) Once habitat conditions are achieved, species populations are able to expand into the newly created habitat. This is a significant issue for any forests not adjacent to existing source populations. Translocation is a generally effective, although expensive, way to reduce this risk.

3) Development, road expansion or other land uses that fragment the landscape degrade the quality of habitat or create additional risks that reduce the ability for regular prescribed burning. Strategic conservation planning to concentrate restoration on large ownerships adjacent to existing protected lands will be important to reducing this future risk.

Targets for performance outputs for longleaf pine and bottomland hardwood forest systems and species outcomes for longleaf pine are addressed in the tables below. Conservation outputs depicted in Figure 10 were developed based on estimated investments in targeted strategies within each landscape.

Figure 10. Coastal Carolinas and Piney Woods Conservation Outputs (5-Year Goals)

SYSTEM TYPE	METRIC	COASTAL CAROLINAS	PINEY WOODS	TOTAL
Longleaf Pine	Acres of longleaf pine restored (planted)	7,500	2,500	**10,000**
	Acres of prescribed burning	90,000	40,000	**130,000**
	Acres treated to improve or maintain longleaf pine ecosystem (through herbicide and mechanical treatments)	4,500	2,000	**6,500**
	Number of private landowners reached	1,250	750	**2,000**
	Acres of longleaf pine conserved in fee or easement	8,000	4,500	**12,500**
	Number of groups[9] of RCW translocated	20	15	**35**
Bottomland Hardwoods	Acres of bottomland hardwood restored (planted)	250	250	**500**
	Acres treated to improve or maintain bottomland hardwood ecosystem	250	250	**500**
	Acres of bottomland hardwoods conserved in fee or easement	500	500	**1,000**

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[9] A group consists of 3 to 4 members with one breeding pair

Based on scientific literature and expert opinion[10], the business plan hypothesis is that the restoration achievements outlined in Figure 10 will lead to targeted habitat and species outcomes (Figure 11). Target outcomes are expressed as a range (increase) above baseline population estimates. The plan recognizes that these are dynamic ecosystems with many external factors that can impact species populations. Baseline estimates for red-cockaded woodpecker, Bachman's sparrow, and Northern bobwhite quail are established based on conversations with Local Implementation Teams, the Range-Wide Conservation Plan for Longleaf Pine and State longleaf coalition goals (North Carolina Longleaf Coalition, 2011), USGS GAP landcover data, the USFWS Red-Cockaded Woodpecker Recovery Plan (USFWS, 2003) and The North American Breeding Bird Survey (Sauer, J.R., et al., 2011). Where GIS mapping data was used, all targets are calibrated to the focus areas where the strategies will be applied. A standard deviation of 10% was applied to the outcome ranges to account for potential fluctuations due to external factors. In addition, the Business Plan attempts to identify specific risks, the probability of their occurrence and resulting impact on the Initiative's goals, and the extent to which the recommended strategies will address those risks (Appendix B: Risk Analysis).

Figure 11. Coastal Carolinas and Piney Woods Targeted Outcomes (15-Year Targets)

SYSTEM TYPE	INDICATOR	METRIC	COASTAL CAROLINAS	PINEY WOODS	TOTAL
Longleaf pine	Maintenance class longleaf[11]	Acres of habitat with improved status	33,000 – 41,000 (26-32% increase)	15,000 – 17,000 (18-22% increase)	**48,000-58,000[12] (23-28% increase)**
	Red-cockaded Woodpecker	Number of groups	55-65 (9-12% increase)	10-15 (3-4% increase)	**65-80 (7-9% increase)**
	Bobwhite Quail	Number of coveys[13]	900-1,100 (7-9% increase)	300-400 (14-17% increase)	**1,200-1,500 (8-10% increase)**
	Bachmann's Sparrow	Number of pairs	2,200-2,700 (16-19% increase)	900-1,100 (16-19% increase)	**3,100-3,800 (16-19% increase)**

[10] Over 125 individuals representing 44 government agencies, conservation non-governmental organizations and academia contributed professional opinions and information included in the development of the business plan through interviews and stakeholder meetings. A complete list of participants is included in the acknowledgements section.

[11] See description in the Definition of Key Terms section.

[12] These goals are in addition to the Plan's objective of maintaining existing maintenance class acreage.

[13] Family members with one breeding pair (average 12 birds)

Cumberland Plateau

Conservation Need

The Cumberland Plateau's combination of complex landforms, limestone geology, cold stream systems, and large habitat blocks support some of the richest terrestrial and freshwater diversity in the United States (TNC, 2003). The landscape also contains some of the largest, privately owned tracts in the Appalachian Mountains, providing the potential, through landowner economic incentives and strategic, voluntary land conservation, to maintain the region's large forest blocks. The Forestland Stewards Initiative will improve the health of these freshwater systems through restoration of native upland and riparian forests, support of sustainably managed working forests and in-stream habitat improvements, with a goal of increasing the amount of favorable habitat conditions supporting increased populations of species whose presence offers strong indication of healthy shortleaf pine-oak savanna and riparian forest, as well as freshwater systems. Indicators of ecosystem health used for this region include: Northern Bobwhite quail, prairie warbler, and Index of Biotic Integrity (IBI) as further described in Appendix A: Materials and Methodology.

Prairie warbler | Credit: U.S. Fish & Wildlife Service

Restoration of upland forest systems will target re-establishment of shortleaf and associated oak-hickory woodland ecosystems, a once extensive fire-adapted system occupying much of the interior southeast and now confined to small patches, largely on public lands. Reduction of this system is the result of fire exclusion, pine beetle kill and planting of loblolly for commercial timber plantations. The Tennessee Wildlife Resources Agency, the Bankhead National Forest in Alabama, and the Daniel Boone National Forest in Kentucky have respectively planted approximately 750 acres[14], 485 acres[15], and 2,400 acres[16] in the region, with smaller amounts on a few other public lands. Very little has been planted on private lands, with current market forces, management considerations, and lack of awareness of shortleaf pine as an option, often leading landowners to prefer loblolly pine[17].

As described in the Materials and Methodology section, Northern Bobwhite quail and prairie warbler were selected as indicators of ecosystem health for the shortleaf pine-oak savanna. Both species rely on savannah-like forest conditions, with northern bobwhite quail preferring the more mature, open grassland stages of shortleaf pine-oak woodlands and prairie warbler responding well to early successional habitat created during initial restoration of these forest types (Appendix A: Materials and Methodology).

Some of the region's most biologically diverse watersheds, like the Duck, Elk, and Green Rivers, generally lack large blocks of forest that can filter runoff and reduce sedimentation; others, like the Paint

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[14] Brant Miller, Wildlife Forestry Program Manager, TN Wildlife Resources Agency (personal communication Nov. 18, 2013)

[15] Trip Gaskins, Silviculturalist, Bankhead National Forest (personal communication Nov. 8, 2013)

[16] USDA Forest Service, Daniel Boone National Forest, _Cumberland River Fire Learning Network Project: A Collaborative Forest Landscape Restoration Act Proposal_ (Feb. 9, 2011)

[17] Robin Mayberry, Area Biologist, USDA/NRCS Area 3, Cookeville, TN (personal communication, Nov. 4, 2013)

Rock River watershed, have forested tributaries but poor riparian forest cover along the larger streams. Freshwater systems will benefit from upland restoration alongside riparian and in-stream restoration. Restoration and management of riparian vegetation will assist with filtering sediment and pollutants and help maintain the cool stream temperatures needed for many fish and other freshwater species (Welsch, 1991). Habitat management will also reduce sedimentation and runoff from dirt road networks and abandoned mines. In addition, in-stream management will remove stream barriers in order to improve genetic diversity and reconnect freshwater habitat.

Due to the difficulty in selecting a single indicator species for freshwater health in the Cumberland Plateau landscape, the Initiative will use the Index of Biotic Integrity (IBI) to monitor response to strategies. The IBI measures the presence and abundance of a variety of aquatic insects and fish as a way of gauging stream ecosystem health, and is affected by riparian zone and in-stream conditions and management actions. This measure varies somewhat in its specific technique in different watersheds and states, but is used throughout the region, and has a similar set of scoring standards, such that improvements made to riparian and in-stream conditions can be reflected in an increase in score or the maintenance of an already-favorable score.

Restoration and conservation projects within the Cumberland Plateau will be targeted to six focal areas (Figure 12) capturing freshwater, riparian and upland forest strategies and representing locations with the greatest potential for restoration based on resource mapping, interviews with the practitioners in the field and capacity to carry out the work. The data sources and process used to define the focal areas are described in Appendix A: Materials and Methodology.

Figure 12. Map of Cumberland Plateau Focal Areas
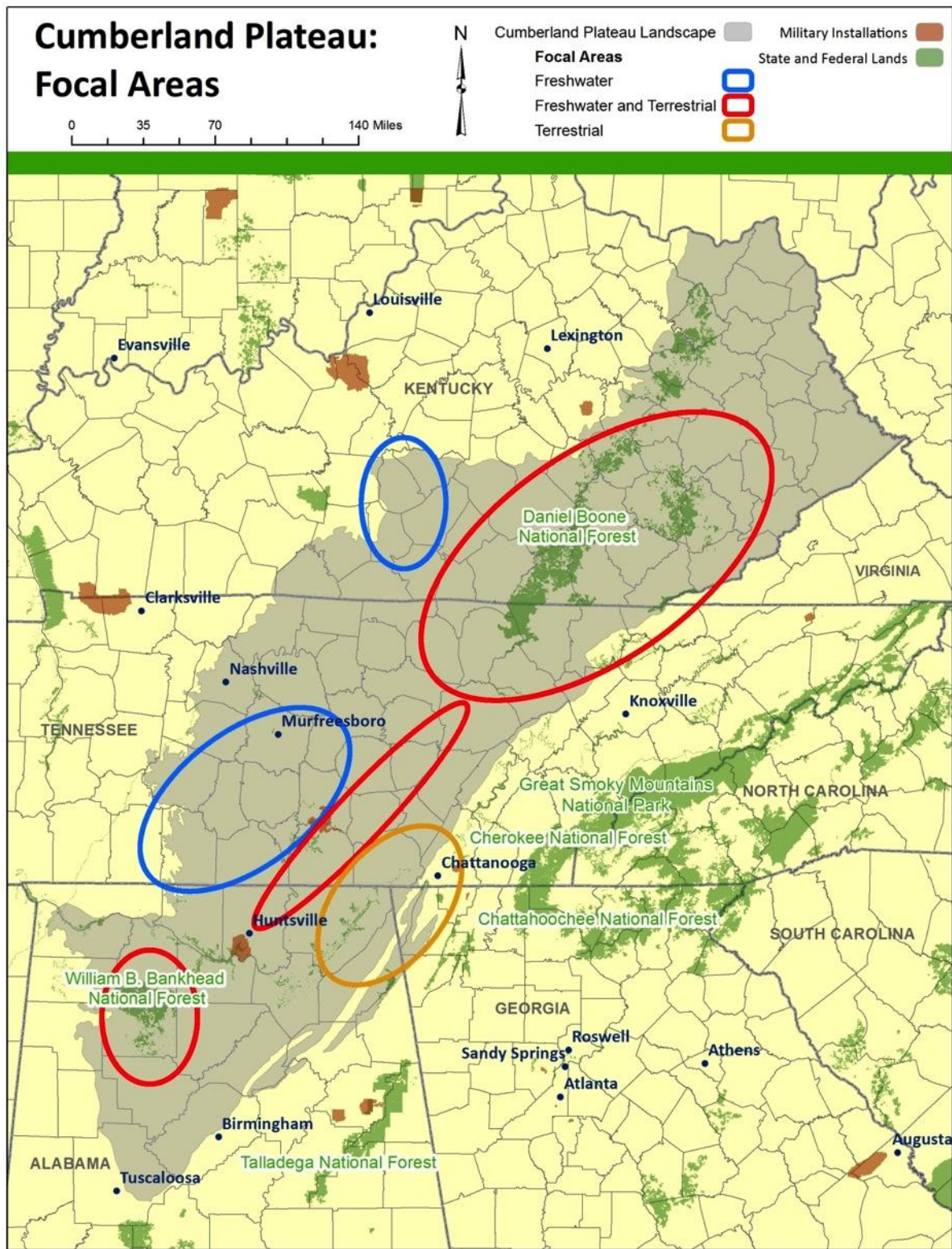
The conceptual model (Figure 13) below is a visual depiction of the conservation situation for shortleaf pine/oak ecosystems and freshwater ecosystems in the Cumberland Plateau. Five major Threats to these ecosystems (pink) are identified: altered fire regime and native invasive pests affecting shortleaf pine/oak forests, and exotic invasive pests, dams and other barriers, and water pollution affecting freshwater systems. While other threats exist, these were identified as having higher potential for intervention through the Forestland Stewards Initiative. The model depicts multiple Contributing Factors (orange) to these Threats that relate to the use and management of fire, vegetation management practices including forestry, and land use practices related to development, agriculture and mining. Yellow diamonds contain descriptors denoting one or more Strategies grouped in accordance with NFWF's standard strategy categorization, and link to the most relevant Contributing Factors. (NFWF's strategy categorization includes (1) habitat restoration, (2) habitat enhancement and incentives, (3) habitat conservation (land protection), (4) capacity and outreach, (5) species-specific strategies, and (6) planning, research, and monitoring.)

Figure 13. Conceptual Model for the Cumberland Plateau

Conceptual Model Legend

30
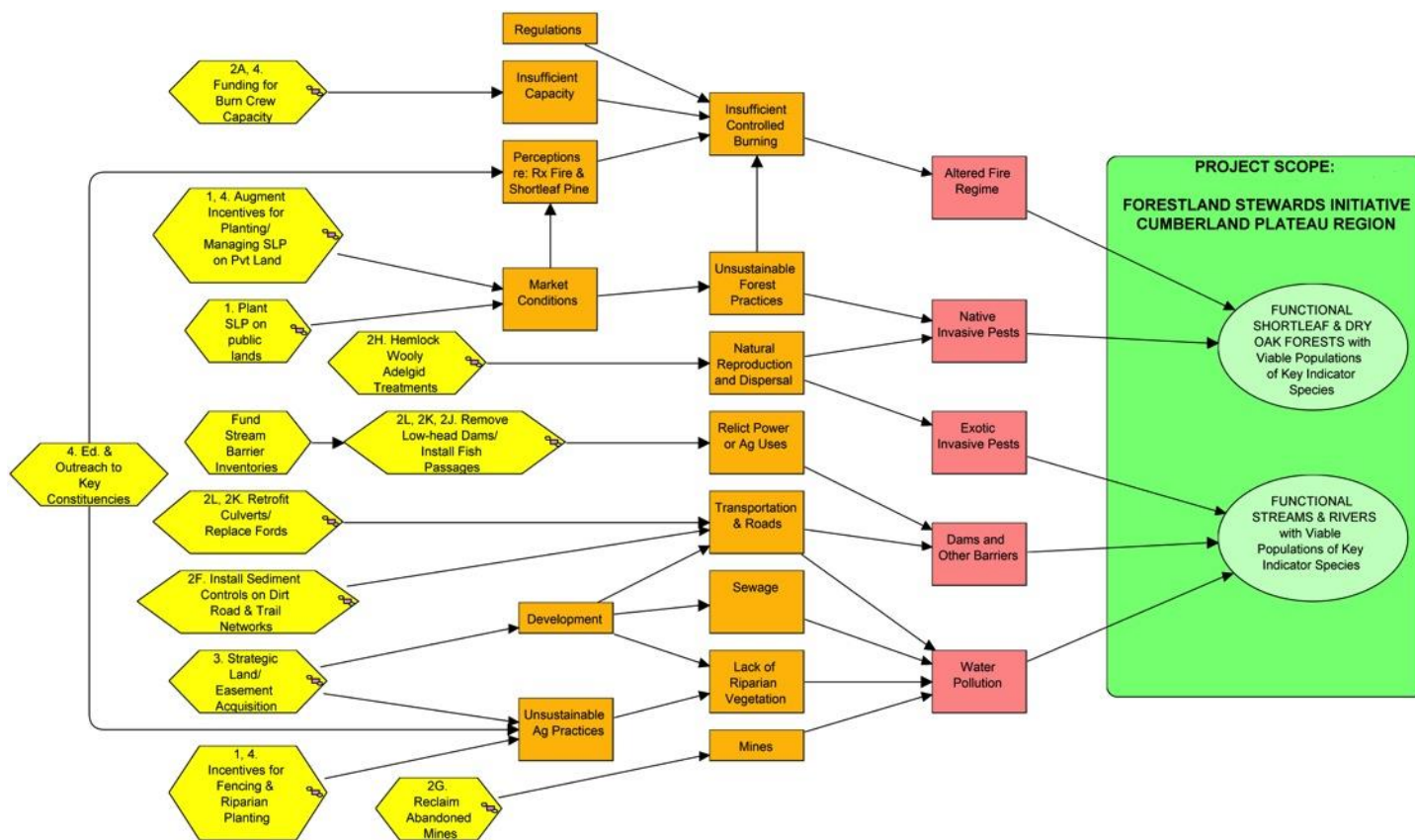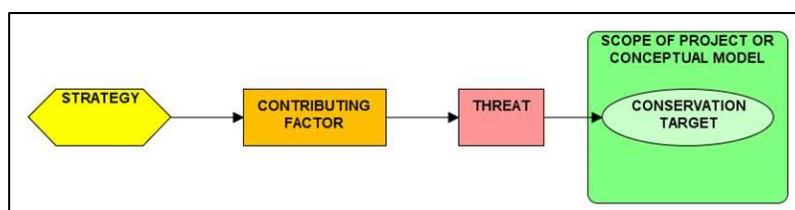
Implementation Plan

The Cumberland Plateau presents a unique opportunity to demonstrate the relationship between healthy, sustainably managed forests and healthy watersheds. Restoring shortleaf pine savanna and riparian forest ecosystems, as well as freshwater habitat will take a number of complementary approaches. The Initiative will target strategies that are most likely to result in ecological outcomes on private and public lands, including working forests, with preference given to locations most likely to achieve ecological conditions that will support targeted outcomes.

The strategies below represent the actions needed to achieve the target outcomes (Figure 13) within the Cumberland Plateau landscape as assessed through interviews, literature review and stakeholder meetings, the process for which is further described in Appendix A: Materials and Methodology. The strategies are grouped into six categories. *Habitat Restoration*, or creation of new habitat where it currently does not exist, and *Habitat Enhancement and Incentives* (including management), which involves the necessary treatments to maintain or improve existing habitat, are the core strategies for achieving goals in all three initiative landscapes. The other four categories: *Habitat Conservation; Capacity and Outreach*; *Species-Specific Strategies*; and *Planning, Research and Monitoring* are supporting strategies to ensure the success and, where possible, the permanence of investments in restoration and enhancement.

Following each strategy is an assessment of *risks* that might reduce the ultimate outcomes. Although the intent of this Plan is to identify the known risks, it is beyond the capacity and scope of the Forestland Stewards Initiative to address all identified risks through implementation of strategies. Specific actions that may mitigate certain risks are identified, where such actions are known or considered feasible to address through this Initiative. Diagrams, or "results chains", provided in Appendix C: Results Chains were developed to assess the efficacy of strategies and visually represent how strategies influence results, reduce threats, and meet conservation targets.

Habitat Restoration Strategies

Restoration strategies within the Cumberland Plateau will focus largely on establishing shortleaf pine-oak savanna and restoring native riparian forests. The Shortleaf Pine Initiative[18] is a relatively new effort and few landowners are aware of the potential benefits of managing for this species. As well, the full suite of ecological outcomes can only be expected after 35-50 years or more. Because of these factors, planting of shortleaf for this five-year initiative is recommended primarily at key demonstration sites and, if possible, on larger ownerships that buffer or are near demonstration sites and source populations of target species.

To improve freshwater quality in the region, strategic planting of site-appropriate hardwoods within riparian areas will be used where natural regeneration may be insufficient to filter sediment and pollutants and help maintain shade for cold water streams.

The business plan recommends focusing investments on the following target restoration actions in order to achieve the identified objectives (Figure 25 and Figure 26).

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[18] Launched in the spring of 2013, the Shortleaf Pine Initiative (SPI) is a collaborative, strategic and energetic response to the dramatic decline of shortleaf pine forests and associated habitats that once covered a vast area from eastern Texas to Florida and up the eastern seaboard to New Jersey. http://www.shortleafpine.org/

<u>Actions</u>

- Target shortleaf planting of genetically appropriate shortleaf seedlings primarily to locations of promising shortleaf demonstration sites and nearby sites where appropriate management treatments are likely to occur at regular intervals
- Use planting as a supplemental strategy to habitat management of existing shortleaf, focused on portions of sites where seed production is insufficient
- Reforest riparian zones with site-appropriate plant species as a supplemental strategy to natural regeneration
- Location-appropriate site preparation for all plantings, potentially including mechanical treatment
- Maintenance and enhancement of planted acreage through invasive species control, intermediate thinning, and additional under-planting as necessary

<u>Risks and mitigating actions</u>

Possible risks to habitat restoration efforts include; the potential for conversion of planted acres (shortleaf and riparian areas) to other land use or unsustainable timber harvest prior to ecological outcomes; delayed or discontinued pine management treatments, including prescribed burning; NRCS cost-share funding rates are too low to create sufficient incentives for private landowners to plant; and shortleaf is not managed for ecological outcomes. To mitigate these risks, the following additional actions are recommended:

- Focus restoration funding for shortleaf planting where conservation easements or landowner mission will allow for ecological outcomes
- Focus restoration funding for riparian areas to locations where there is at least a 10-year enforceable agreement to exclude livestock and maintain a vegetated buffer
- Focus funds and planting to protected lands where there is an established commitment to wildlife management
- Leverage cost share incentives from NRCS and assist with targeting resources to high priority sites and/or practices
- Focus funding on plans that outline ecological management goals

Habitat Enhancement and Incentives Strategies

Upland pine and oak-hickory woodland/savanna ecosystems are fire adapted, and burning every one to four years is needed in order to achieve desired future conditions for canopy, mid-story, and ground cover (Stambaugh, et al., 2007). Decades of fire suppression and heavy fuel loads in many places indicate the need for mechanical and chemical treatments as well (Harper and Birckhead, 2012).

In riparian areas, habitat management addresses a number of diverse issues. Excluding livestock from streams through the installation of fencing in less forested watersheds like the Duck, Elk, and Green will support buffer reforestation by planting and natural regeneration, and will also reduce sedimentation from stream banks.

Direct in-stream habitat management can also result in immense improvements to freshwater ecosystems in the region, including removal of low-head dams, fords and culverts.

The business plan recommends focusing investments on the following target enhancement and incentives actions in order to achieve the identified objectives (Figure 25 and Figure 26).

<u>Actions</u>

- Fund the use of prescribed fire, including firefighter training, seasonal crews, equipment, and burn unit planning
- Supplement funding for commercial thinning on shortleaf sites planted within 10-20 years
- Fund herbicide treatments where appropriate to prevent re-sprouting of competing species
- Fund mechanical treatments in exceptional circumstances because of higher expense and practicality (e.g., on portions of burn unit properties where prescribed burning is not feasible)
- Install fencing and alternative watering systems to exclude livestock from streams
- Leverage cost share incentives from NRCS and assist with targeting resources to high priority sites and/or practices
- Make improvements to existing dirt road networks in order to reduce sedimentation
- Reduce runoff from abandoned and active surface mine sites
- Treat high ecological-priority hemlock stands on public or other protected lands
- Control invasive exotic plants through mechanical means and/or use of herbicides to prevent monocultures and sedimentation
- Remove or retrofit stream barriers, with an emphasis on lower cost/high gain methods (culvert retrofitting) in locations known to fragment habitat for priority species
- Remove low-head dams and replace hardened concrete fords in locations widely acknowledged to be high conservation priorities
- Re-route stream channels around sediment-filled watershed lake dams and install fish passageways where other barriers limit movement in priority stream reaches

<u>Risks and mitigating actions</u>

Possible risks to habitat enhancement efforts include: low prescribed fire capacity, including lack of contractors; prescribed fire and other treatments are discontinued or delayed over the long-term because of terrain, land ownership patterns, or capacity, compromising habitat conditions; a relatively small number of burn window days; smoke management conditions and public resistance to controlled burns make it difficult to implement burn plans; funding at federal and state level for conservation cost-share programs may be reduced; treatments for hemlock woolly adelgid are not successful or funding doesn't exist to continue treatments; lack of data and prioritization in hemlock treatment and stream barrier removal; and public opposition to removing barriers that are valued as cool-water angling locations. To mitigate these risks, the following additional actions are recommended:

- Sharing burn resources between partners
- Concentrate efforts to establish demonstration sites at strategic locations
- Increase burn capacity to enable burning during windows of optimal conditions
- Create effective public communications plans for specific events, and about fire generally as an ecological management and wildfire prevention tool
- Focus funding on places with demonstrated link to protecting conditions in priority freshwater habitats
- Fund hemlock and/or stream barrier inventory through GIS or field work
- Focus barrier removal work on locations that are less likely to generate controversy

__Habitat Conservation Strategies__

With limited resources, the Initiative can provide critical support for transaction costs or a portion of acquisition costs to leverage limited funding. Pairing protection and restoration efforts is a potentially

high leverage opportunity. These land protection funds can leverage other funding for acquisitions in key priority wildlife areas, such as those funded by the Southern Cumberland Land Protection Fund, managed by OSI and the development of the new Paint Rock Fish and Wildlife Refuge.

The business plan recommends focusing investments on the following target conservation actions in order to achieve the identified objectives.

<u>Actions</u>

- Provide funding for high leverage, targeted conservation transactions that protect and encourage sound management of critical habitat affecting priority terrestrial and freshwater areas
- Support synergies between potential land protection projects and management/restoration projects
- Leverage other sources of permanent conservation funding by providing transaction costs and/or direct investment in the purchase, depending on the needs of the transaction and the significance of the conservation gains
- Purchase 10-15 year riparian easements of minimum widths (e.g. 35 feet) and on larger acreage areas (e.g. 10+ acres) where possible in order to allow enforceable establishment of riparian vegetation

<u>Risks and mitigating actions</u>

- Possible risks to habitat conservation efforts include: funding levels for land conservation continue to remain low, providing limited opportunities for leverage; and riparian landowners are reluctant to make 10-15 year riparian buffer commitments. To mitigate these risks, the following additional actions are recommended:

    ○ Create sufficient financial incentives for landowners to commit to long-term conservation

Capacity and Outreach Strategies

Expanding outreach to private landowners and forestry consultants who can apply that knowledge and methodology to additional lands is a critical strategy as the shortleaf initiative grows. Unlike the Coastal Carolinas and Piney Woods landscapes, the Cumberland Plateau does not have a long history of partner coordination, similar to the local implementation teams that have developed or are currently being developed in these areas. Supporting capacity for communication and coordination among partners within this landscape is important for ensuring resources are used efficiently and to facilitate development of a sustainable conservation effort.

Burning is limited by a relative lack of burn crews and contractors.[19] Increasing burn crew capacity will be an important factor in taking advantage of the relatively limited number of burn windows in the region and increasing the acreage receiving prescribed fire treatments.

The vast majority of stream restoration work must occur on private land. In order to maximize restoration on private lands and adjacent waters, geographically targeted and multi-partner coordinated efforts must be made to educate private landowners about the water quality and financial benefits of riparian zone restoration on their property.

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[19] Robin Mayberry, Area Biologist, USDA/NRCS Area 3, Cookeville, TN (personal communication, Nov. 4, 2013)

The business plan recommends focusing investments on the following target capacity and outreach actions in order to achieve the identified objectives.

Actions

- Create effective shortleaf/shortleaf-oak woodland/savannah demonstration tools through media and workshops
- Target direct interaction with landowners through correspondence, meetings, and site visits
- Develop training, demonstration sites and workshops, and technical assistance for resource professionals and landowners
- Develop informational media and publicity regarding resource values, conservation need, and cost-share opportunities
- Focus on coordinating partners and landowner affiliation groups, such as local farm and forestry associations, and local land trusts

Risks and mitigating actions

Possible risks to capacity and outreach efforts include: burn window limitations preclude reaching burn goals; Informational materials, workshops, and personal contacts are ineffective; and outreach and education efforts fail to target locations where practices will impact high priority terrestrial and freshwater habitats. To mitigate these risks, the following additional actions are recommended:

- Support research to better predict feasible burn times, potentially opening the window for possible treatments
- Review lessons learned from the longleaf and other initiatives
- Support the use of GIS and other tools to evaluate or that will direct specific proposals

Planning, Research and Monitoring Strategies

In order to ensure stream barrier removal is targeted to the highest priority locations, there is a need to inventory stream barriers. State-level data exists for dams regulated under dam safety laws, but most of the barriers on which stream barrier strategies would focus are not subject to such regulation. Examples of potential project sites can be cited by conservation practitioners throughout the Cumberland region, but systematic inventories are rare or incomplete.

The business plan recommends focusing investments on the following target planning, research and monitoring actions in order to achieve the identified objectives.

Actions

- Fund stream barrier surveys in order to determine priorities for future connectivity restoration

Risks and mitigating actions

Possible risks to planning, research and monitoring efforts include: GIS-based assessments fail to detect important small-size stream barriers, leading to some overestimates of potential habitat connectivity restoration; difficulty accessing stream reaches on private land during ground-based surveys could affect reliability of portions of surveys; stream barrier data is not made sufficiently available for use by partnerships to determine common priorities for restoring connectivity; and stream barrier inventory is

created but resources are lacking to fund barrier removal or retrofitting. To mitigate these risks, the following additional actions are recommended:

- ○ Support a combination of region-wide GIS-based assessment supplemented with focused on-the-ground work in priority watersheds
- ○ Use databases and GIS systems that have already been used to guide existing partnerships and make data available on existing websites where possible
- ○ Fund barrier removal and retrofitting for projects widely acknowledged as high priority and high conservation gain, funding lower cost projects to maximize gain

Conservation Outcomes

Investments made in the Cumberland Plateau landscape through the Forestland Stewards Initiative will restore and enhance shortleaf pine-oak savannah, riparian forests and in-stream habitat to conditions that will improve associated wildlife species and the health of freshwater systems, while advancing strategies to support working forests. For the purposes of this Plan, Northern bobwhite quail, prairie warbler, and the Index of Biotic Integrity (IBI) have been identified as good indicators of healthy shortleaf pine-oak savannah, riparian forest, and aquatic ecosystems (Appendix A: Materials and Methodology).

Often habitat takes many decades to develop to a point where they can self-sustain native diversity. Because of this, we differentiate between outputs stemming directly from grant activity, which will be measured in the five-year Initiative timeframe (
Figure 14), and longer term targeted outcomes, which will begin to be registered during the life of the Initiative and then continue to be measured over an additional 10-15 years after the Initiative (Figure 15).

As with any initiative, there is the risk that immediate outcomes might not be achieved due to political, economic or other external factors. To the extent possible, this business plan seeks to identify potential risks and assess the ability of the Initiative to mitigate these risks through direct strategies (Appendix B: Risk Analysis). Because of the long timeframe and complex habitat conditions associated with some of the targeted outcomes for this Initiative, risks are particularly relevant. The three major risks for species outcomes include:

1) Delayed or discontinued management treatments that compromise habitat conditions. For shortleaf pine, further delaying burning can create a significant setback in targeted outcomes and this by far is the most significant risk to these outcomes. Selecting strategic sites where burning is already occurring nearby or where landowners are committed to wildlife management may reduce the likelihood of this risk.

2) Once habitat conditions are achieved, species populations are able to expand into the newly created habitat. This is a significant issue for any forests not adjacent to existing source populations. Translocation – or movement of the species from robust population areas – is a generally effective, although expensive, way to reduce this risk.

3) Development, road expansion or other land uses that fragment the landscape degrade the quality of habitat or create additional risks that reduce the ability for regular prescribed burning. Strategic conservation planning to concentrate restoration on large ownerships adjacent to existing protected lands will be important to reducing this future risk.

Estimated targets for performance outputs and species outcomes within the Cumberland Plateau are addressed in the tables below. All targets are calibrated to the focal areas where the strategies will be applied.

Figure 14. Cumberland Plateau Outputs (5-Year Goals)

SYSTEM TYPE	MEASURE	5 YEAR GOALS
Freshwater Systems & Riparian Forest	Acres riparian forest restored	2,000 acres riparian forest restored
	Miles of stream under improved management (e.g., by roads restored, hemlock treatment, stream bank livestock exclusion fencing installed, stream barriers removed)	1,000 miles under improved management
Riparian & Upland Forests	Acres protected in fee or by long-term conservation easement (>30 years)	1,000 acres protected
	Number of individuals reached by outreach, training, or technical assistance activities	1,000 individuals
Shortleaf Pine/Shortleaf-Oak Forests	# of demo sites effectively established	6 demo sites
	Acres of shortleaf pine restored	3,500 acres shortleaf restored
	Acres under improved management	50,000 acres under improved management

Based on scientific literature and expert opinion, the business plan hypothesis is that the restoration achievements outlined in
Figure 14 will lead to multiple ecosystem benefits and reach targeted outcomes (Figure 15). A detailed summary of the methodology used to estimate targeted species outcomes in Figure 15 is included in Appendix A: Materials and Methodology. The plan recognizes that these are dynamic ecosystems with many external factors that can impact species populations. The Plan attempts to identify specific risks, the probability of their occurrence and resulting impact on the Initiative's goals, and the extent to which the recommended strategies will address those risks (Appendix B: Risk Analysis).

Figure 15. Cumberland Plateau Targeted Outcomes (15-year Targets)

SYSTEM TYPE	INDICATOR	METRIC	15 YEAR TARGETS
Shortleaf Pine/Shortleaf-Oak Forests	Bobwhite Quail	Number of coveys	20 – 25 additional coveys
	Prairie Warbler	Number of pairs	8,000 – 10,000 additional pairs

Freshwater Systems & Riparian Forest	Index of biotic integrity (IBI)	Change in score	Improved or maintained score in 75% of stream segments where strategies are implemented.

Monitoring & Evaluating Performance

NFWF's Monitoring & Evaluation Approach

To better demonstrate results and improve the effectiveness of our conservation investments, a comprehensive monitoring and evaluation strategy has been incorporated into the entire lifecycle of NFWF's initiatives. At initiative inception, NFWF works with scientists and practitioners to develop a business plan that identifies clear conservation goals, strategies to achieve these goals, and metrics for assessing progress. During proposal review, proposals are prioritized based on how well they align with the initiative's priority strategies. At the project level, individual grantees will monitor and provide updates on key project activity and outcome metrics in annual and final reports.

On an annual basis, data across individual projects will be scaled up into an initiative scorecard which will provide a snapshot of progress on the initiative's primary strategies and focal species and habitat outcomes. Every three years, NFWF's in-house evaluator will conduct an assessment to examine the factors that have facilitated and hindered successful implementation of the initiative. Towards the end of the initiative's life cycle, a more comprehensive third-party evaluation may be conducted if resources are available. Findings from all monitoring and evaluation activities will be used to continuously learn from our grant-making and inform future decision-making to ensure initiative success.

Funding Plan

For each of the Forestland Stewards Initiative landscapes, NFWF has identified six broad strategies in which to invest to accomplish the objectives outlined in this business plan. These strategies are well defined in the preceding sections. The funding that will be used to execute this plan includes a generous donation from International Paper who is the principal sponsor of the Forestland Stewards Initiative. In addition, NFWF will work with its federal partners including, the Department of Defense, USDA Forest Service and Natural Resources Conservation Service, and U.S. Fish and Wildlife Service to attract additional funding. NFWF will continue to attract other private funding from foundations, corporations, and individuals committed to the goals of this plan. The final source of funding will come from grantees who match IP and NFWF funding. In total, the draft financial plan for the Forestland Stewards Initiative equals $30.375 million over a 5-year period (Figure 16). This financial plan will adjust year to year as we implement the program, evaluate results, and adjust to better meet the outlined objectives.

Figure 16. Forestland Stewards Funding Plan Table

BUDGET CATEGORY	INTERNATIONAL PAPER INVESTMENT	NFWF INVESTMENT	GRANTEE MATCH	TOTAL
Habitat Conservation	$894,000	$720,000	$3,229,000	**$4,843,000**
Habitat Restoration	$1,410,000	$1,118,000	$5,056,000	**$7,584,000**
Enhancement & Incentives	$2,178,000	$1,745,000	$7,845,000	**$11,768,000**
Capacity & Outreach	$660,000	$540,000	$2,400,000	**$3,600,000**
Species Specific Strategies	$305,000	$245,000	$1,100,000	**$1,650,000**
Planning, Research, Monitoring	$178,000	$132,000	$620,000	**$930,000**
TOTAL:	$5,625,000	$4,500,000	$20,250,000	**$30,375,000**

Long-Term NFWF Support

This Business Plan lays out a strategy to achieve clear outcomes that benefit wildlife over a 5-year period. At that time, it is expected that the conservation actions partners have taken will have brought about new institutional and societal standards and environmental changes that will have set the population in a positive direction such that maintaining those successes or continuing them will be possible without further (or greatly reduced) NFWF funding. To help ensure that the population and other gains made in 5 years won't be lost after the exit of NFWF funding, the partnership must seek development of solutions that are long-lasting, cost-effective, and can be maintained at lower levels of funding in the future or with other secure sources of funds. Therefore, part of the evaluations of this initiative will address that staying power and the likelihood that successful strategies will remain successful into the future.

The adaptive nature of this initiative will also allow NFWF and partners to regularly evaluate the strategies behind our objectives, make necessary course corrections or additions within the 5 year frame of this business plan. In some cases these corrections and additions may warrant increased or reduced investment for specific strategies by NFWF and other partners.

Ancillary Benefits

In addition to the outcomes outlined above, longleaf, shortleaf and bottomland hardwood restoration, and in-stream restoration will provide numerous other benefits to wildlife and residents of the region.

Among the additional species benefitting from habitat management and restoration activities are:

Longleaf Pine:
- Flatwoods Salamander
- Gopher Frog
- Wild Turkey
- Black Pine Snake
- Southern Hog-nose Snake
- Eastern Diamondback Rattlesnake
- Henslow's Sparrow
- Brown-headed Nuthatch
- Numerous threatened and endangered plant species

Bottomland Hardwoods:
- Wood Stork
- Swallow-tail Kite
- Cerulean Warbler
- Black-throated Green Warbler
- Hooded Warbler
- Northern Parula
- Swainson's Warbler
- Yellow-throated Vireo
- Wood Thrush
- Mallards, Wood ducks and Mergansers
- American Woodcock
- Muskrat
- Beaver
- Various other reptiles and amphibians

Shortleaf Pine:
- American Woodcock
- Chuck Will's Widow
- Red Cockaded Woodpecker
- Brown-headed nuthatch
- Worm-eating warbler
- Kentucky Warbler

- Eastern spotted skunk
- Southeastern shrew
- Big Brown bat
- Timber Rattlesnake
- Indiana bat
- Northern long-eared bat
- Tri-colored bat
- Cerulean Warbler
- Northern Pine Snake
- Eastern Slender Glass Lizard
- Hairy Tailed Mole
- Allegheny Woodrat

Freshwater – over 100 freshwater species of greatest conservation need could potentially benefit from the Initiative, including species such as those listed below.

- Fish: Streamline Chub, Palezone Shiner, Blotchside Logperch, Snail Darter, Blackside Dace, Spring Pygmy Sunfish, Slackwater Darter, Tuscumbia Darter, Chucky Madtom, Bluebreast Darter, Ashy Darter, Boulder Darter, Shoal Chub, Ghost Shiner, Mountain Madtom, Stonecat, Gilt Darter, Stargazing Minnow, Sipsey Darter, Blueface Darter, Bankhead Darter,
- Mussels: Mucket, Pheasantshell, Elktoe, Southern Elktoe, Slippershell Mussell, Spike, Snuffbox, Shiny Pigtoe, Fine rayed Pigtoe, Longsolid, Pink Mucket, Alabama Lampmussel, Tennessee Heelsplitter, Black Sandshell, Cumberland Moccasinshell, Round Hickorynut, Ohio Pigtoe, Tennessee Clubshell, Pyramid Pigtoe, Tennessee Pigtoe, Slabside Pearlymussel, Kidneyshell, Creeper, Pale Lilliput, Painted Creekshell, Rabbitsfoot, Snuffbox, Cracking Pearlymussel, Slabside Pearlymussel, Orangenacre Mucket, Alabama Moccasinshell, Dark Pigtoe, Triangular Kidneyshell, Southern Purple Lilliput, Alabama Rainbow
- Amphibians: Eastern Hellbender, Black Warrior Waterdog
- Snails: Engraved Elimia, Angled Marstonia, Rugged Hornsnail, Warty Rocksnail

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About NFWF

The National Fish and Wildlife Foundation protects and restores our nation's wildlife and habitats. Created by Congress in 1984, NFWF directs public conservation dollars to the most pressing environmental needs and matches those investments with private contributions. NFWF works with government, nonprofit and corporate partners to find solutions for the most intractable conservation challenges. In 29 years, NFWF has funded more than 4,000 organizations and committed more than $2 billion to conservation projects. Learn more at www.nfwf.org.

Appendix A: Materials and Methodology

The National Fish and Wildlife Foundation (NFWF) contracted with the Open Space Institute (OSI) to conduct the Forestland Stewards Initiative business planning process, including identifying focal areas for targeted investments, synthesizing relevant research and scientific data, engaging stakeholders in evaluating restoration goals, developing strategies for implementation, and setting outcomes and metrics for measuring success.

NFWF engaged OSI based on its eight years of experience with conservation across the eastern United States. OSI has worked to assess conservation priorities and provide strategic investment to foundations since 2000. OSI began work in the Southern Appalachian Mountains in 2006 after completing an assessment of conservation needs and opportunities for that region. Since that time, OSI has completed a wildlife vulnerability assessment focused on 175 critical at-risk freshwater and terrestrial species across seven Southern Appalachian states that includes a more detailed analysis of relevant land protection priorities on the Southern Cumberland Plateau. To expand OSI's expertise to the Piney Woods region of Texas and Louisiana, OSI contracted with Working Lands Investment Partners, LLC, which has extensive experience with forest management issues in that region. OSI staff members working on this project are based in Charleston, South Carolina; Asheville, North Carolina; and New York City.

Landscape Selection

In April 2013, NFWF gathered key stakeholders in each of the three target landscapes: Coastal Carolinas, Piney Woods, and Cumberland Plateau (Figure 17). This early series of in-person meetings served to announce the initiative and seek early feedback about the ecological and geographic focus of the initiative. As a result of these meetings and early interviews, NFWF committed to focusing on longleaf and bottomland hardwood restoration in the Coastal Carolinas and Piney Woods landscapes, and shortleaf pine and freshwater systems in the Cumberland Plateau.

To define landscape boundaries and more refined focal areas for investment by the Forestland Stewards Initiative, OSI reviewed stakeholder input from the April meetings and analyzed relevant data sources in Geographic Information Systems. Data sources included the resources listed below[20]. Initially, data were used to develop the broader landscape boundaries for each region. This initial screening focused on (1) distribution of relevant ecosystems and habitats and (2) land use patterns, including development, forest cover and public ownership. The final landscapes represented a concentrated opportunity to restore target habitats on public and private forest lands with identified bases of permanently protected lands to serve as critical hubs or demonstration sites for building private landowner buy-in.

Data informing the Coastal Carolinas, Piney Woods, and Cumberland Plateau Landscape boundary selection includes (citations and web links are provided in the Data Sources section):

- Protecting Southern Appalachian Wildlife Study (OSI)

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[20] See Methods Diagram in Appendix A for additional detail on the process used to collect, evaluate and integrate information into the Business Plan

- National Gap Analysis Program Land Cover Data- Version 2 (GAP) with a focus on shortleaf pine, oak savannah, longleaf and bottomland hardwood types (U.S. Geological Survey Gap Analysis Program)
- Protected Areas Database of the United States (U.S. Geological Survey Gap Analysis Program)
- Range-Wide Conservation Plan for Longleaf Pine, Significant Geographic Areas (America's Longleaf Restoration Initiative)
- Longleaf Priority Areas (The Nature Conservancy)
- EPA Level 3 and 4 Ecoregions (U.S. Environmental Protection Agency)
- Watershed boundaries (U.S. Geological Survey)

Figure 17. Map of Forestland Stewards Initiative Landscapes

Indicator Species

Coastal Carolinas and Piney Woods

The Jones Center for Ecological Research published a report in 2012, with support from NFWF that sought to identify conservation outcomes and performance metrics for the longleaf pine ecosystem. The goal of the effort was to identify the forest conditions necessary to support the broad range of biodiversity supported by this ecosystem and select species that could serve as indicators of a healthy longleaf pine

system. This report was driven by a steering committee including representatives from the NFWF, the Jones Center, the US Forest Service, and US Fish and Wildlife Service. Representatives from the East Gulf Coastal Plain Joint Venture Open Pine Decision Support Tool, USFWS Southern Pine Desired Forest Condition project and NatureServe USFS Longleaf Ecological Integrity Assessment were also engaged as advisors. The committee revised a draft list of candidate wildlife species and narrowed the list to eight potential species. Factors that were considered in narrowing the list of potential focal species included (McIntyre, 2012):

1. "Species of conservation concern but yet still common enough that responses to restoration treatments can reasonably be expected given adequate proximity to source populations
2. "Representative of different classes, i.e. not only birds
3. "Distribution across a large portion of the range of longleaf pine
4. "Permanent resident, not migratory
5. "Demonstrated association with higher quality longleaf pine habitats
6. "Potential to be considered "umbrella" species (e.g. red-cockaded woodpecker)
7. "Potential to be considered "flagship" species (e.g. Northern bobwhite)
8. "Given the focus on upland longleaf restoration (specific to NFWF's Longleaf Stewardship Fund), species that are associated with upland pine sites rather than embedded wetlands
9. "Public trust species for Federal partners and/or priorities for other partners (red-cockaded woodpecker, gopher tortoise)
10. "Monitoring is practical, e.g. relatively easy to locate
11. "Sufficient knowledge of species is available to adequately make assessments (McIntyre, 2012 p. 4)"

A detailed literature review was conducted and a stakeholder workshop was held with Federal agencies (USFS, USFWS, and NRCS), State agencies, conservation NGOs and academia to review the

Northern bobwhite quail | Credit: Gary Kramer

recommendations and habitat model proposed. A final suite of four species was chosen to represent both biological and program priorities across the longleaf range: Northern bobwhite quail, Bachman's sparrow, red-cockaded woodpecker and gopher tortoise (McIntyre, 2012). These four species were chosen due to their mutual preference for parameters of major elements of habitat structure, including basal area, canopy cover, midstory cover and understory cover and composition. For the purposes of this business plan, the gopher tortoise was not included as an indicator species due to limited overlap with its range, which does not extend to the Piney Woods and only includes the very southern portion of the Coastal Carolinas. The other three species were adopted and confirmed as valuable indicators for both landscapes.

Bachman's sparrow, Northern bobwhite quail, and red-cockaded woodpecker all show a preference for high-quality mature longleaf habitat. Bachman's sparrow and Northern bobwhite quail also may utilize early successional habitat such as conditions found in recently established longleaf pine. All of these species are also fairly well-distributed across the range of longleaf pine and sufficiently abundant that a positive response to habitat restoration could be expected without translocation. Northern bobwhite also attracts a community of support beyond those interested primarily in longleaf conservation due to its popularity for recreational hunting. The red-cockaded woodpecker[21] was also of particular interest

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[21] The U.S. Fish & Wildlife Service's *Recovery plan for the red-cockaded woodpecker (Picoides borealis): second revision* was consulted in the development of this business plan. However, the business plan has adopted the habitat parameters and average density measure developed through the Jones Center (McIntyre, 2012) report. The recovery

because of its protected status and relative concentration on Federal lands. Red-cockaded woodpecker also represents a classic umbrella species; if habitat structure is suitable for this species, then it is suitable for a suite of longleaf-associated species. However, for many restoration sites, red-cockaded woodpecker will require active translocation unless the sites are located relatively close to source populations and is not likely to utilize afforested/reforested sites in their early successional stages (McIntyre, 2012).

Bottomland hardwood forest systems are extensive throughout the coastal plain. These ecosystems support a set of species that are uniquely adapted to flood conditions and alternating dry periods, often exhibiting higher diversity than adjoining upland forests and acting as a breeding source for bird populations (Guilfoyle, 2001). Recent analysis has also shown that these forests provide critical connectivity between inland and coastal regions (Anderson et al., 2014). Because bottomland hardwood restoration will be conducted adjacent to priority longleaf restoration sites, this business plan did not offer specific species targets but instead suggested general acreage targets for bottomland restoration. This plan recommends asking grantees to document current and target species populations for the appropriate selection of indicators at their site.

Cumberland Plateau

Because of the great biodiversity and range of ecosystems in the Cumberland Plateau, stakeholders noted the challenge of selecting indicators that could be used to signal health for the broad range of species and ecosystems that could be affected by the Forestland Stewards Initiative. Significant review was conducted of literature and data sources including NFWF's Conservation Values Index[22], TNC's State Wildlife Action Plan-based GIS tool (TNC, 2012), and TNC's Cumberland and Southern Ridge and Valley Ecoregional Assessment (TNC, 2003), as well as extensive conversation with regional experts from government, academic, and nonprofit agencies like the Tennessee Wildlife Resources Agency, Kentucky Department of Fish and Wildlife, Alabama Department of Conservation and Natural Resources, the Alabama Aquatic Biodiversity Center, the Geological Survey of Alabama, the U.S. Fish and Wildlife Service, the U.S. Forest Service, the National Park Service, Tennessee Technological University, and The Nature Conservancy.

These inquiries led to the selection of the prairie warbler and the northern bobwhite quail as indicators for shortleaf pine and pine/oak ecosystems[23]. While these species are not as much of an "umbrella" indicator of entire ecosystem health in the manner of red-cockaded woodpeckers in longleaf ecosystems, they do thrive in different seral stages and forest types which are expected to result from Forestland Stewards Initiative investments. Prairie warblers should respond well to early successional, shrubby habitat generated in the early re-establishment of shortleaf/oak savannahs, and where there are appropriate conditions for population recruitment, northern bobwhite quail will respond to both early successional and later grassland stages of shortleaf/oak woodlands and savannahs (USDA Forest Service, 2011 and Yarrow, 2009)

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guidelines outlined in the Service's Recovery Report are similar to the habitat parameters and average density developed in the Jones Center report. The Jones Center report incorporates additional research and literature published since the release of the Service's most recent draft of the Recovery Plan.

[22] NFWF's Conservation Values Index is a tool developed by the Foundation to identify conservation priorities. The index evaluates species based on five criteria: (1) taxonomic value, (2) charismatic value, (3) ecological value, (4) economic value, and (5) threat level. Based on these five criteria, NFWF can derive a conservation value associated with a particular species and identify regions in the country that have high overall conservation value (because they have suites of species with high individual values).

[23] A relatively nascent Shortleaf Pine Initiative has been launched and co-coordinated by The Nature Conservancy and the National Bobwhite Conservation Initiative. The historic range of shortleaf pine overlaps a large portion of the Cumberland Plateau landscape and provides important savanna ecosystems important to bobwhite quail and prairie warbler. General information about the Initiative and its progress is available at http://www.shortleafpine.net .

Because of the region's extremely high levels of freshwater biodiversity and endemism, identifying a freshwater species that was both highly indicative of ecosystem health and also widely distributed across the region was not possible. Ultimately, an indexed measure of freshwater health was chosen, the Index of Biotic Integrity (IBI). The IBI measures the presence and abundance of a variety of aquatic insects and fish as a way of gauging stream ecosystem health, and is affected by riparian zone and in-stream conditions and management actions. This measure varies somewhat in its specific technique in different watersheds and states, but is used throughout the region, and has a similar set of scoring standards, such that improvements made to riparian and in-stream conditions can be reflected in an increase in score or the maintenance of an already favorable score.

Focal Area Selection

Coastal Carolinas and Piney Woods

Once the three broad landscapes were delineated and indicator species were selected, other data were evaluated in mapping programs to locate specific focal areas for investment. These data included information on distribution of indicator species, non-governmental organization and public agency priorities that sought to achieve similar goals, and the location of existing conservation lands. The selection of final focal areas was an interactive and multi-faceted process of visually examining the intersections of data layers, discussing candidate focal areas with stakeholders, and reviewing of organizational capacity to achieve outcomes. At all stages, a variety of reports were reviewed and interviews were conducted to verify or amplify data sources.

For the purposes of this business plan, "Significant Geographic Areas" (SGA) developed by The America's Longleaf Restoration Initiative were adopted as the focal areas for targeting investments through the Forestland Stewards Initiative. These focal areas encompass a base of established longleaf pine on permanently protected lands surrounded by private lands that are currently or could potentially be in longleaf. These focal areas were vetted through review of species locations, longleaf soils and discussion with stakeholders, and ultimately recommended utilizing these existing boundaries in order to take advantage of the capacity and land management momentum in the SGAs (Figure 7 and Figure 8).

To better understand the need for bottomland forest restoration, OSI developed a data set that evaluated the USGS GAP "macro group" forested floodplains against the flooding frequency of soils from NRCS SSURGO data. Non-forested areas that occurred in soils that experience flooding were designated as potential areas for restoration. This information was not used to adjust focal area boundaries but rather to confirm the opportunity for floodplain restoration within these areas.

Cumberland Plateau

In contrast, the Cumberland Plateau landscape selected for the Forestland Stewards Initiative covers a much larger landscape that includes a wider diversity of habitats and ecoregions, but lacks a previously existing coherent set of focal areas similar to those defined for the Coastal Carolinas and Piney Woods. For this region, OSI carefully reviewed both terrestrial and freshwater restoration priorities, based on a variety of broadly recognized planning efforts and datasets. OSI's Protecting Southern Appalachian Wildlife study (2011), which covers a significant portion of the Forestland Stewards Cumberland Plateau landscape, served as a starting point. That study spatially identified the largest forest blocks in the Southern Appalachians, and prioritized them based on metrics and expert opinion relating to species considered to be of greatest conservation need in state wildlife action plans. Potential terrestrial focus areas were identified based on locations of higher priority forest blocks that typically included a core of

public lands. These areas were then scoped and refined based on interviews with land managers and other experts in the region.

Freshwater priorities in the region were established through a number of sources, including extensive discussions with freshwater biologists in the region. Data sources forming the core of the analysis included aquatic information from OSI's Protecting Southern Appalachian Wildlife study; U.S. Fish and Wildlife Service watershed-based data on locations of species for which Endangered Species Act petitions have been filed; EPA priority watershed data; the state and federal multi-agency Strategic Habitat Unit analysis in Alabama (Wynn et al., 2012); state wildlife action plans (SWAPs) in Kentucky and Tennessee (Kentucky Department of Fish and Wildlife Resources, 2013 and Tennessee Wildlife Resources Agency, 2005); and The Nature Conservancy's SWAP-related GIS and Relational Database Management System (TNC, 2012), which overlapped with a significant portion of the Forestland Stewards Initiative Cumberland Plateau landscape.

Data informing Focal Area selection:

- Breeding Bird Survey, Population Data (USGS)
- National Gap Analysis Program Land Cover Data- Version 2 (GAP) (U.S. Geological Survey Gap Analysis Program)
- Longleaf plots (USDA Forest Service, Forest Inventory Analysis)
- Longleaf soil suitability (Natural Resource Conservation Service)
- Longleaf sites (Natural Heritage Program)
- Red-Cockaded Woodpecker Recovery Units & Support Populations (U.S. Fish and Wildlife Service)
- Flooding probability (Natural Resource Conservation Service)
- Protecting Southern Appalachian Wildlife Study (OSI)
- State Wildlife Action Plans (KY, TN)
- The Nature Conservancy's GIS and Relational Database Management System (KY, TN, AL)
- Strategic Habitat Unit/ Strategic River Reach Unit Mapping (AL, multi-agency)
- Mollusk Recovery Strategic Plans (Miscellaneous)
- Petitioned Aquatic Species Locations (U.S. Fish and Wildlife Service)
- Priority Watersheds (Environmental Protection Agency)
- Hemlock Restoration Priorities (Tennessee Hemlock Conservation Partnership)

Baseline Assessment

Once focal areas and indicator species were identified, select datasets were used to assess baseline conditions. Baseline conditions provide the starting assumptions for the condition and quality of existing habitat and indicator species in order to serve as a point of reference for tracking progress. The two datasets that were used for assessing baselines were the USGS GAP land cover data and the USGS Breeding Bird Survey, Population Data. We extracted the relevant land cover types from the GAP data and "clipped" them to the focal area boundaries and then calculated their extent. For the longleaf pine regions, we compared these data to more local datasets derived by the Local Implementation Teams. Numbers varied but served as a reasonable starting place for a consistent analysis across all of the focal areas. The Breeding Bird Survey was similarly "clipped" and the populations were assessed. We also reviewed these data against local surveys and found significant discrepancy, but after discussion with experts determined this was the best available data source for this purpose.

Development of Indicator Outcome Estimates

Coastal Carolinas and Piney Woods

As described in the *Indicator Species* section above, three indicator species were selected for the Coastal Carolinas and Piney Woods landscapes: Red-cockaded woodpecker (RCW), Northern bobwhite quail, and Bachman's sparrow. All three species show an affinity for "maintenance class" longleaf pine.[24] Maintenance class, or ideal habitat parameters preferred by these species, is defined in the Longleaf Pine Restoration Assessment: Conservation Outcomes and Performance Metrics report (McIntyre, 2012) based on common habitat needs for these species. The preferred habitat parameters identified in the report are listed in Figure 18 below.

Figure 18. Maintenance Class Longleaf Habitat Parameters

Metric	Parameters
Basal Area	40 – 70 square feet per acre
Canopy Cover	40 – 60 percent
Midstory Cover	Less than 20 percent
Understory Cover	Greater than 65% contiguous herbaceous; at least 20% grasses

Source: McIntyre, R. Kevin. 2012. Longleaf Pine Restoration Assessment: Conservation Outcomes and Performance Metrics, Final Report. Joseph W. Jones Ecological Research Center. 92 p.

The first step to understanding possible species outcomes was to establish an estimate of new acres of maintenance class longleaf pine that could be reasonably expected to be established based on the Initiative and partner investments over the five year lifetime of the fund.

Initial estimates for existing and potential new maintenance class acres were established based on goals developed by state-wide or region-wide targets. Often these data extended beyond the Coastal Carolinas and Piney Woods landscape boundaries and estimates were refined for these target landscapes and focal areas (Significant Geographic Areas). An informal email survey was distributed to the coordinators for all of the Local Implementation Teams for the SGAs within the Coastal Carolinas and Piney Woods landscapes. The survey requested the following information:

- Estimate of how many acres are in "restore" condition (soils that could support longleaf but are not currently planted in longleaf)
- Estimate of how many acres are in "improve" condition (planted in longleaf but not high-quality and/or mature)
- Estimate of how many acres are in "maintenance class" condition (high-quality mature longleaf)

Maintenance class targets were revised using the available information provided from the surveys and subsequently reviewed and confirmed with regional stakeholders.

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[24] Bachman's sparrow and northern bobwhite quail also utilize, to some degree, early successional habitat such as conditions found in recently established longleaf pine. However, to maintain consistent methodology across all three species, targeted outcome estimates for Bachman's sparrow and northern bobwhite quail were based on the information and habitat parameters developed in the Jones Center Report.

Establishing targets for species outcomes was developed using the maintenance class longleaf habitat parameters identified in the Jones Center report. The report provides standard average estimates for species response based on a literature synthesis and expert stakeholder input. Figure 19 shows the average density for the indicator species that could be reasonable supported by the defined maintenance class conditions.

Figure 19. Average Species Density Table

Species	Average Density
Bachman's sparrow	10 acres/pair
Bobwhite quail	40 acres/covey (average 12 birds)
Red-cockaded woodpecker	150 acres/group (average 3-4 birds)

Source: McIntyre, R. Kevin. 2012. Longleaf Pine Restoration Assessment: Conservation Outcomes and Performance Metrics, Final Report. Joseph W. Jones Ecological Research Center. 92 p.

Based on proposed strategies and investments for the Forestland Stewards Initiative, it is estimated that approximately 33,000-41,000 and 15,000-17,000 additional acres of longleaf pine will reach maintenance class within the Coastal Carolinas and Piney Woods landscapes within the next 15 years, respectively. Using the average species densities provided in Figure 19, target species outcomes are calculated in Figure 20 below. These estimates were considered as the "potential carrying capacity" and were subsequently adjusted based on expert stakeholder feedback.

Through a detailed review of the RCW recovery plan (USFWS, 2003) and discussions with National Forest Service managers and Local Implementation Team leaders, the carrying capacity was refined down for Bachman's sparrow (65% of carrying capacity) and RCW (10% of carrying capacity for Piney Woods and 25% of carrying capacity for Coastal Carolinas). These adjustments were made based on concerns about species response within the 15 year time window. The bobwhite quail numbers were not adjusted. There were contradicting reports on this species' response and these numbers were left unchanged until further review.

Figure 20. Coastal Carolinas and Piney Woods Species Target Estimates

Conversion factors for estimating species targets within the Coastal Carolinas and Piney Woods						
Species	Measurement	Density	Piney Woods Correction	Piney Woods Target	Coastal Carolinas Correction	Coastal Carolinas Target
Red-cockaded woodpecker	acres per group	150	10%	10	25%	65
Bobwhite quail	acres per covey	40	100%	400	100%	900
Bachman's sparrow	acres per pair	10	65%	1000	65%	2500

To further account for potential fluctuations in outcomes achieved due to external factors, target outcomes are expressed as a range (increase) above baseline population estimates. The ranges are based on a standard deviation of approximately 10% of the estimated target for each outcome. Final targeted outcome ranges are depicted in Figure 11 and Figure 15.

Cumberland Plateau

The prairie warbler and northern bobwhite quail outcomes (Figure 15) were ultimately calculated based on the estimated outputs for shortleaf/oak restoration: 50,000 acres of shortleaf/oak to be under improved management, and 3,500 acres of shortleaf/oak to be restored (
Figure 14).

Prairie warbler: The information obtained from stakeholders in the region (particularly written interviews with Bankhead National Forest staff, TWRA/Tennessee State Ornithologist) indicated that one could expect either two to three prairie warbler territories per acre in suitable habitat, or one per two acres of habitat. Taking approximately the midpoint of that range (2 territories per acre) and dividing 53,500 acres by that, equals 26,750 territories. Limitations on actual numbers of prairie warbler territories include both temporal factors and habitat quality and size factors. Prairie warbler increases would occur in the early successional stage of shortleaf-oak management where there is a sufficient shrub component. This stage would occur primarily for approximately a decade during the early stages of woodland/savannah restoration (which will coincide with the life of the Forestland Stewards Initiative). Assuming that not all forest managed under the Initiative would provide suitable prairie warbler habitat, and also that not all territorial behavior would result in successful pairing and breeding, we conservatively estimated an increase in prairie warbler population in treated acreage at just under half the maximum number of territories possible within the output goals, with an estimate of 8,000-10,000 additional pairs.

Northern bobwhite quail: Information obtained from stakeholders in the region (particularly written interviews with Bankhead National Forest staff, TWRA/Tennessee State Ornithologist), indicated one covey per approximately 38-50 acres of suitable habitat. Using the conservative end of this range (50) yields an expectation, based on output acreage numbers, of potentially 1,000 additional coveys. However, feedback from land managers in the Cumberland Plateau indicates that in many parts of the region, the restoration of quail habitat has often failed to attract quail by natural migration. The cause of this is not fully understood, although a major factor appears to be that some habitat restoration has occurred in relatively small patches (e.g., a couple of hundred acres) within a larger forest matrix, and in some places quail are not able to easily migrate into new habitat because of their limited flight capabilities. For example, much of the Kentucky portion of the Forestland Stewards Initiative focal area for shortleaf restoration is a place where the most shortleaf restoration is occurring, but is also deemed by the NBCI to be lower in priority for the state of Kentucky overall for bobwhite quail restoration. Ultimately, because of the likely variability in location, size, and context of restoration investments, the potential that land management efforts at locations funded by the Forestland Stewards Initiative will need to persist further into the future than 15 years in order to establish excellent quail habitat and see migration occur, as well as other unknown factors concerning quail habitat needs, we very conservatively estimated the increase in northern bobwhite quail in the Cumberland Plateau region over the next 10-15 years at 20-25 additional coveys.

IBI outcome target: the IBI outcome target ("improved or maintained score in 75% of stream segments where strategies are implemented") is a rough estimation of the potential effect of Forestland Stewardship Initiative investments in riparian areas and direct in-stream improvements. The reference to maintained scores pertains to scores that are already considered good. The choice of which sampling locations to use will depend upon the locations of Forestland Stewards Initiative investments. Relevant to the likelihood of meeting the target is that other factors outside of the Initiative (e.g., large storms) can have a temporary effect on IBI scores, as well as the greater likelihood that Initiative investments will positively affect IBI scores if investments are concentrated in particularly promising local areas.

Methodology Diagram

The methodology diagram (Figure 21) below provides an illustrated overview of the methods and major inputs for development of the landscape boundaries, focal area boundaries and indicator species targets. The diagram indicates the places where stakeholder and advisory committee review was incorporated. The diagram can be read from left to right as a flow chart, starting with the initial gathering of stakeholders in each of the three landscapes. The row of circles on the left lists the foundational sources used to select longleaf (top left) landscapes, and Cumberland landscapes (bottom left) and the center circles indicate the use of a range of reports, interviews and land ownership data for development of strategies and draft focal areas in all three regions. The focal areas and strategies were then reviewed by advisors and, together with further review of reports and interviews, lead to the final focal areas and species targets. Estimated costs, financial plan and outcomes and outputs were developed to create the draft business plan. Advisors were convened a final time to review the draft business plan and endorse the proposed outcomes and outputs.

Figure 21. Forestland Stewards Materials and Methodology Diagram
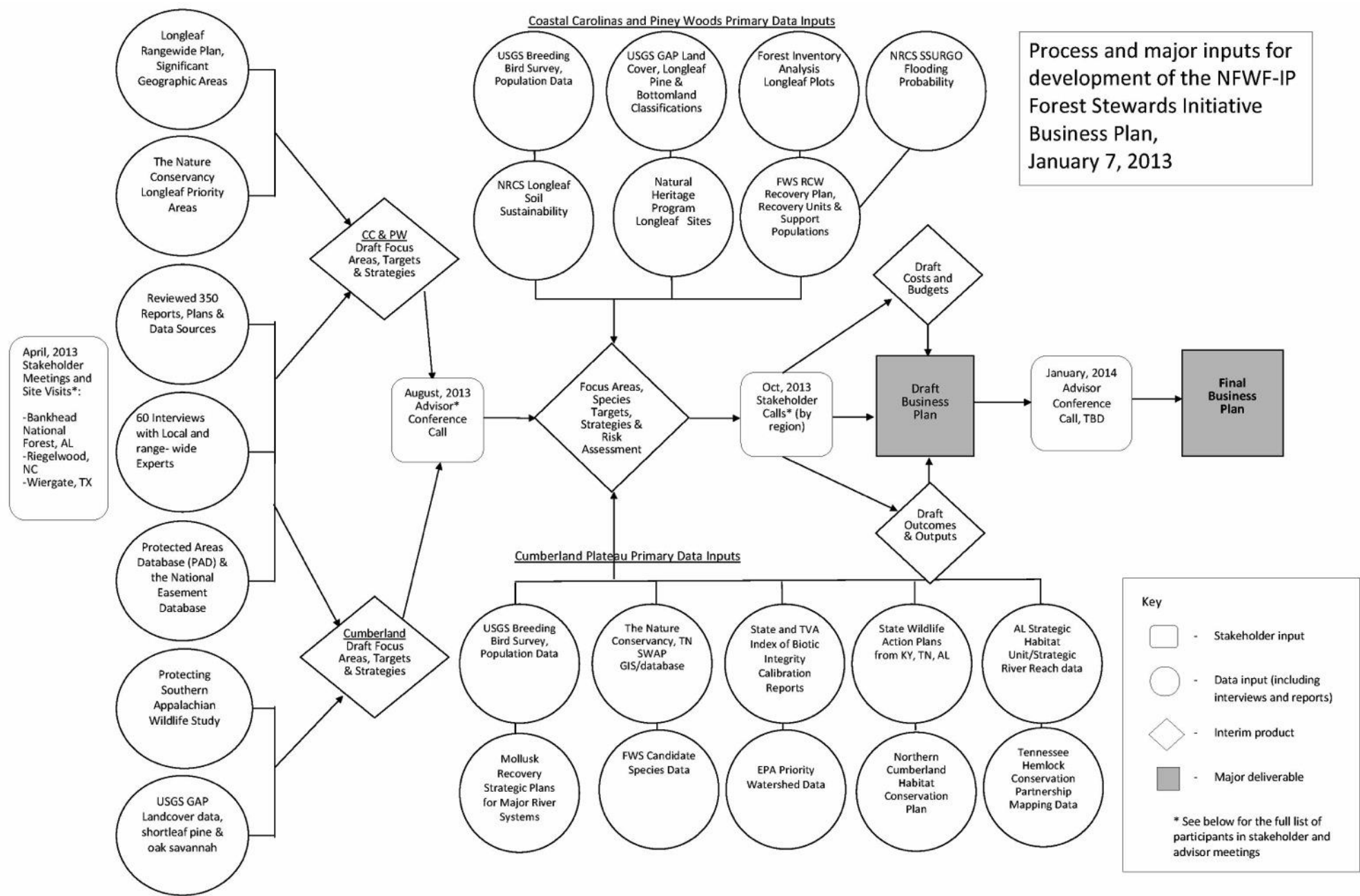
Appendix B: Risk Analysis

The risk analysis included below provides a more detailed analysis of the relative probability of an obstacle occurring and the relative impact if it does occur. The planning team developed the risk analysis using its professional judgment, based on extensive interviews with experts and stakeholders and review of significant literature during the course of business planning. Risks were identified during development of the Implementation sections of the business plan, and then evaluated for "probability" and "impact" factors in accordance with NFWF's standard risk evaluation method.

The analysis involved placing specific risks into standard NFWF categories. "Probability of Occurring" and "Impact on Goals if it Occurs" were each scored within one of five levels, based on percent likelihood of occurrence and percent reduction in goals if a risk did occur. The "total" provides an ultimate assessment of the likely impact of the risks on the ability for the Forestland Stewards Initiative to achieve outcomes, with red color indicating a higher risk and green indicating a lower risk. The numerical values are based on standardized matrices provided at the bottom of this page.

Economic issues rise to the top as possible obstacles to achieving outcomes. This relates to the challenge of finding a way to expand restoration to landowners who need to meet financial goals for their forestland. Regulatory and Financial factors, relating to restrictions on prescribed burning and reduced funding for conservation programs, are likely moderate risks.

Figure 22. Risk Analysis Matrix

		Probability	Impact	Total
Regulatory	More restrictive liability laws, air quality rules for prescribed burning	0.5	0.2	0.10
Financial	Reduced Funding at federal and state levels	0.9	0.1	0.09
Environmental	Fragmentation, Extreme Weather,	0.5	0.1	0.05
Species-related	Insufficient local source populations/breeding pairs; managed habitat conditions not sufficiently optimal	0.5	.1	0.05
Scientific	Lack of geospatial data, Lack of data on longleaf quality, Difficulty combining/coordinating assessment tools and metrics	0.1	0.4	0.04
Social	Landowner Skepticism, Public aversion to smoke, Landowner reluctance to encumber property long-term, Landowner unease about managing for T&E species	0.3	0.2	0.06
Economic	Development, Landowner forest economics - harvesting, rotation length, Limited markets for pre-commercial thinning timber, High equipment/labor costs for smaller landowners, Lack of premium for longleaf in market and general lack of shortleaf market.	0.7	0.4	0.28
Institutional	Lack of permanent conservation/time-limited contracts, Geographically diffuse/Non-targeted cost-share funding, Multiple agencies and different stakeholders with different mandates and conservation priorities	0.5	0.1	0.05

Considerations for assessing risks

- Regulatory: EPA is trying to be more restrictive about smoke and air quality. And with more wildfires there may be more concern. Fragmentation and population is increasing.
- Financial: The federal Farm Bill, signed into law in February 2014, reduces conservation funding by approximately 6.5% (or $3.97 billion—about $860 million better than the worst case scenario). Relevant programs remain in place, though sometimes under different names.
- Environmental: Longleaf and shortleaf are more resilient to extreme weather.
- Species-related: Expert opinion indicates that local focus areas within each FSI landscape vary in responsiveness to habitat management, particularly for Northern bobwhite quail and red-cockaded woodpecker. Source population issues are one factor; reintroduction efforts can help ameliorate. Other factors related to habitat needs are not fully understood.
- Scientific: Most limitations related to data and knowledge can be overcome.
- Social: Assumes that landowners have an issue with this if not all the issues. Has a moderate impact, and can be managed through outreach and education.

- Economic: Big impact due to large ownership of TIMO/REIT land in the Piney Woods and Coastal Carolinas, and limited market for longleaf and shortleaf timber.
- Institutional: Not going to prevent you from doing the work as much as make it less efficient.

Probability of Occurring

Very unlikely: 0-20%   (.1)
Unlikely: 21-40%   (.3)
Even chance: 41-60%   (.5)
Likely: 61-80%   (.7)
Very likely: 81-100% (.9)

Impact on Goals, if it Occurs

0-10% reduction   (.05)
11-20% reduction   (.1)
21-40% reduction   (.2)
41-80% reduction   (.4)
81%+ reduction   (.8)

Impact

Probability	0.05	0.1	0.2	0.4	0.8
0.9	0.05	0.09	0.18	0.36	0.72
0.7	0.04	0.07	0.14	0.28	0.56
0.5	0.03	0.05	0.1	0.2	0.4
0.3	0.02	0.03	0.06	0.12	0.24
0.1	0.01	0.01	0.02	0.04	0.08

Appendix C: Results Chains

A results chain is a chain of logic, derived from strategies hypothesized in a conceptual model, which illustrates how a specific strategy is presumed to reach a particular conservation outcome. Results chains serve as the framework for testing the assumption that strategy implementation will lead to intermediate results, and ultimately to threat abatement and improvement in the health of target ecosystems or species. Results chains include strategies (yellow hexagons), activities (yellow squares), intermediate results (blue), threat reduction results (purple), and conservation targets (green). NFWF will not necessarily fund all activities listed in the results chains; partners and other organizations are currently or will engage in some of the activities.

Figure 23 and Figure 24 show two results chains for longleaf pine ecosystems in the Coastal Carolinas and Piney Woods landscapes. The specific strategies from the related conceptual models are classified as together contributing to either "Forest Enhancement" (i.e., related to habitat management), or "Forest Restoration" (i.e., related to habitat restoration or planting). The Forest Enhancement chain shows how implementation of these strategies and accomplishment of various intermediate results will lead to healthy composition and structure in longleaf forests, while the Forest Restoration chain shows how they will lead to larger and more contiguous habitat (purple), thus reducing species isolation and increasing genetic diversity (grey).

Figure 25 and Figure 26 show two results chains for the Cumberland Plateau landscape: one for freshwater targets, and the other for shortleaf/oak forest targets. The freshwater results chain includes strategies related to riparian zones (hemlock woolly adelgid treatments, reclaiming abandoned mines, sediment controls, riparian zone planting and livestock exclusion fencing) and in-stream practices (barrier inventory and removal). Implementation of these strategies and accomplishment of intermediate results will lead to improved stream structure, connectivity, and water quality and temperature regulation (purple and grey). The shortleaf/oak results chain includes strategies focused primarily on habitat restoration (planting) and habitat management (prescribed fire and other management activities). Special emphasis is placed on the kind of education and outreach stakeholders emphasized as being needed through demonstration sites and landowner incentives in order to re-establish the perception of shortleaf pine-oak woodlands and savannas as a viable, important, and desirable forest type for both private and public land managers to establish and maintain. The hypothesis of this results chain is that these strategies and results will lead to increasingly effective fire management and reduction of pine beetle risk in select locations, and ultimately the creation of several very good examples of shortleaf/oak woodlands and savannas that will spur further interest and investment in the target ecosystem.

Results Chain Legend

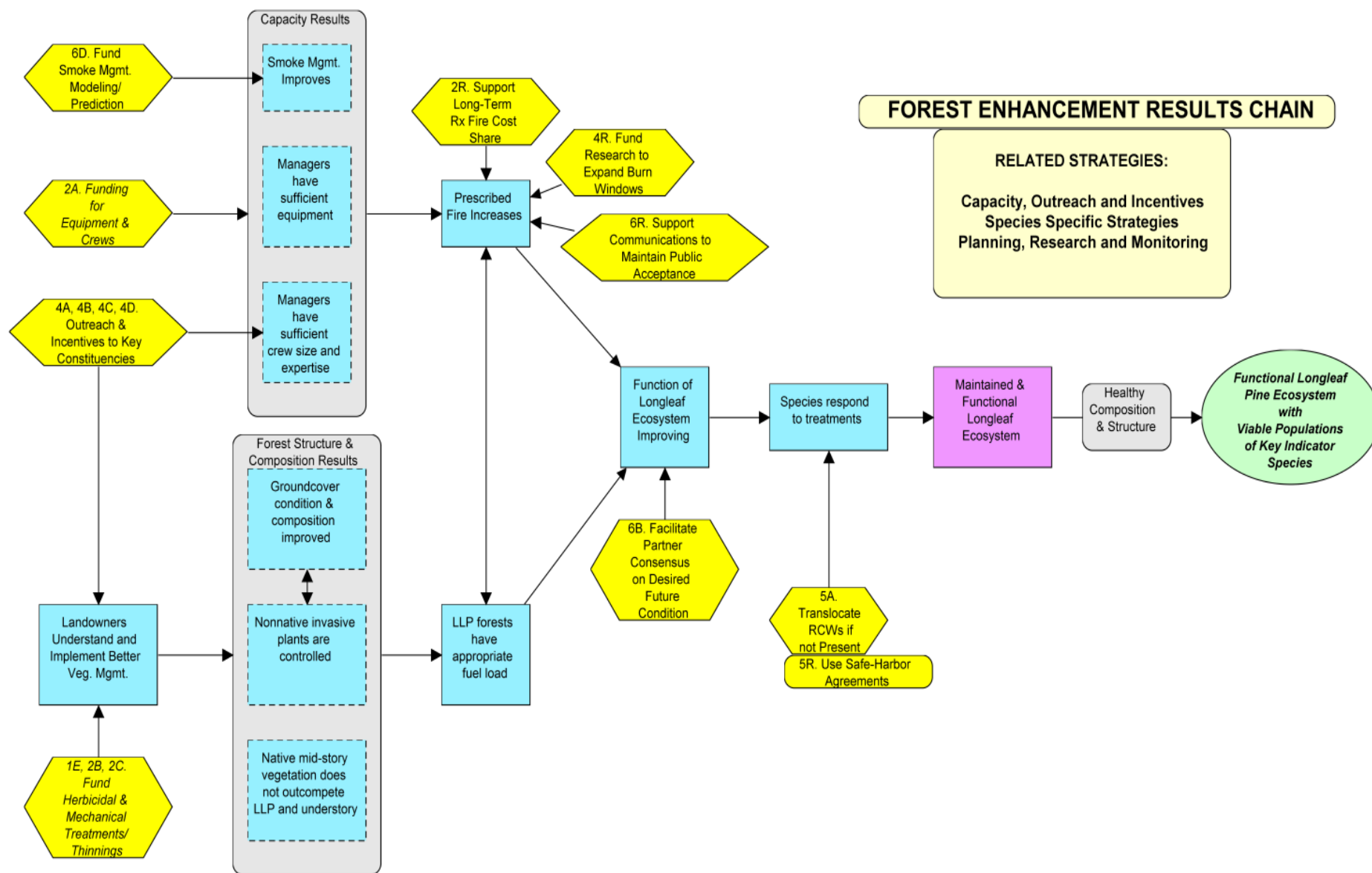**Figure 23. Coastal Carolinas and Piney Woods Forest Enhancement Results Chain**

Capacity Results

6D. Fund Smoke Mgmt. Modeling/ Prediction → Smoke Mgmt. Improves

2A. Funding for Equipment & Crews → Managers have sufficient equipment

4A, 4B, 4C, 4D. Outreach & Incentives to Key Constituencies → Managers have sufficient crew size and expertise

2R. Support Long-Term Rx Fire Cost Share
4R. Fund Research to Expand Burn Windows
6R. Support Communications to Maintain Public Acceptance
→ Prescribed Fire Increases

FOREST ENHANCEMENT RESULTS CHAIN

RELATED STRATEGIES:

Capacity, Outreach and Incentives
Species Specific Strategies
Planning, Research and Monitoring

Forest Structure & Composition Results

Groundcover condition & composition improved

Nonnative invasive plants are controlled

Native mid-story vegetation does not outcompete LLP and understory

Landowners Understand and Implement Better Veg. Mgmt.

1E, 2B, 2C. Fund Herbicidal & Mechanical Treatments/ Thinnings

LLP forests have appropriate fuel load

Function of Longleaf Ecosystem Improving → Species respond to treatments → Maintained & Functional Longleaf Ecosystem → Healthy Composition & Structure → Functional Longleaf Pine Ecosystem with Viable Populations of Key Indicator Species

6B. Facilitate Partner Consensus on Desired Future Condition

5A. Translocate RCWs if not Present
5R. Use Safe-Harbor Agreements

Figure 24. Coastal Carolinas and Piney Woods Forest Restoration Results Chain
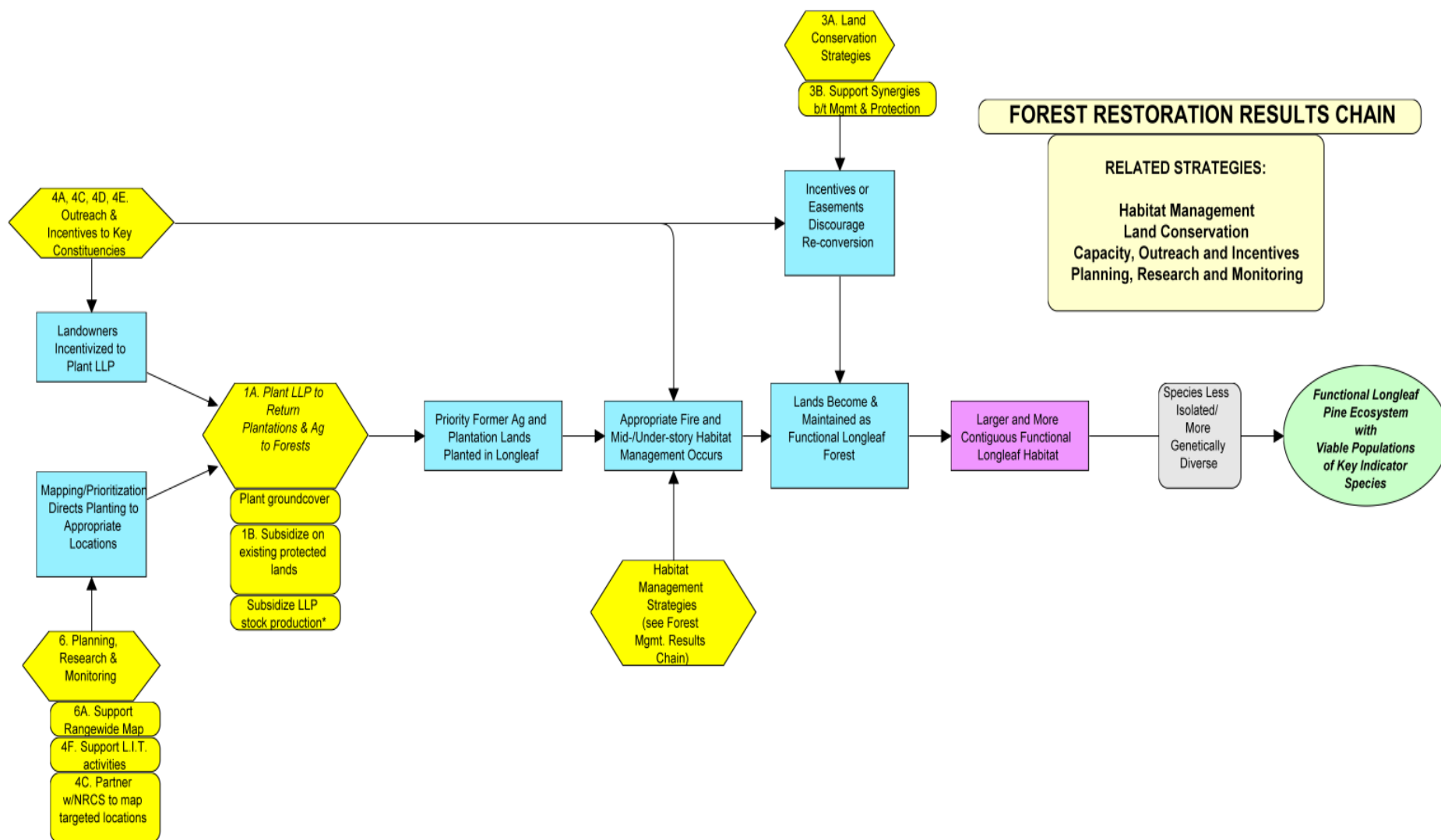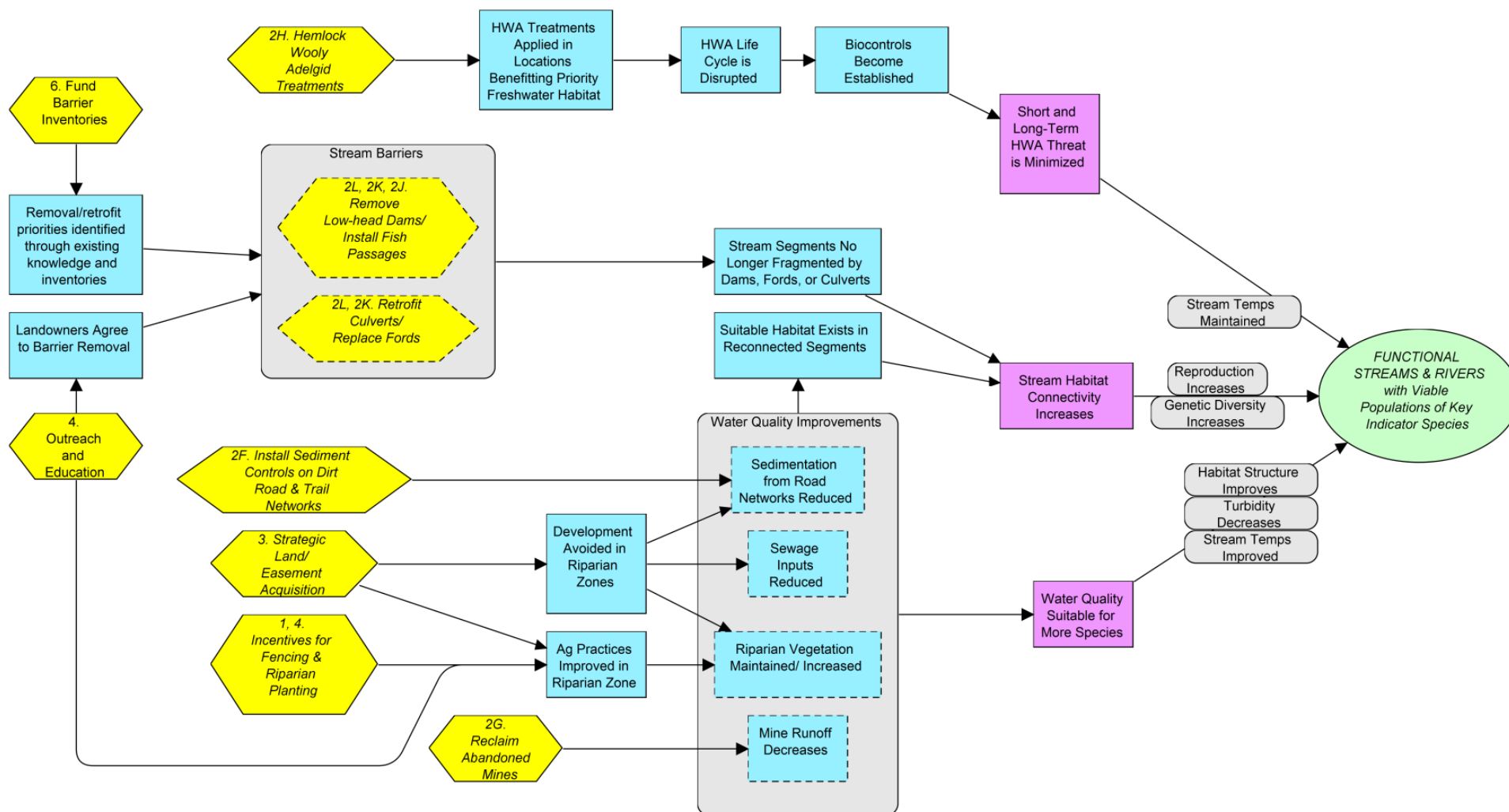
Figure 25. Cumberland Plateau Freshwater Results Chain

Figure 26. Cumberland Plateau Shortleaf Pine and Oak Savannah Results Chain